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Nutrition and Population Growth

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The Delicate Balance

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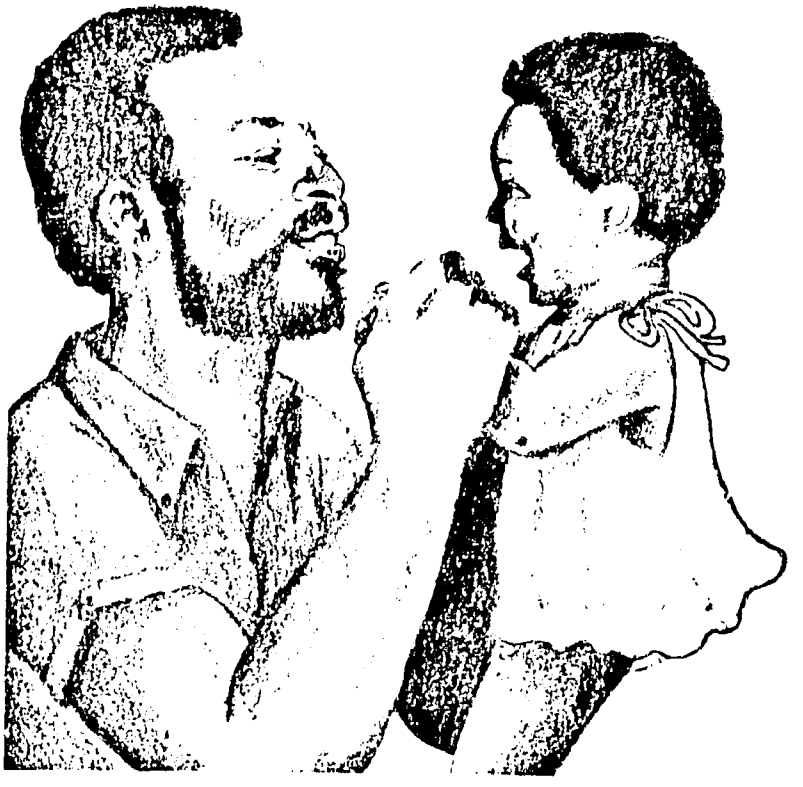

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NUTRITION AND POPULATION GROWTH: THE DELICATE BALANCE

1. POLICIES FOR U.S. ASSISTANCE TO DEVELOPING COUNTRIES

2. ANNOTATED BIBLIOGRAPHY OF NUTRITION-FERTILITY INTERACTIONS

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AND

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Marian F. Zeitlin
Project Director

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Introduction

A. Overview

This volume reports the findings of a project designed to investigate the interactions between nutrition and population growth in developing countries. The first section, Nutrition and Population Growth: The Delicate Balance, is the synthesis of our findings. The second section, Annotated Bibliography of Nutrition-Fertility Interactions, provides the reader with abstracts from our extensive literature review in the form of an annotated bibliography arranged by region and country.

B. Report on Nutrition and Population Growth

Three separate approaches have been used to study the relationships linking nutrition and population growth: Biological and nutritional scientists and epidemiologists have investigated the physiological relationships between nutrition and reproduction. Demographers, economists, and other social scientists have studied the demographic transition and the psychosocial models determining family size. At the program level, specialists in community medicine, public health, and program management have worked to develop and evaluate integrated programs that simultaneously improve nutritional status and reduce population growth rates. Experts from these three domains have been in general agreement for at least ten years that nutrition and population growth were linked and should be addressed through integrated programs. These specialists met at high level seminars and produced policy statements concerning the need to combine nutrition and population programs in what is now known as a basic needs approach to development. Inevitably, there are controversies concerning specific nutrition-population interactions, but these controversies do not detract from the overall consensus.

So far as we know, this report represents the first systematic attempt to synthesize the research findings from these three domains in order to test whether such a sysnthesis:

--supports the consensus

--provides new insights into current controversies

--reveals additional policy implications extending beyond the conclusions that have emerged from the short-term efforts of interdisciplinary working groups.

Our findings support but go considerably beyond most current policy conclusions. We have attempted to be relatively thorough in our treatment of each domain because our purpose was to construct a synthesis which included the consideration of specialized aspects of each approach. The reader who does not wish to review each domain in detail will find a policy summary in Chapter 4.

Our first chapter reviews physiological interactions between nutrition and fertility, looking first at the effects of nutritional improvement on mortality, next at the contraceptive effects of breastfeeding, next at the impact of nutritional improvement on fertility, and finally at the effects of uncontrolled fertility on nutritional status and mortality. The second chapter examines psychosocial interactions. It opens with a discussion of the demographic transition and of the changing value of children with socioeconomic development. We then review the replacement, insurance, and investment strategies of responding to changes in child mortality, and the role of nutrition in these changes. The third chapter provides an overview of the state of the art in integrated nutrition and family planning programs and discusses factors that appear to be important for successful program development.

There are areas we did not find time to cover. For example, we do not review the research linking estrogen-based oral contraceptive agents to decreased production of breast milk, although we note that this relationship has been clearly established, with the important implication that estrogen-based contraceptives should not be given to breastfeeding mothers. This issue is of particular interest since AID continues in 1981 to supply estrogen-based pills throughout the world although their negative effect on breastfeeding has been public knowledge for at least five years. At the same time AID promotes breastfeeding through numerous educational programs. The very real technical problems that may be involved in a world-wide change-over from estrogen-based to alternative oral contraceptives deserve further investigation.

Similarly, we do not discuss the effects of contraceptives on maternal nutritional status, beyond noting that iron status of the users of intrauterine devices (IUD's) should be monitored. Although oral contraceptives do alter biochemical blood levels of some nutrients, harmful clinical side effects of these changes have not been established. Such side effects still are under investigation, as are other possible health hazards, such as an increased risk of cancer in women receiving depo provera. As of this writing, however, the risks posed by unwanted pregnancy to malnourished women and to their low birthweight infants appear to clearly outweigh the nutritional risks of the contraceptive agents.

C. The Annotated Bibliography

The purpose of the annotated bibliography is to provide a representative sample of research reports concerning interactions between nutrition and population growth in developing countries. The abstracts that have been included fall into five categories. The first three are the physiological, psychosocial, and programmatic domains discussed above.

The fourth is made up of abstracts dealing with socioeconomic covariables that must be considered in interpreting nutrition-fertility research findings. Much of the research relating nutritional change to development variables, such as urbanization, education, economic devel-

opment, and women's employment, for example, has simultaneous implications for fertility behavior, and vice versa. The changing value of children and patterns of investment in children with socioeconomic development affect both the numbers born and the quality of food and health care invested in each child. The fifth category is made up of studies of data quality.

In a few locations, as among the Yoruba in Nigeria, in Egypt, Bangladesh, and in Papua New Guinea, for example, a sufficient number of studies have been conducted to make collections of abstracts that function as mini-case studies. Many of the studies conducted in any given country, however, are not matched by corresponding data in other locations. Regional patterns exist but are not uniform within regions. For example, postpartum sexual abstinence is common in much of West Africa, but not among the Akan peoples of Southern Ghana. Lactation periods generally are longer in Africa and Asia than in South America, but the Arusi Gala herdsmen of Ethiopia have traditionally breastfed for only two to six months in order to increase tribal birth rates.

Chapter 1 Physiological Interactions Between Nutrition and Population Growth

This chapter reviews the physiological links between nutritional status and population growth from a policy and programming perspective. Section A, Ways in Which Nutritional Change Affects Population Growth, identifies conditions under which nutrition interventions and food aid programs may induce accelerated population growth, the size and likelihood of such effects, and their implications for program design.

Section B, Ways in Which Fertility Affects Nutritional Status and Mortality, details the physiological reasons for combining family planning with nutrition and primary health care programs. Reliable methods of regulating fertility are required for health and nutritional reasons alone. The nature of the mechanisms involved have implications for program design.

A. Ways in Which Nutritional Change Affects Population Growth

Changes in nutritional status or in nutritional practices may exert physiological effects on fertility and on population growth in three major ways. This section will discuss these mechanisms in the order of their apparent potential to affect population growth at the macro level. They are:

reduced infant and child mortality caused by improved nutritional status;

reduced birth intervals caused by declines in breastfeeding;

increased fecundity caused by improvement in maternal nutritional status.

Small reductions in mortality produce macro level increases in population growth. Improvements in maternal and infant nutrition have a high potential for reducing mortality, particularly when this improvement is combined with increased access to health care. Nutritional interventions or policy shifts that have the effect of improving nutritional status thus appear to have the potential for exerting macro level effects on population growth via reduced mortality, if family planning programs are not developed simultaneously. Yet this situation is a hopeful one. The literature review on which this report is based reveals that simultaneous provision of integrated nutrition, health, and family planning services leads to rapid acceptance of family planning if the social environment favors reductions in family size. Convincing evidence for macro level effects of the other two mechanisms did not emerge from the literature review. But

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*This chapter was written by Marian Zeitlin, Joe Wray, and John Stanbury.

they were found to be of grave concern at the micro level among disadvantaged and transitional socioeconomic groups in need of development assistance.

1. Infant and Child Mortality

The population explosion of concern to family planners everywhere results primarily from reductions in mortality. Schultz (1976) calculated that a reduction in infant mortality of any given percentage must be accompanied by a 30% greater reduction in fertility in order to cause no increase in population growth. According to a simulation model published by Venkatacharya (1978), if families place no limits on fertility, the net reproduction rate rises above 1.6 as soon as the infant mortality rate drops below about 230/1000, childhood mortality drops below 146/1000, and life expectancy rises above 34 years.

These figures are a way of stating the fact that the human race has the reproductive capacity for survival under adverse conditions of very high mortality. This restatement of the obvious implies something much less so, which is that improvements in health and reduction in mortality rates to acceptable levels according to twentieth century standards automatically entail the need to reduce ideal family size to two or three children. Accordingly:

- Any health and nutrition inputs that reduce mortality will upset the population balance unless they are accompanied by family planning.

- Large families can no longer be viewed as an acceptable cultural variant unless they are counterbalanced by large numbers of adults who remain childless.

Improved nutrition may decrease child mortality by two separate but related chains of events. First, improvement in maternal nutritional status before and during pregnancy leads to a reduced incidence of low birthweight or otherwise malnourished babies, which in turn leads to a reduction in infant and child mortality rates. In this sequence, purely nutritional inputs, in the absence of health care, can significantly lower infant and child mortality.

Second, improved infant nutrition across the weaning age is associated with decreases in child mortality. The decreases achieved by nutritional inputs alone, however, appear to be less impressive in the preschool age group than the decreases achieved by a combination of nutrition and primary health care, or by medical care alone. The effects of immunization, antimalarials, and antibiotics, available without prescription in most developing countries, presumably account for much of the reduction in infant and child mortality, irrespective of nutritional status. This section will review the nature and size of nutritional effects on infant and child mortality, looking first at maternal and then at child nutrition.

a. Improved Maternal Nutrition

• Low Birthweight and Prematurity as Causes of Mortality

Low birthweight and prematurity are the commonest causes of death in the neonatal period (not counting neonatal tetanus in some settings). Both are closely related to maternal nutrition before and during pregnancy. The Inter-American Investigation of Mortality in Childhood (Ross Laboratories, 1974) looked at causes of infant mortality in 15 locations in Latin America and in the United States and found a steep drop in neonatal mortality with increasing birthweight at all levels of socioeconomic development. Table 1 (Puffer and Serrano, 1975) illustrates this decrease at a low income project site in Brazil and at a site in California. In Brazil, neonatal deaths per 1,000 live births dropped from 215.7 for infants weighing 2,500 g or less to 10.0 for infants over 2,500 g. The corresponding figures in California were 129.9 and 3.1. From death records, this study estimated that low birthweight and immaturity were the causes of 50% to 80% of neonatal deaths (Ross Laboratories, 1974). Since these records tend to report immediate rather than underlying causes of death, actual percentages were probably higher.

Low birthweight infants may be born prematurely or may be born at term, in which case they have suffered from intrauterine growth retardation and are termed 'small for date' babies. Both conditions may be caused by maternal malnutrition. In developing country studies it has been difficult to sort out the relative rise of mortality attributable to low gestational age versus intrauterine growth retardation because of the large sample sizes and careful records needed to examine the possible gestational age and birthweight combinations. A prospective study of about 59,000 pregnancy outcomes in the United States (Niswander and Gordon, 1972; Hardy et al., 1979) disaggregated these effects for North American white and black infants as shown in Figures 1 and 2 (Hardy et al., 1979). These figures imply that low birthweight per se is a relatively greater mortality risk factor than low gestational age, although both are important.

Mata and coworkers (1976), studying 458 pregnancies in a typical rural village in Guatemala, found that 34% of infants were small for gestational age, having weights below 2501 g at term, and that 7% were born before 37 weeks gestation. They found that the preterm infants had the poorest rates of survival in the first year of life, but that the survivors thrived and showed good growth rates thereafter. The full term small for dates group showed poor survival and poor growth from birth through 3 years. The full term infants with normal birthweights had the best survival and growth rates.

• Maternal Nutrition, Low Birthweight, and Prematurity

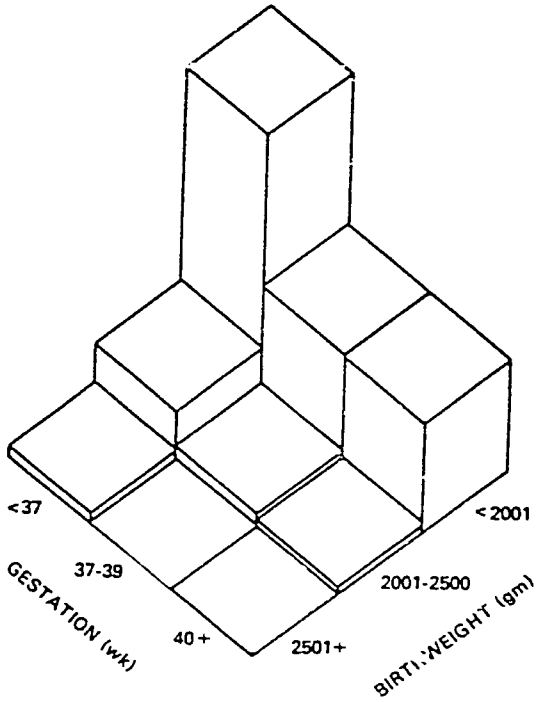
This discussion focuses on birthweight as a key variable linking maternal nutrition to mortality. Poor maternal nutrition may also increase infant and child mortality through other mechanisms such as iron,

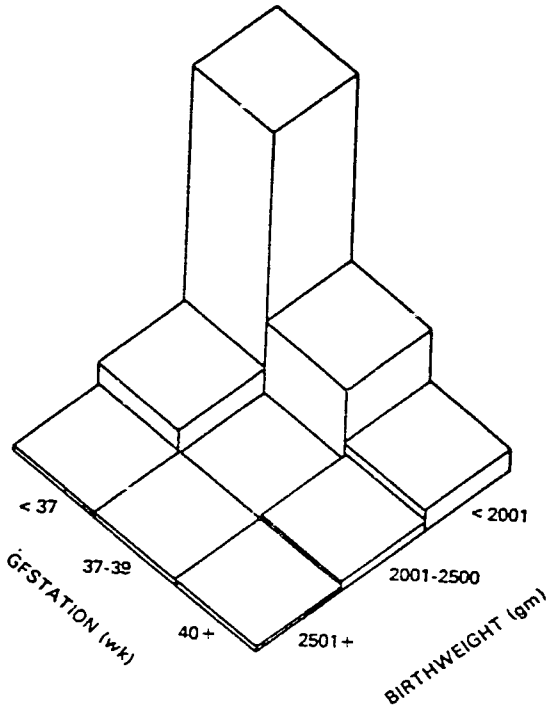
Table 1

Neonatal mortality by birthweight, Ribeirão Prêto, Brazil, and California projects, Inter-American Investigation of Mortality in Childhood and United States 1960 birth cohort (deaths per 1,000 live births)

Birthweight in grams	California project 1969-1970	Ribeirão Prêto project 1968-1970	United States birth cohort 1960
1,000 or less	940.0	890.6	912.8
1,001 - 1,500	434.8	696.3	521.5
1,501 - 2,000	106.9	391.0	180.6
2,001 - 2,500	28.2	68.1	41.4
2,500 or less	129.9	215.7	171.6
2,501 - 3,000	5.4	16.8	9.9
3,001 - 3,500	2.5	8.5	4.7
3,501 - 4,000	2.2	6.0	3.6
4,001 and more	3.1	8.7	5.0
2,501 and more	3.1	10.0	5.5
Total	12.7	28.2	18.4

Source: Puffer and Serrano, 1975.





Source: Hardy et al., 1979

Figure 1

Neonatal Death Rate by Birthweight by Gestation at Delivery - White

Figure 2

Neonatal Death Rate by Birthweight by Gestation at Delivery - Black

vitamin A, or iodine deficiency, for example. These mechanisms are less well documented and generally have not been disaggregated from effects on birthweight.

Both maternal prepregnancy weight and pregnancy weight gain are strongly correlated to birthweight. Because of the large samples required to disaggregate effects, we will again turn to the Niswander and Gordon (1972) study for an illustration of these relationships.

Figures 3 and 4 show birthweight by mother's prepregnancy weight and by pregnancy weight gain for North American white and black women. The authors noted that most of the differences between the races disappeared if gestational age were controlled, since the black women had gestations that averaged approximately 9 days shorter than the whites. These figures show differences of about 1 kg between the average birthweights of infants born to light women with low weight gains and those born to heavy women with high weight gains. The slope is steepest for women with low prepregnancy weights. Since the standard deviation for birthweight is about 0.5 kg (WHO, 1978a), improvement in pregnancy weight gain should be capable of shifting a significant proportion of newborns above the high mortality risk category, even within supposedly well nourished populations.

We can presume that some of the U.S. women with prepregnancy weights below 101 lb were in fact malnourished, although not to the same degree as low income women in developing countries. If this weight group were further disaggregated, using developing country figures, into women weighing below 81 lb and women weighing from 81 to 91 and from 91 to 101 lb, one would expect that the slopes of the curves of birthweight with increasing pregnancy weight gain would be still steeper than the lowest curve in the Niswander and Gordon graph.

A large part of differences in birthweight found by Niswander and Gordon probably was due to differences in gestational age. Moodie and coworkers (1970) found in South Africa that 32% of infants born to mothers with a prepregnancy weight for height below 100% were below 38 weeks in gestational age, as compared to only 6% of infants of mothers above 100% in weight for height. Premature birth may also arise from infection in low socioeconomic groups with poor hygienic practices. The Women, Infants and Children (WIC) supplementary feeding program in the United States was found by Kennedy (1978) to reduce the incidence of low gestational age.

- Effects of Interventions Improving the Diets of Malnourished Mothers

Lechtig and coworkers (1979) have published the findings of an international workshop held to review the effects of projects designed to improve the pregnancy diets of malnourished women. Their report, analyzing and comparing results from eight maternal nutrition studies, concludes that nutritional supplementation programs for malnourished mothers have been successful in increasing birthweight in spite of the usual range of barriers to successful program implementation.

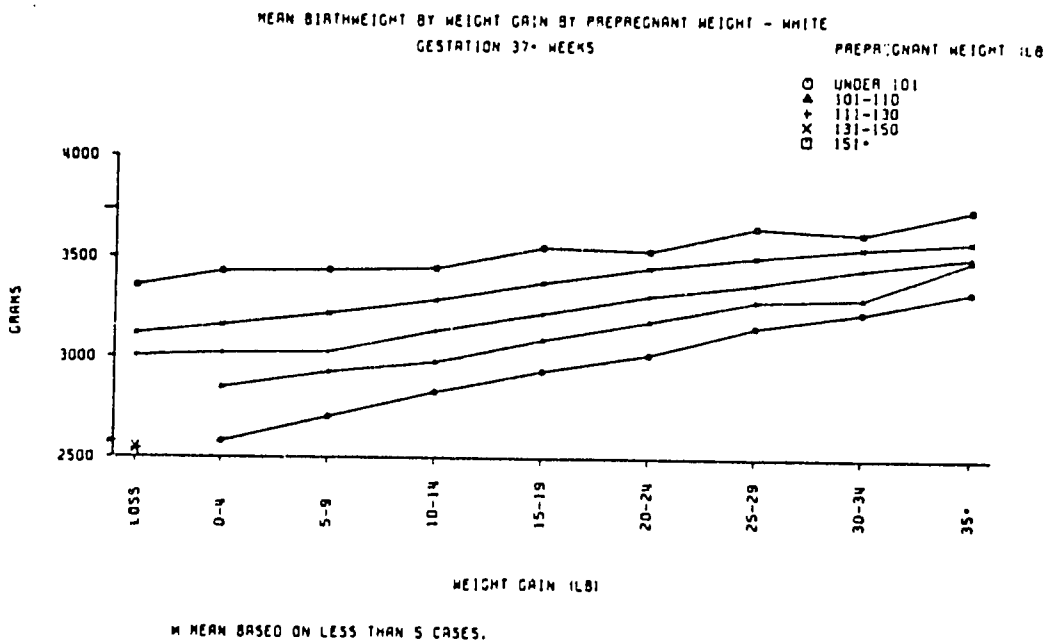


Figure 3

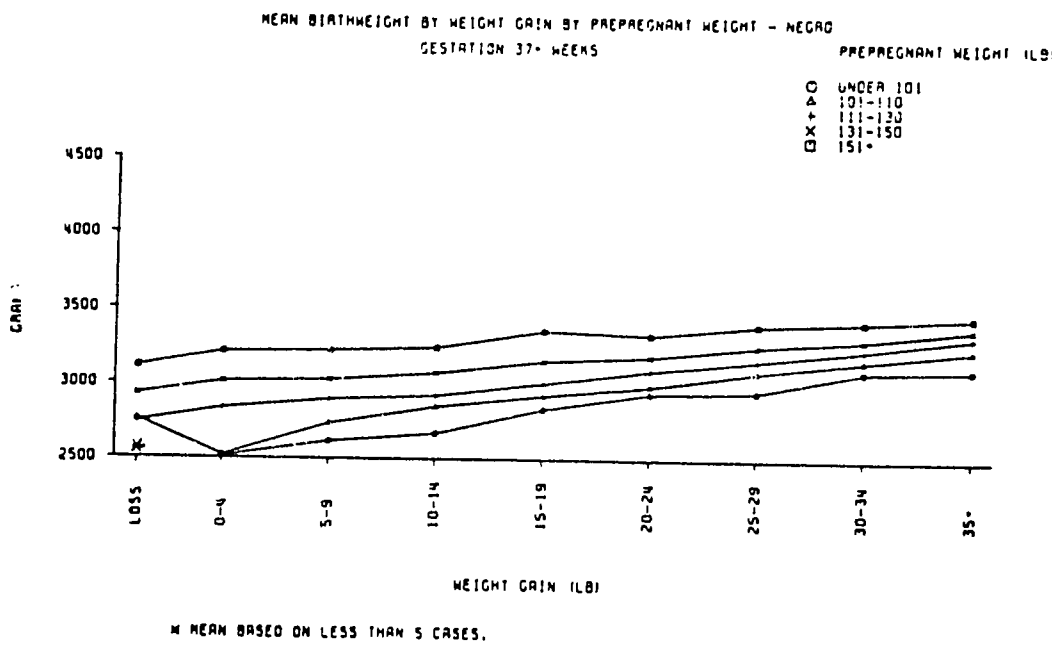


Figure 4

Table 2 presents a summary of their findings from studies in Holland, Colombia, Guatemala. India, Mexico, Canada, the United States, and Taiwan. The one study, in India, that admitted malnourished women to the hospital and clinically monitored their intake achieved much greater increases in birthweight--up to 600 g average increment--than the others. Most programs providing food supplements knew that the foods were substituting for some portion of the home diet, were shared with other family members, or were not completely consumed for other reasons. Most projects could not measure the impact of supplementation on total maternal dietary intake. The fact that most still achieved significant increases in average birthweight is noteworthy and undoubtedly reflects the strong relationship between pregnancy weight gain and birthweight in small, thin women.

Three of the studies reported reduced infant mortality associated with better nutrition, although mortality was not the focus of most of these investigations. Another study in Narangwal, India (Kielmann et al., 1977) separated the effects of nutrition supplementation and medical care on mortality. Among Narangwal village women, the provision of iron and folic acid tablets plus supplementary food reduced perinatal mortality (stillbirths plus first week of life) from 57/1000 to 31/1000, versus a reduction to 45/1000 for medical care without supplementation.

b. Improved Infant and Preschool Nutrition

Morley and coworkers (1968) working in Imesi, Nigeria, traced a strong relationship between maternal nutritional status, birthweight, lactation performance, and growth of the child up through 5 years. Their study is discussed in more detail in the section on maternal depletion in Part B of this chapter. Zeitlin and coworkers (1981) found, in the analysis of data from nine Ghanaian preschool clinics, that weight for age at time of enrollment at 2 or 3 months of age was the strongest prediction of weight for age between 1 and 2 years. Moreover, participation in clinic services and activities explained only half as much of the variance in nutritional status during the weaning age for those infants who had entered the program with a high initial weight for age as for those who were malnourished at the time of enrollment. In other words, infants what were initially well-nourished tended to remain well nourished and to have less need for the clinic services.

Wray (1975) summarized the classic findings of Scrimshaw and coworkers and of Puffer and Serrano concerning the interactions of nutrition and infection and other analyses of the causes of death of infants and young children from a wide range of countries and different historical settings. He reviewed the evidence which showed that from 30% to 70% of deaths of children under five years in developing countries have malnutrition as an associated cause. These findings were powerfully confirmed by Kielmann and coworkers (1977) reporting a prospective study in Narangwal, India, which showed that mortality rates of malnourished children according to weight for age criteria during the weaning period are consistently higher than those for children of normal nutritional status. These findings are

shown in Table 3. Chen and coworkers (1980) found in Bangladesh that mortality rates during two years of study were about 5 times higher in the worst than in the best nourished 10% of 0 to 2 years olds. A number of mechanisms by which malnutrition depresses the immune system are well documented (Suskind, 1977) and others still are under investigation.

Studies of percentages of malnourished children among those who die in a particular population undoubtedly inflate the degree to which malnutrition alone contributes to mortality because there is no way to take into account socioeconomic factors and maternal competence which affect both nutritional status and the management of illness. Field experiments in Nigeria and in Narangwal, India, concerned with the impact of feeding programs and primary health care programs on nutritional status, showed that food supplements alone increase infant nutritional status but were less effective than medical services alone in reducing infant and child mortality at certain ages (Edozien, 1970; DeSweemer et al., 1980)[1]. Primary health care alone did not produce normal growth rates.

Food supplements combined with primary health care can both improve nutrition and reduce mortality at a level of expenditure only slightly higher than that of each separate component. Programs that have taught new weaning practices without distributing foods, such as the nutrition and primary health care program in Yako, Upper Volta (Zeitlin, 1981) appear able to achieve comparable results at lower costs. Such findings have supported long standing policies of integrating nutrition with primary health care.

Other studies of operational integrated nutrition and primary health care programs in developing countries tend to support the estimate that these programs can reduce infant and young child mortality rates by about 50% during the first few years of operation, without necessarily decreasing the incidence of severe malnutrition (probably because severely malnourished children who would have died are surviving). Table 4 shows the reductions in infant and 1 to 4 year mortality rates achieved by integrated nutrition and primary health care programs in rural areas of 6 countries (Austin et al., 1981).

c. Policy and Program Implications

Nutritional improvement programs combined with primary health care and food assistance programs that reach large numbers of malnourished preg-

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[1] A problem with the aggregate figures presented in these studies is that they fail to show whether the most malnourished and therefore most at-risk infants were the ones that gained weight in response to food supplementation. Increases in average weight of a group of infants could occur because better nourished but genetically large children gained above average amounts. Many of the infants that died may, in fact, have remained malnourished.

Table 2

Summary of Studies on the Impact of
Maternal Nutrition Interventions During Pregnancy on Infant and Child Health

	Dutch Famine Study	Bogota, Colombia	Guatemala/INCAP	India
STUDY OBJECTIVE	Impact of acute starvation during pregnancy on birth weight and subsequent development in 18-year-old men.	Effect of prenatal and postnatal nutritional supplements on birth weight and child development.	Effect of prenatal and postnatal nutritional supplementation on birth weight, child development and infant morbidity and mortality.	Impact of maternal supplementation on birth weight.
RESEARCH DESIGN (Strategy)	Retrospective study of records from maternity hospitals, vital records, and military services for cohort of all births to women exposed to acute famine during World War II. Records available of weekly rations provided to population segments. Control groups from comparable maternity hospitals and for males whose mothers were not exposed to famine.	Prospective intervention study of offspring of women supplemented in third trimester and/or during lactation with available foods to meet recommended dietary allowances; medical care provided.	Prospective intervention study of offspring of women supplemented in pregnancy and lactation and children supplemented to 7 years of age. Liquid supplements consumed in community center; medical care provided.	Poor malnourished women identified in last trimester and hospitalized to assure supplement intake. Project consists of several small clinical studies.
DESCRIPTION OF POPULATION	n = 40,000 births. Dutch cities under Nazi occupation; well-fed up to 1940; food rationing 1941-4; near starvation 1944-5; rehabilitation 1945-6.	n = 413 births. Urban slums. Pregnant women identified as having prior malnourished child. Their estimated average daily intake was: 1,600 calories 35.5 g protein.	n = 1,536 pregnancies in 4 rural villages. Estimated average daily intake for pregnant women was: 1,400 calories 45 g protein.	Urban subjects. Basal intake was: 1,600-1,800 calories 40 g protein.
DIETARY MODIFICATION	Starvation due to stoppage of external food supplies (1944-1945); then restoration to high dietary intake.	Selected foods provided for entire family. Net increment for pregnant woman was 133 calories and 20 g protein daily.	Liquid supplements: 1) Fresco = low calorie, no protein, vitamin-mineral fortified. 2) Atole = proteins plus calories, vitamin-mineral fortified. *Ad libitum* intake measured at level of individual.	Regular hospital foods (2,000 cal) plus up to 500 calories in additional foods or supplements.

Mexico	Montreal	New York City	Taiwan	
Impact of supplementation during pregnancy and lactation on birth weight, lactation, and development in the young child.	Impact of prenatal dietary improvement program on birth weight and infant survival	Impact of prenatal supplementation on birth weight and infant development.	Impact of prenatal and postnatal nutritional supplementation on birth weight and child development.	STUDY OBJECTIVE
Prospective studies of matched pairs of non-supplemented and supplemented pregnant women living in rural villages; medical care provided.	Prospective study of patients entered through public prenatal clinic; supplementary foods based on dietary and clinical characterization; education and health care provided.	Prospective study of nutritional intervention of public prenatal clinic patients with follow-up of infants to one year of age; medical care provided. Randomized control trial.	Prospective study of liquid nutritional supplements or placebo provided to women for consumption in community health center. First child not treated; second child assigned randomly to treatment groups. Mecical care provided.	RESEARCH DESIGN (Strategy)
n = 39 pregnancies. Rural village. Estimated daily intake of pregnant women was: 1,950 calories 50 g protein. Clinical indicators of malnutrition and anemia.	n = 1,213 white urban patients. Generally low income women with prior history of low birth weight.	n = 769 poor black urban women identified as being "at risk" for low birth weight upon entrance to public prenatal clinic. Daily dietary intake at start was: 2,200 calories 80 g protein.	n = 294 enrolled; 169 completed two pregnancies and consumed adequate supplements. Population from 14 poor rural villages. Married women only with 1 child prior to male child. Basal daily intake of women was: 1,200 calories 40 g protein.	DESCRIPTION OF POPULATION
2-3 glasses partly-skimmed milk to provide average daily supplement in pregnancy of: 205 calories 15 g protein. During lactation about 50% greater. Mineral supplement also provided.	Free foods provided on "prescription basis" coupled with nutrition education; dietary histories taken regularly	Liquid "Supplement": 470 calories plus 40 g protein plus vitamins and minerals. Liquid "Complement": 322 calories plus 6 g protein plus vitamins and minerals. Control: no supplement; routine vitamins and minerals.	Supplement A: 800 calories 40 g protein Supplement B: 80 calories no protein Control: no nutrition intervention.	DIETARY MODIFICATION

Table 2 - Continued

	Dutch Famine Study	Bogota, Colombia	Guatemala/INCAP	India
INCREASE IN BIRTH WEIGHT FOLLOWING DIETARY IMPROVEMENT	Yes: 400 g maximum when diet improved for last half of pregnancy. Moreover, as the famine continued, birth weight declined to a maximal mean decrement of 300 g from the pre-famine level.	Yes: average mean increment of 50 g for all supplemented; 77 g for those supplemented one trimester or more. Data suggest increased birth weight associated with increased protein intake.	Yes: 25 g per 10,000 supplemental calories consumed during pregnancy (based on 405 births). Data suggest increased birth weight associated with increased energy intake.	Yes: up to 600 g average increment.
INFLUENCES OF GESTATIONAL AGE ON RESPONSE TO DIETARY CHANGE	Nutritional rehabilitation during third trimester was sufficient to restore mean birth weight to pre-famine level.	Last trimester or more showed effect.	No effect detected; birth weight increment dependeu on total calories ingested during pregnancy.	Treatment limited to third trimester.
INFLUENCE OF SEX ON INFANT IN RESPONSE TO DIETARY CHANGE	At height of famine decrement, birth weight was greater for males than for females.	Increment in males (100 g) greater than in females (12 g).	None detected.	None reported.
EFFECTS ON MOTHER	Measure of maternal weight at 10 days post-partum showed maternal weight decrement preceding decrease in birth weight. During alleviation of famine, maternal weight increased before birth weight did, and continued to increase as full feeding continued.	Greater maternal weight gain associated with supplementation.	Supplement intake associated with increased weight gain during pregnancy; placental weight; placental RNAase activity and with shorter post-partum amenorrhea and birth interval.	Maternal weight gain with supplement.
ADVERSE EFFECTS OBSERVED	An excess in the number of very early premature and increased perinatal mortality was reported when starvation occurred in the first trimester with refeeding in second and third trimesters.	None reported.	None detected.	None reported.

Mexico	Montreal	New York City	Taiwan	
Yes: 180 g average increment in supplemented groups; marked decrease in number of low birthweight infants reported.	Yes: 40 g average increment.	Yes: 41 g reported with Complement (not statistically significant). No increase with Supplement. Heavy smoking decreased birth weight; Supplement and Complement overcame the decrease in birth weight due to heavy smoking.	Yes: 74 g in "good supplement" group; e.g., woman consumed more than 50% of Supplement A (not significant). Yes: 60-100 g increment (not statistically significant) for those consuming more than 50% of Supplement A compared to Supplement B and controls.	INCREASE IN BIRTH WEIGHT FOLLOWING DIETARY IMPROVEMENT
None reported.	No effect detected.	Birth weight not related to gestational age at which supplements were started.	Treatment before and during pregnancy; no effect reported.	INFLUENCES OF GESTATIONAL AGE ON RESPONSE TO DIETARY CHANGE
None reported.	Not analyzed.	None detected.	No clear difference demonstrated.	INFLUENCE OF SEX ON INFANT IN RESPONSE TO DIETARY CHANGE
Supplemented women gained 6.4 kg more than unsupplemented women.	Maternal weight gain not significantly increased by added dietary intake.	Maternal weight gain greatest in women entering program early in pregnancy.	No effect of Supplement A on maternal weight gain. Mothers on Supplement A excreted 1.2 g N more than those on Supplement B, but consumed 4.8 g N more.	EFFECTS ON MOTHER
None reported.	None reported.	Large number of premature babies (IUGR) and excess neonatal deaths observed in some women on high-protein supplement, especially those with prior low birthweight infants.	Not examined.	ADVERSE EFFECTS OBSERVED

Table 2 - Concluded

	Dutch Famine Study	Bogota, Colombia	Guatemala/INCAP	India
ADDITIONAL OUTCOMES:				
INFANT MORBIDITY AND MORTALITY	Starvation associated with increased infant mortality at least up to 90 days post-partum.	Supplementation associated with reduced perinatal mortality. Infant and child morbidity data not yet analyzed.	No relationship between supplement consumption and duration of diarrhea; supplementation plus frequent medical care usage associated with decreased infant mortality (1,536 births).	Not reported.
BEHAVIORAL EFFECTS	No changes in young adult males born to mothers starved during pregnancy.	More rapid habituation in supplemented 15-day-old infants.	Advanced psychomotor performance in supplemented infants and children to 4 years of age.	Not studied.
SOURCES	Stein et al., 1975; Stein et al., 1978	Brozek et al., 1977; Mora et al., 1979	Lechtig et al., 1979; Stein et al., 1978; Brozek et al., 1977; Klein, R.(unpublished)	Iyengar, L., 1972; Iyengar, L. (unpublished)

Mexico	Montreal	New York City	Taiwan	
None reported.	None reported.	Not detected.	Not examined.	INFANT MORBIDITY AND MORTALITY
Supplemented infants "more active" throughout study.	Not studied	Rapid habituation in Supplement group at 1 year of age; no changes in the usual development measures.	One significant effect among 22 subtests from the Bayley tests.	BEHAVIORAL EFFECTS
Chavez, A., 1978; Brozek et al., 1977	Rush, D. (unpublished): Stein et al., 1978	Rush et al., 1979; Stein et al., 1978; Brozek et al., 1977	Blackwell et al., 1973; Herrat et al., 1979	SOURCES

Table 3

Risk of Death Within a Year by Nutritional Status and Age-Group, Narangwal, India

	Age-group (months)	Nutritional status (% of Harvard weight median)					Statistics	
		60	60-69	70-79	80+	All	(d.f.)	
Deaths	1-5.9	7	10	25	28	70		
Children		48	109	258	1138	1553	38.6	0 001
Risk*		0 146	0 092	0 097	0 025	0 045	(3)	
Deaths	6-11.9	11	17	15	7	50		
Children		62	212	437	748	1459	57.0	0 001
Risk*		0 177	0 080	0 034	0 009	0 034	(3)	
Deaths	12-35.9	8	8	7	5	28		
Children		218	1025	2126	1776	5145	42.8	0 001
Risk*		0 037	0 008	0 003	0 003	0 005	(3)	
Deaths	1-35.9**	26	35	47	40	148		
Children		328	1346	2821	3662	8157	77.8	0 001
Risk*		0 120	0 060	0 045	0 012	0 029	(3)	

* Probability of death/child/year, assuming 16% of children 1-5.9 mos., 18% 6-11.9 mos., and 66% 12-35.9 mos.

**Adjusted for differential age distribution by assigning equal weights to each age-group.

Source: Kielmann and McCord (1978).

Table 4

Mortality rates in six integrated MCH-Nutrition Programs

	Population receiving services		Population in same area without services	
	Infant mortality rate	1 - 4 mortality rate	Infant mortality rate	1 - 4 mortality rate
Imesi (Nigeria)	57.5	18.0	91.4	51.2
Guatemala	55.4	5.9	84.7*	22.0*
Narangwal (India)	95.9	10.1**	126.5	16.3**
Jamkhed (India)	39	--	90	--
Hanover (Jamaica)	10.6	5.6	47.0	14.5
Kavar (Iran)	64.3	n.a.	127.7	n.a.

*From official statistics, which are probably low estimates.

**1 - 3 mortality rate.

Source: McCord, 1977; Gwatkin et al., 1979

nant women can significantly reduce infant and child mortality rates as shown in the previous section. Famine relief reduces mortality directly by preventing starvation. Nutritional improvement combined with improved water supply and environmental sanitation is expected to reduce mortality but has not yet been demonstrated to do so. Other forms of nutrition intervention such as food price subsidies, for example, or supplementary feeding to preschoolers given without health care probably have relatively small effects on mortality, unless these programs are carefully targeted and exceptionally well managed.

These findings imply the need to combine family planning activities with integrated primary health care, nutrition, and sanitation programs. Fortunately, the very program designs that have proven most effective in reducing mortality have shown even greater effectiveness in achieving contraceptive acceptance. These results suggest that the level of trust and community cooperation generated by effective integrated primary health care potentially has a larger impact on contraceptive use than on mortality.

In India, for example, in the Kasa Integrated Mother-Child-Health-Nutrition Project, the number of sterilizations increased from 45 to 750 in the year following the initiation of the program (Shah, 1976). No such increase was found in neighboring areas not reached by the program. The Jamkhed Comprehensive Health Program reported that the percentage of eligible couples practicing family planning went from 2.5% in 1971 to 50.5% in 1976 in the project area, versus 10% in 1976 in neighboring non-project areas (Austin et al., 1981). Since 65% acceptance is commonly considered to be the threshold at which population growth comes under control, this program comes close to achieving family planning objectives.[1] Programs in Bangladesh and Colombia have reported similar high rates of increase (Companiganj Health Project, 1975; Drake and Fajardo, 1976). A factor to be discussed in Chapter 2 that is believed to contribute to these change rates is parents' confidence that children protected by health and nutrition services will not die, so that they do not need to produce a large excess of children in order to insure that a few will survive to adulthood.

The great importance of maternal nutrition during pregnancy to infant nutrition and mortality, is one of a number of reasons for focusing program inputs on the prenatal and perinatal periods. The reduction of child mortality is in itself an important step in reducing population growth, as will be shown in Chapter 2. For this reason we will briefly discuss the design of programs to reduce infant mortality by improving maternal nutrition.

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[1] Dr. R.T. Ravenholt (1980) derives this figure by assuming an uncontrolled fertility rate of 50/1000 and noting that fertility rates in developed countries are about two-thirds of this.

• Maternal Nutrition Programs

Improvement in pregnancy weight gain of at-risk women has the potential for decreasing infant mortality and hence for increasing population growth in the absence of medical services. The studies reviewed by Lechtig and coworkers (1979) show, however, that nutritional improvement is most effective when combined with health care.

Maternal nutrition programs should be targeted to malnourished mothers at risk of delivering low birthweight infants and should use nutrition education and surveillance of pregnancy weight gain to improve birthweights. Supplementary feeding may also be appropriate in some programs. A discussion of these program design elements follows.

--Targeting to malnourished or otherwise at-risk mothers The majority of mothers, even in low income areas, are not at high risk of delivering low birthweight infants. It is important to identify those that are at high risk so that they can receive extra counseling and foods, if food supplements are practical. Mothers at risk of delivering infants weighing less than 2500 g tend to have one or more of the following characteristics: thin, very short, closely spaced pregnancies, failure to gain weight during pregnancy, previous low birthweight infants, age below 20, first pregnancy at age above 35. A list of at-risk factors specific to the location should be drawn up and should include other pregnancy conditions.

The method used to screen pregnant women for malnutrition should depend on the level of sophistication of maternity services. An arm circumference band, screening women with circumferences below 21 cm as severely malnourished and 23.5 cm as mildly malnourished, has been used by Tibrewala and Shah in India (1977), is very simple, and is probably a better measure than weight or weight for height because it is not affected by the stage of pregnancy. A prepregnancy weight less than 85 lb (39 kg) or a weight less than 95 lb (43 kg) at 32 weeks of pregnancy also have been found useful as cut-off points for screening (Shah, 1976). Height less than 60 inches (152 cm)(or less in short populations) is an important screening index both because of increased risk of low birthweight and increased risk of difficult delivery (Everett, 1975).

--Nutrition education Education is the first strategy suggested by Lechtig and coworkers (1979). They write:

"As a first consideration, all maternal nutrition improvement programs should include educational activities emphasizing the need for a better use of locally-available food coupled with recognition that pregnant women, lactating mothers, and young children have special needs which require that they receive priority consideration in the distribution of food within the family. Specific attention should focus on reinforcing favorable feeding traditions and on counteracting cultural traditions or recommendations that limit the intake of foods or of a particular food during pregnancy. Educational programs must also stress the importance of adequate food and nutrition for the lac-

tating mother, along with the value of breast feeding for the infant's health and welfare. Physicians, nurses, health auxiliaries and others must be trained concerning the undesirability of limiting maternal weight gain during pregnancy and of restricting water and salt intake during same, unless the latter measure is clearly indicated for specific medical reasons."

If a pregnant woman is to gain more weight, she and her family must understand that it is important for her to eat more of the right nutritious foods during pregnancy for fear of miscarriage or of poor development of the fetus. Many women--and their care providers--fear that a large baby will be difficult to deliver. This fear may be legitimate if caesarian delivery cannot be performed. But this fear should not be a major concern except in women with small pelvic measurements. The program is designed to identify women whose babies would be too small and to bring their babies up to normal size--not to increase birthweight above the average.

--Surveillance of pregnancy It isn't possible to know if a pregnant woman is gaining weight without weighing her. In areas where this is not practical because of low levels of literacy, it still is important to follow the course of pregnancy and identify potential danger signals. The prenatal period also is an important time for family planning education.

--Supplementary feeding Lechtig and coworkers emphasize that supplementary feeding programs have potentially undesirable side effects, including severe management problems, disincentives to local initiative and production if imported foods are used, and dependency. On the other hand, some pregnant women inevitably are too poor to improve their diets unless they receive food supplements. The above cited workshop concluded that supplementation programs should be limited to situations where malnutrition is severe on a community basis or where supplements are specifically indicated for at-risk individuals as a part of prenatal care.

• Infant and Child Nutrition Programs

Nutrition and health surveillance programs for infants and preschoolers have been more extensively studied and described than maternal nutrition programs (Austin and Zeitlin, 1981; Austin et al. 1981; Morley, 1973). The same principles of targeting, nutrition education, weight surveillance, and supplementary feeding in special cases apply to both maternal and child nutrition programs.

--Targeting Arm circumference can again be used in place of weight for screening and targeting purposes. Table 5 (Chen et al., 1980), showing mortality rate per 1000 children aged 0 to 3 years by nutrition level over a 24-month period in Bangladesh, indicates that 65% of weight for age and 75% of arm circumference per age were sensitive

cut-off points for mortality risk in a severely malnourished Bangladeshi study population. Weight for height and height for age are not recommended for screening purposes because of the difficulty of obtaining accurate heights. The simplest screening measurement is the Shakir strip (Shakir and Morley, 1974) or an analogous thigh circumference tape developed by Zeitlin and coworkers (1981). These are color coded measurements that are independent of age and can be used by nonliterate workers.

--Nutrition education Breastfeeding and supplementary feeding are the key topics for education in infant feeding. Key information is that breastfeeding should be on demand and should continue as long as is practical for the mother and that supplementary foods should be introduced by 6 months, or earlier for infants failing to gain weight normally. These supplementary foods can be soft versions of the adult diet or special mixtures. They must include a good source of protein, a starchy staple, oil or fat for calories, and green leafy vegetables or fruits. They must be fed frequently--at least 4 times a day. and in sufficient quantity--the 12-month old baby should eat almost half as much as his/her mother.

--Surveillance Only about 5% of malnourished infants and young children can be visually detected as being malnourished. The remainder of the malnourished look normal. They are normally proportioned, but too small for their age. This normal appearance is not a protection against the general retardation and poor immune defenses caused by malnutrition. Ideally, all babies should be delivered by trained midwives and should be weighed at birth, in order to identify the low weight infants that require close postnatal supervision. Throughout the first three to five years of life, all infants should be weighed at regular intervals. But those who are normally nourished and do not have special health problems do not need to be seen as frequently as those who are growing poorly. High-risk children should be seen monthly, while others may be seen according to the schedule of their immunizations, unless cultural weaning practices are exceptionally poor. As mentioned earlier, the Shakir strip measuring arm circumference may be used to screen the community to identify children who need intensive surveillance. From six months of age onwards, 12.5 cm corresponds roughly to 60% and 13.5 cm to 70% of weight for age (Zeitlin, 1977). Even nonliterate community members can be shown how to use the strip and can give tickets to mothers of the babies they identify as malnourished, with instructions to produce these tickets at the health center in order to be preferentially enrolled for weight chart surveillance.

--Supplementary feeding It is desirable to have some foods available for extreme cases of need, such as powdered milk for orphans or twins. Whether or not to embark on large scale feeding programs depends on many factors. To the extent that the communities are interested in providing the foods and in collaborating in their preparation and distribution, the program probably will be positive and beneficial. If, on the other hand, people attend the program primarily to obtain a free handout of a foreign food, the experience may be nonproductive. The same concerns expressed in the section on supplementary feeding for pregnant women apply to infants and preschoolers.

2. Lactation Amenorrhea

a. Mechanisms by Which Breastfeeding Delays Ovulation

Differences in breastfeeding behavior account for a large proportion of the fertility differences between non-contracepting populations. A recent analysis of data from 25 subpopulations in 9 countries, from the WHO Collaborative Study on Breastfeeding found that postpartum differences in the proportions of women who were breastfeeding explained an average of 85% of the variation between populations in the proportion of menstruating (and hence ovulating and fertile) women (Billewicz, 1979). Thus in the absence of contraception, differences in fertility attributable to lactation practices would be of the same order, although differences in mortality rates, average marriage age, fecundity, and a range of other factors would contribute to the actual size of comparative fertility effects induced by changes in lactation. Insofar as an understanding of the nature of the lactation-fertility relationship is important to program design this section will discuss the mechanisms involved in some detail.

The anterior pituitary secretes prolactin (PRL) in response to mechanical nipple stimulation in both lactating and non-lactating individuals. This effect is much stronger in lactating women in the early period of lactation than in later lactation (Tyson et al., 1976) or in normal non-lactating women (Archer and Josimovich, 1975). It has sometimes but not always been demonstrated in men (Kolodny et al., 1972). When levels of PRL are high enough, gonadal function is suppressed. In vitro studies suggest that concentrations in the range of 30 ng/ml are sufficient to decrease steroid hormone production from human granulosa cells (McNatty et al., 1974).

PRL levels increase from an average of 25 to 207 ng/ml (Tyson et al., 1972) during pregnancy, when lactation is suppressed by large amounts of estrogen and progesterone produced mainly by the placenta. The sudden fall, particularly in estrogen, following delivery of the placenta triggers the flow of milk on the 2nd to 4th day post-partum (Tyson, 1974). In non-lactating women, PRL falls to prepregnancy levels of below 25 ng/ml

by the second or third week postpartum (Reyes et al., 1972; Bonnar et al., 1975). In lactating women, mean PRL remains about 35 ng/ml (Bonnar et al., 1975). Elevated basal levels have not been found to decrease significantly during the first 12 months of lactation in women who nurse frequently (Delvoye et al., 1977). However, women who nurse less frequently and particularly those who nurse less than six times per day experience a decrease to prepregnancy levels by about 2 to 6.5 months (Noel et al., 1974).

Regardless of nursing frequency, the rise in plasma PRL that occurs during each nursing episode, when the infant is at the breast, is much higher during the first 2 to 3 months of life (to about 213 ng/ml after nursing (Tyson et al., 1976) than in the later months when the increase during nursing is not always statistically significant. The composition of the milk changes with the decrease in PRL secretion, so that the later milk contains less fat, more lactose, and marginally less protein than previously. Use of thyrotropin releasing hormone to stimulate PRL secretion during the later period boosts milk volume and increases percent fat to the earlier levels (Tyson et al., 1975). It is not certain whether the PRL response level during nursing is dependent solely on the time elapsed since pregnancy or whether it may be induced by the physiological nursing pattern of the very young infant. However, one woman who induced lactation by frequent nursing of an adopted newborn infant was found to maintain higher basal PRL levels after lactation began, without marked increases during each nursing episode (Tyson and Perez, 1978).

Tyson (1977) proposed the mechanism for lactational amenorrhoea that is given in the following diagram, and accompanying explanation (see Figure 5, next page).

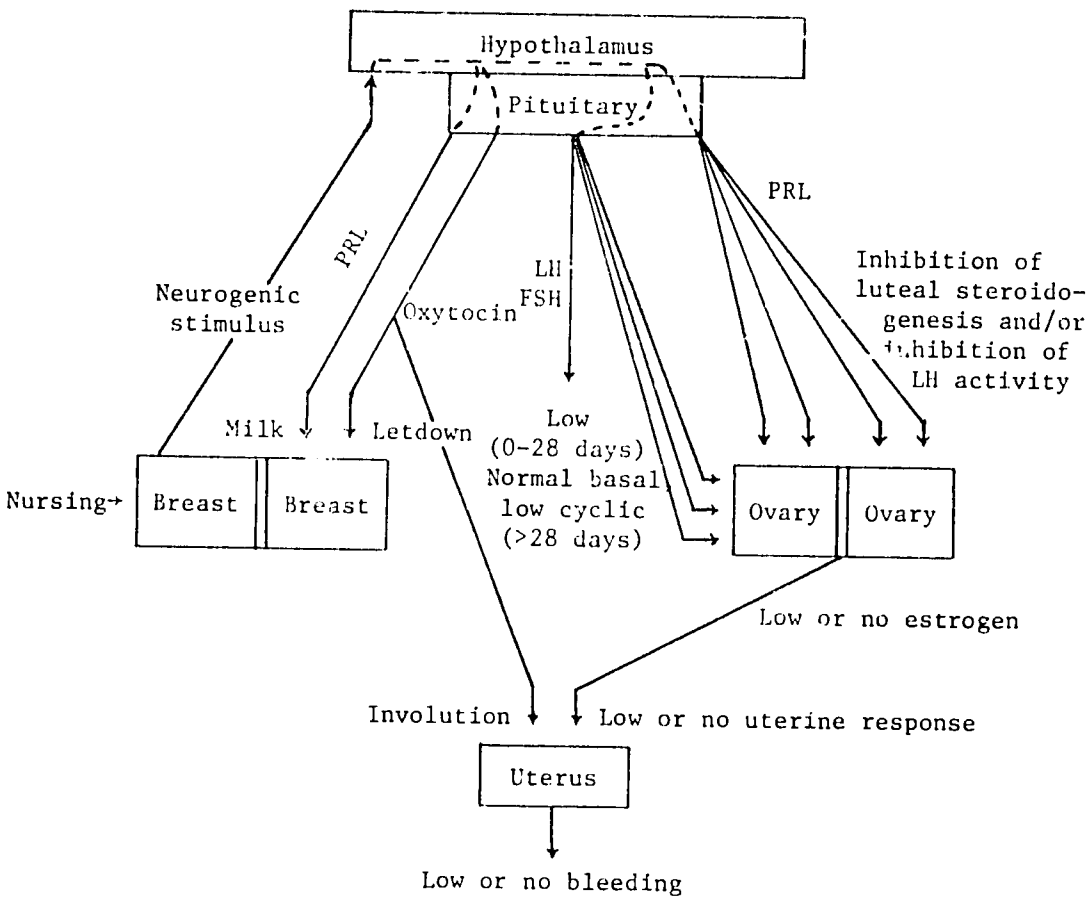
PRL may have a direct effect on the ovaries by inhibiting progesterone secretion, as shown by in vitro studies (McNatty et al., 1974; Short, 1976). The half life of PRL in plasma is estimated to range from 10 to 30 minutes (Konner and Worthman, 1980 (summarizing 5 studies)) and appears to be modulated by hypothalamic dopamine, functioning as a PRL inhibiting factor (Tyson, 1974).

Strength and duration of sucking influence PRL release in the neonatal period when some infants suck poorly (Aono et al., 1977). Konner and Worthman (1980) found in 3 to 24 month old infant-mother pairs among the !Kung Bushmen in Botswana that total nursing time per day and average length of each nursing were not related to gonadal steroid secretion, but that nursing frequency was the significant determinant.

Konner and Worthman (1980) observed that average time intervals between nursing bouts of !Kung infants lengthened late in the child's second year when it spent longer play periods separated from the mother. They hypothesized that ovulatory cycling returned when the regression line of inter-nursing interval on age reached a level that was approximately equal to the half-life of prolactin in human plasma. In other words, when the inter-nursing interval lengthened to about 30 minutes, ovulation returned. They postulated that impaired luteal function or interference with implan-

Figure 5

Theoretical Aspects of Lactational Amenorrhoea



Possible mechanism for the maintenance of lactational amenorrhea. The nipple stimulated by suckling induces the release of prolactin, via a neurogenic pathway to the hypothalamus, which is proportional to the degree and duration of this stimulation. There is evidence that catecholamines and serotonin are involved in this nursing-induced release of prolactin, as well as in the inhibition of cyclic gonadotropin secretion. High prolactin levels are thought to affect luteal function by inhibiting steroidogenesis and/or modulating the effect of luteinizing hormone (LH) on ovarian function. Nursing also induces release of oxytocin from the pituitary causing milk let-down, but it may also have a uterine effect.

Source: Adapted from Tyson, J.D., Neuroendocrine Control of Lactational Infertility. J. Biosoc., Sci. Suppl. 4:23-29. 1977.

tation further lengthened the !Kung birth interval to more than 3 years. Evidence for continued infertility after the return of menstruation is not strong, however, in populations among whom nursing is less frequent (Perez et al., 1971).

The greater PRL response at each nursing during the early weeks of life appears consistent with the finding that relatively few nursings per day are sufficient to postpone the return of fertility for about 6 months, as in the case of the Hutterites, a breastfeeding and non-contracepting religious community in Canada (Huntington and Hostetler, 1965), whereas a pattern of very frequent nursing may be required to sustain infertility from 10 to 18 months, as achieved by well nourished American women practicing a style of frequent demand breastfeeding referred to as total mothering (Kipley and Kipley, 1977) and by the majority of developing country women who nurse on demand.

Breastfeeding during the night while the mother sleeps could be more effective in maintaining high PRL levels than daytime feedings since basal prolactin is higher during sleep. Tyson and Perez (1978) also found much higher PRL response to nursing at the end of the afternoon than in the morning.

Frequent breastfeeding does not work as a contraceptive for all women because of great individual variability. Van Ginneken (1975) reviewed 6 studies carried out in populations where amenorrhea lasts an average of 10 to 11 months which showed that one fourth of the women who began nursing were likely to resume menstruation within six months after birth. Only very early menstrual cycles tend to be anovulatory. Perez and coworkers (1971) used a variety of methods to study the return of ovulation during an average of 4 months after delivery in 200 Chilean women. They found no ovulation during the first 30 days postpartum, but that about half of first menstrual cycles ending 30 to 59 days postpartum, and that more than 80% of cycles ending after day 60 were ovulatory. Although the women in this study did not tend to breastfeed frequently in the traditional manner and tended to wean early, other studies generally conclude that resumption of menstruation during prolonged lactation usually is preceded by ovulation.

Van Ginneken reviewed 10 studies that measured pregnancy rates during lactation amenorrhea and found a variation of from 3 to 13% with an average of 7 to 9% of women becoming pregnant during amenorrhea. He then estimated corresponding pregnancy rates standardized per 100 women per year of amenorrhea from these studies and found a range of from 8 to 17% with an average of 11 to 12%. He compared these rates unfavorably with pregnancy rates for oral contraceptive and IUD acceptors, which range from 1 to 5% in the first year of use and which have average periods of use of 18 months or more in most family planning programs, in contrast to relatively shorter rates for lactation amenorrhea.

b. Policy and Program Implications

Prolonged lactation probably remains responsible for delaying more conceptions than all other contraceptive methods currently in use in the Third World. Rosa (1975) calculated that lactation provided 40% more couple years of protection against conception in 1973 than the services of family planning programs in developing countries. Nevertheless, the world wide decline of breastfeeding has not yet lead to the population crisis that should be feared if birth intervals suddenly dropped from three years to one year, for example.

The reason for this is that in most countries both bottle feeding and modern contraceptive methods or illegal abortions have been practiced by urban groups in such a manner that the loss of the contraceptive effects of breastfeeding has been more than compensated for by other means of birth prevention. If this were not the case, urban fertility rates would be higher than rural, whereas urban fertility is in fact consistently lower than rural fertility. As an example, Millis (1959) documents the decline of breastfeeding in Singapore, while Neville (1978) attests that fertility rates in Singapore have consistently dropped since 1950. Similar trends are observed in countries with less active family planning programs than Singapore, as in Nigeria, for example (Caldwell and Igun, 1970; Omolu, 1973).

While negative effects do not seem to occur at the macrolevel, loss of the contraceptive effects of breastfeeding does frequently have a disastrous impact on individuals and population subgroups. These are persons and groups whose socioeconomic status is marginal, as defined by inadequate purchasing power, inadequate access to health and family planning services, and to the modern sector in general. Schaefer (1971) for example, reported that adoption of bottle feeding among the Eskimos resulted in a jump in fertility from 40 births per thousand to 64 per thousand 10 years later. When, as has been reported in marginal peri-urban areas in Guatemala, low income bottle feeders experience high rates of infant mortality due to the nutritional consequences of shortened birth intervals and increased infection (Lebshtein and Bahay, 1976; Kanawati and McLaren, 1973; Plank and Milanesi, 1973; French, 1967), uncontrolled population growth may not be the outcome, but the results are equally devastating. Such deprived groups are precisely the target groups that require government intervention in nutrition and family planning.

The fact that a decline in the practice of breastfeeding results in a loss of contraceptive protection among socioeconomically deprived groups and individuals clearly implies the need to promote breastfeeding.

Two questions arise in the attempt to interpret further the policy significance of the lactation-fertility interactions. The first is whether or not it is advisable to promote the style of almost continuous breastfeeding that is required to maintain long periods of lactation infertility. The second is whether to introduce contraceptives during lactation amenorrhea or after menstruation returns.

The answer to the first question depends on whether the very frequent breastfeeding required for contraceptive effects after about six months also is required to maintain the mother's milk supply to her infant and to promote emotional well-being. Although these issues need further study, PRL level is not the only or possibly even the major determinant of milk volume (Lunn et al., 1980) and adequate nursing often continues after the return of menstruation and ovulation, although prolactin levels are greatly reduced (Delvoye et al., 1977). Maintenance of high prolactin levels consistent with amenorrhea also does not guarantee milk volume, which typically drops from about 650 ml/day in the first 6 months of life to about 450/day during the second 6 months (Chávez et al., 1975) despite amenorrhea.

So far as the anti-infective properties of breast milk, and the emotional benefits of breastfeeding are concerned, it would be hard to support the argument that several nursings per hour during the second year of life would be beneficial for all infants. Moreover, the chronic hunger of malnutrition may be necessary to induce some infants to nurse frequently enough to maintain amenorrhea, as suggested by the Lunn study to be discussed in the next section.

Promotional claims that all breastfeeding women should feed their infants day and night, several times an hour would be counterproductive for breastfeeding. Advice to breastfeed every 15 minutes would alienate women whose daily schedules and personal preferences couldn't accommodate this feeding style. Advice to feed the baby "freely" and "on demand," on the other hand, leaves the woman free to interpret the baby's cues according to her own needs. With monitoring, this advice usually is sufficient to guarantee the baby's physical and emotional well-being, but it cannot guarantee contraceptive protection for the mother.

The pattern of almost continuous nursing does not seem to be sustainable even among the !Kung when they give up their nomadic lifestyle and have access to a more regular food supply (Kolata, 1974). They then typically experience a drop in interbirth interval from about 4 years to the 2 to 3 years that is more common among traditional agrarian populations, where very frequent nursing at night and during portions of the day alternates with periods when the infant is left with a caretaker or is fed supplements so that the mother is freed for agricultural or other tasks.

Mothers should be encouraged to breastfeed their babies whenever they are hungry, even if they have eaten very recently, but such instructions must not be coercive, and the feedings must not be given in order to maintain amenorrhea. The mother cannot be told to feed a sleeping baby every half hour, for example, for the sole purpose of protecting herself from a new conception.

In response to the second question, the introduction of contraceptives that do not interfere with lactation as soon after delivery as possible has the major advantages of providing better contraceptive protection than lactation amenorrhea alone and even more importantly, of providing a learning

period for the use of contraception, when mother and health staff must see each other frequently for the infant's postnatal care. This protected period when amenorrhea makes pregnancy unlikely permits pill users and users of mechanical methods to make mistakes in the course of the learning process without immediately becoming pregnant. It also permits frequent initial monitoring of any side effects by the clinic staff. This is particularly desirable in the case of the IUD and for follow-up of tubal ligation. As noted by Masnick (1978) those women most in need of contraception frequently have no learning time because they conceive with the first contraceptive mistake. The Population Council did in fact institute a postpartum contraceptive program in hospitals on a global basis in the mid 1960's (Zatuchni, 1974).

Van Ginneken claims that the above 'postpartum' strategy is less useful than the 'postamenorrheic' strategy of introducing contraception when menstruation resumes in conservative societies where there are strong beliefs that lactation prevents pregnancy during amenorrhea or in societies with long periods of postpartum abstinence. He states that early contraceptive measures may appear meaningless or unacceptable to people in these cultures (1975).

Yet recent evidence shows that postpartum abstinence may rapidly be discontinued with modernization (Caldwell and Ware, 1977; Ring and Scragg, 1973; D'Alois, 1980[1]). For this reason and because of the need to modernize beliefs and practices generally, the 'postamenorrheic' approach probably should be used only as a fallback position in situations where programs encounter opposition to postpartum measures. Such a situation has been reported from a family planning clinic in Kalabar, Nigeria (Weiss and Udo, 1980) where use of contraception in place of abstinence appeared to face strong resistance. An intermediate policy of introducing contraception at 3 or 6 months postpartum, or as early as acceptable, still would be preferable to waiting until the end of amenorrhea.

3. Maternal Nutritional Status and Fecundity

Much of the interest in development circles in the effects of maternal malnutrition on fecundity stems from the concern that food aid and other programs that improve nutrition may inadvertently increase birth rates and add to already serious population problems. At the same time researchers and practitioners in gynecology, obstetrics and other clinical aspects of fertility are equally interested in the mechanisms by which maternal nutritional status affects fecundity and fetal development. While the same physiological mechanisms are of interest to both groups, the clinical group treating individuals mainly in developed countries are concerned with much smaller effects than the development community. For example, malnourished developing country women are estimated to have a stillbirth

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[1] D'Alois personally communicated to the writer that her doctoral thesis research in Liberia showed a shift in belief. Formerly, sexual relations per se spoiled the milk. Now, sex with the baby's father is permissible, but sex with another partner would spoil the milk.

rate (intrauterine death after the 28th week of pregnancy) of 4% compared to 1% in well nourished Western communities (WHO, 1970). Such a difference in probabilities is important to the clinician and to the individual pregnant woman. However, at the population level, stillbirths are estimated to make up a very small fraction of intrauterine deaths, and the impact of differences of this size on population growth may be too small to merit consideration by development planners.

John Bongaarts (1980) has produced a recent review of evidence concerning the effects of malnutrition on fecundity. Rather than attempt to repeat his work, this section will summarize Bongaarts' major findings and discuss the types of deficiencies that exist in the data he reviewed. We will then present and discuss the significance of counter-evidence suggesting that nutritional status may have larger effects on fecundity than are initially apparent. Referenced statements are from our own rather than Bongaarts' review of the literature.

a. Summary of Evidence That Improved Nutrition Doesn't Increase Fecundity

Bongaarts' paper focuses on chronic moderate malnutrition of the degree found in low income groups in developing countries rather than famine conditions, in which fertility is known to be impaired. Almost all research concerns the effects on females, with the exception of evidence that moderately malnourished boys (Galal and Salem, 1977) also, like girls, reach puberty later than well nourished boys.

The growth rate of a population is determined by its fecundity which sets a physiological upper limit on number of births and by cultural and behavioral factors regulating fecundity. These include age of marriage, marital disruption, deliberate birth control, and breastfeeding. Macrolevel effects of nutrition on fecundity cannot be studied in population groups that regularly practice birth control. Among such groups, good nutrition, small family size, and high socioeconomic status almost always are highly intercorrelated. Comparisons of historic and contemporary populations that do not normally practice birth control reveal no macrolevel relationships between nutritional status and population growth rate. Well-nourished Saudi and Kuwaiti women have the same fertility rates as malnourished women of Bangladesh.

Interpopulation differences that do exist appear to reflect differences in breastfeeding patterns and in age of marriage. The well-nourished Hutterite religious group in the United States, for example, has 9.5 births per woman compared with 7.2 among the poorly nourished in Bangladesh. The Hutterites introduce pacifiers and early solid foods to their infants in place of frequent breastfeeding. Their duration of lactational amenorrhea is 6 months, versus about 18 months in Bangladesh, while median marriage age for Hutterites is 22 years, versus 17 in Bangladesh.

The lack of relationships between nutrition and population growth rates in intercultural comparisons doesn't guarantee a lack of relationship within the same cultures. A food program that improved nutritional status without changing cultural factors within a given group could result in increased birth rates within that group. Feeding programs, food price subsidies or food fortification programs could conceivably improve nutritional status without educational or integrated service inputs that would promote birth spacing. In Morocco, for example, Catholic Relief Services provide a substantial ration of high quality food per month to women who have certificates of poverty and have two children between the ages of 3 and 5 years. Nutrition education in this program does not emphasize family planning. This particular program inadvertently rewards high birth rates by insisting that recipient women have two children between 3 and 5 in order to be eligible to receive donated food. The program presents a research opportunity to determine whether fertility has increased in response to this incentive.

In order to estimate the effects on fecundity of nutritional improvement per se, Bongaarts (1980) has reviewed the evidence surrounding the various biological factors that determine fecundity. The following conclusions summarize his findings together with comparable evidence from our literature review.

- Menarche: There is strong evidence that poor nutrition can delay menarche from the average age of 12 to 13 years seen in well-nourished adolescents to about 19 years at the extreme upper limit in poorly nourished populations. Forms of malnutrition that produce stunted chubby children as in Chile or Guatemala may not delay menarche. Menarche at about 15 years of age due to nutritional delays is not uncommon in developing countries. However, the average age at marriage in developing countries ranges from 2 to 10 years older than age at menarche; thus age at first birth is almost always independent of age at menarche. For this reason, various methods of calculating fertility increases that might occur from lowering the age of menarche yield estimates that do not exceed about 4%.

- Menopause: There is no conclusive evidence for nutritional effects. Mean age in developed countries ranges from 47 to 50 years. Ages as low as 44 years are reported for malnourished groups in India and New Guinea, but 50.7 years is reported for South African Bantu. Confounding effects may come from the fact that childhood malnutrition could delay menopause by slowing the life cycle generally. Animal studies show that low caloric intake extends the time span of the entire life cycle in all species studied (Stunkard, 1976). If poor childhood nutrition initiated such an extension, menopause could actually be delayed by malnutrition, providing that midlife nutritional status were not poor enough to induce amenorrhea. Effects on fertility of such interactions as may exist appear to be small. Average timing of last birth in natural-fertility populations appears to remain close to 40 years regardless of nutritional status.

- Inhibition of ovulation by lactation: As noted in the previous section, duration of lactation amenorrhea seems to depend mainly on the frequency of breastfeeding, which is a matter of cultural and personal style. Studies of the effects of nutrition on duration of amenorrhea have compared groups of women within the same culture, who are assumed to differ in nutritional status as measured by weight, weight for height, or dietary intake. These studies have not controlled for individual breastfeeding behavior. Nonetheless, results of carefully conducted studies in Bangladesh and Guatemala are consistent in finding very small effects attributable to differences in bodyweight or dietary intake. These studies suggest a difference of about 1 month in the amenorrheic intervals of high and low nutritional status groups. Bongaarts calculates that a 1 month change would yield no more than a 3% difference in marital fertility in the highest and lowest nutritional status groups in populations having typical mean birth intervals of 2-1/2 to 3 years.

- Regularity of ovulation and quality and quantity of sperm: Mean waiting time to conception of menstruating non-contracepting women is used as an indirect measure of reproductive capacity, because the clinical tests required to look more closely at ovulation and sperm production are impractical to conduct on a population basis. Prospective studies using the same Bangladeshi and Guatemalan populations cited in the above section found significant differences between the locations but not between nutritional status groups within location. Mean waiting time was 10 to 11 months in Bangladesh and about 6 months in Guatemala.

- Intrauterine mortality: Good evidence establishing a link between moderate maternal malnutrition and fetal mortality does not exist. From one eighth to one third of conceptions are estimated to end in spontaneous abortion or in stillbirth both in well nourished and in malnourished population groups. The existing data is weak both because of difficulties in measuring mortality that may occur before a woman knows that she is pregnant and because of reporting problems. Bongaarts cites a rate of 17.6% in Lahore, Pakistan (Awan, 1975), for example. A woman anthropologist known to one of the writers, who conducted in depth investigations of this subject in villages not far from Lahore, found a taboo against admitting to or discussing spontaneous abortion out of fear that such admissions would be unlucky. She estimated an actual fetal loss rate of about a third. Bongaarts gives further indirect evidence that nutritional status probably does not affect fetal death rate from the previously discussed Guatemalan population. Maternal nutritional status did not affect the mean duration of the interval between the end of postpartum amenorrhea and the next birth, whereas an increase in intrauterine mortality would have lengthened that interval.

- Fecundity and fertility in famine: Extreme food deprivation always causes a reduction in birth rates. Amenorrhea, gonadal atrophy, and loss of libido occur during starvation. However, psychological stress also can cause amenorrhea. Spouses may also be separated or may voluntarily control fertility. Males, subjected during a study by Keys (1950) to a 50% reduction in caloric intake for 24 weeks, experienced loss of libido and reduced sperm motility and longevity. Most individual women appear to have a weight threshold below which they become amenorrheic, and will resume mentruation when weight becomes normal (Frisch, 1978). In every society, a very few individuals under severe stress may become infertile from insufficient nourishment. However, moderately malnourished women who are adapted to the diets of low income communities appear to remain above this threshold.

Bongaarts concluded that the effects of nutrition on fecundity are too small at the population level to arouse concern that food aid to developing countries will increase population growth. The writers of this volume do not fully concur with this conclusion, for reasons to be noted in the next section.

At the clinical and epidemiological levels, even relatively minor effects of nutrition on fecundity are sufficient to merit further research. Conditions that affect small numbers of men and women remain important for individual treatment and for preventive public health measures. Moreover, most pathological conditions of concern in industrialized countries such as hyperprolactinemia, for example, have much lower incidences than the basic problems that remain critical in developing country settings.

b. Problems of Data Quality

Masnick (1979), in a critical review of the studies used to estimate the impact of breastfeeding on fertility, concludes that the major research on lactation and postpartum anovulation is yet to be done. Some of the methodological weaknesses that he notes also are applicable to other nutrition-fertility research. In this section we summarize Masnick's points. The works explicitly referenced are from our own rather than Masnick's review of the literature. Methodological weaknesses in current estimations include the following:

Estimates that report similar rates of intrauterine death for well nourished and malnourished populations may be based on higher rates of underreporting in developing country settings. Laurentin and Benoit (1976) report from studies in Upper Volta that spontaneous abortions are greatly underestimated, and that overly long birth intervals caused by pathology following fetal loss and by venereal disease make average birth intervals unrepresentative of healthy women. Potter and coworkers (1965a) concluded in the Khana study that fetal death rates were underreported.

On the other hand, Chen and coworkers in Bangladesh (1974) still report observed abortion rates of only 13.4% after correcting for official reporting errors by means of prospective survey methods.

Masnick points out that high infant mortality rates should imply high fetal wastage since the same lack of prenatal and perinatal care contributes to both conditions. The village health worker program in Kavar, Iran, confirms this line of reasoning by reporting fetal death rates of 36 versus 79 per 1000 and infant mortality rates of 64 versus 128 per 1000 in project versus control villages (Gwatkin et al., 1979).

Death rates may be underreported generally. Madigan and coworkers (1976) used the randomized response technique in a household survey in Misamis Oriental Province, Philippines, to investigate the extent of purposive concealment of all deaths. They estimated that 75% of urban and 47% of rural deaths were not registered with municipal authorities. Births and deaths of infants dying in the neonatal period are frequently not registered.

Interpreters of historical records concerning lactation and birth intervals have assumed, perhaps erroneously, that differences in lactation, rather than fetal deaths or delayed conception by fertile women, explain birth intervals. Masnick notes that the data do not fully support this assumption.

Recent survey data examining lactation-amenorrhea relationships do provide evidence for strong correlations but cannot be used to derive accurate quantitative estimates concerning the level of contraceptive protection provided by lactation or of the effects of nutritional status on amenorrhea. Retrospective surveys that cover sufficiently long time intervals for estimation contain memory bias favoring digit preference, with 6 months or 1 year as popular figures. Prospective surveys generally cannot extend their coverage long enough to include women with long periods of amenorrhea and long waiting periods to next conception. Truncated observations bias the averages downwards. Differences in frequency and style of lactation and in coital frequency, fecundability, contraceptive use and fetal wastage are not adequately documented by existing surveys.

Comparisons between Boston and Taiwanese data suggest that racial or unexplained environmental differences may also exist. As an example, 40% of Taiwanese women who did not breastfeed resumed menstruation by 1 month postpartum, versus less than 10% of Boston women.

Like sample surveys, clinical studies measuring rates of ovulation are biased towards short periods of amenorrhea both because of time limited study designs and because women tend to be lost to follow-up over time, so that those who resume menstruation late are likely to be underrepresented in study samples. Clinic populations also tend to breastfeed on schedule, to supplement breastfeeding, and to wean relatively early.

Errors in age estimation, retrospective study designs, and lack of measurement of type of malnutrition (thinness versus stunting on a calorically adequate diet; micronutrient deficiencies) flaw studies of menarche and menopause. A study by Damon and Bajema (1974) showed a correlation of only 0.6 between actual ages of menarche and women's memory of these ages 39 years later, although mean remembered age in this U. S. population differed by only 2.4 months from mean actual age of menarche. Moreover, adolescent and premenopausal subfertile periods have been shown to exist (Montagu, 1957; Gray, 1977) and may differ in length with nutritional status.

A wide range of animal studies suggests that animals on low calorie diets are more fertile than when calories are overly abundant (Correa and Jacoby, 1978). Current infertility rates of up to 15% in the United States (Science News, 1980) are higher than those usually reported from developing countries. These high rates may be caused primarily be deferring childbirth from the 20's to the 30's and may reflect relatively short term infertility. However, to the extent that fecundity follows an inverted 'U' shaped curve with respect to caloric intake, comparisons between populations falling at the extremes would not be particularly revealing.

c. Counter-evidence: Seasonality of Conception and of the Termination of Postpartum Amenorrhea

In the agricultural village of Keneba, Gambia, 39% of conceptions were found to occur when women's body weights were highest, from February to May, and only 11% when weights were low, from November to February (Thomson et al., 1966). Similarly among the San Bushmen of the Kalahari, 32% of bush-food-dependent nomadic mothers conceived from June to August, when calorie and protein intakes were highest and individual weights were at their peak (Wilmsen, 1973). Births of settled San women, who consumed domestic foods and whose weights averaged 4 kg higher than those of bush-food eaters, were distributed more evenly by season. Huffman and coworkers (1978) found seasonal trends in termination of postpartum amenorrhea. Women giving birth in February and in September in Bangladesh both had median durations of amenorrhea which resulted in the resumption of menses in December or January, following the harvest. Chen and coworkers (1974) found more conceptions in Bangladesh occurring in the cold season when food was plentiful. Pasternak (1978) concluded from studies of two villages in Taiwan that the food production cycle exerted a greater influence on birth seasonality than time of marriage or attributes of temperature, rainfall, or workload.

These findings suggest a relationship may exist between nutritional status and fertility which is not apparent in the results of the cross-sectional studies cited earlier that divide women into weight for height or dietary categories. Huffman noted that the difference in mean amenorrhea length calculated cross-sectionally between women of the highest and lowest weight categories in the above Bangladesh study was less than 2 months. This was consistent with findings from Guatemala.

d. Proposed Hypothesis: Individual Thresholds

Several quite different hypotheses could contribute to the explanation of this apparent discrepancy. An overly simple one would be that the greater food availability after the harvest induces women to give more supplementary foods to their infants, thereby reducing the frequency of breastfeeding and triggering the resumption of ovulation, irrespective of maternal nutritional status.

A second comprehensive hypothesis that appears to fit the evidence is that individual women have individual nutritional thresholds below which their fertility is reduced in part via lactational mechanisms, and that these thresholds do not depend on weight for height or body fat alone but on a number of hormonal and physiological factors, each with its own set of controls. This would be a modification of Frisch's (1978) contention that within any given population all women should exhibit the same consistent threshold pattern. Frisch's hypothesis has been shown not to fit data from the United States where women are usually well nourished (Zacharias et al., 1976) or from Bangladesh where they are frequently malnourished (Huffman and coworkers, 1978). A theory of individual thresholds is consistent with data from anorexic women and from famines.

Lunn and coworkers (1980) have shed further light on seasonal nutrition-lactation interactions in a comparative study of three groups of Gambian and one group of British breastfeeding mothers. The Gambian women had different average levels of caloric intake: 1500 calories for the preharvest rainy season group, 1650 for the postharvest dry season group, and 2300 for a dry season group receiving a food supplement. The caloric intake of British women averaged 2450. The three Gambian groups together produced the same average amount of milk per day (700 ml) as the British mothers during the first 3 months of pregnancy. However, plasma PRL varied greatly with nutrient intake. The mean PRL concentrations in the low calorie Gambians were about twice as high as those of the high calorie Gambians, and this high calorie group had levels about twice as high as the British mothers whose PRL dropped to prepregnancy levels by 3 months postpartum.

The authors of the study proposed that nutrient intake of the mother directly determines PRL level, which in turn governs the length of postpartum infertility. They claimed that frequency of sucking was not an important determinant of PRL because they estimated that all three Gambian groups had nursed their infants with equal frequency, 10 to 16 times per day (versus 6 times per day for the British group). One of the writers of this section, who has observed and interviewed African mothers concerning frequency of nursing episodes in Upper Volta, Ghana, Nigeria, and the Sudan, wonders about the accuracy of their estimates of nursing frequency among the Gambian groups. She has commonly seen older infants take the breast 10 times or more during an hour's interview, and has concluded that it is impossible to estimate accurately the number of nursings at night when some babies are reported to suck continuously while their mothers sleep.

Strongly suggestive evidence that breast milk volume decreases with decreasing nutrient intake of the mother (summarized by Wray, 1978) makes it appear probable that the infants of the low calorie group were in fact nursing more frequently and thereby increasing the mothers' PRL levels and their 24 hour milk output relative to their nutrient intake. Additionally, nutrient intake might also directly affect PRL level.

Whether or not the infant's appetite functions as a variable linking dietary intake to PRL level, this study demonstrates a potential relationship between nutrition and amenorrhea that might not be revealed by measuring weight for height.

An individual threshold theory proposes that during times of food scarcity most women in a social group reduce their intake relative to their individual nutrient requirements; their body weights decrease relative to individual prior weights; their efficiency of breast milk production decreases according to individualized control mechanisms, inducing increased sucking by their infants and increased PRL secretion; and they remain or become amenorrheic according to a complex set of hormonal responses in which levels and thresholds again vary individually.

This hypothesis is consistent with the finding of little or no difference between women in different weight categories at the same season. It can be assumed, for example, that nearly all women in each weight category are above their individual thresholds in the postharvest season. Similarly, in seasons of food scarcity, near equal proportions of women in different weight classes might be expected to fall below their individual thresholds with respect to the various components of fertility and become less fertile.

The individual threshold hypothesis might be tested by instituting a preharvest feeding program for a test population of lactating amenorrheic mothers in a region known to have serious food shortages, and comparing their subsequent rates of termination of amenorrhea and of conception with those of a control group. Such an experiment would have validity only if breastfeeding patterns and supplementation of infants did not differ in the treatment and control groups, or if differences that occurred were measured by methods similar to those used by Konner and Worthman (1980) among the !Kung.

Huffman and coworkers (1978), looking at the termination of amenorrhea in the postharvest season in Bangladesh, did not find it to be related to changes in the mothers' weight or to the total number of minutes per day spent by the child at the breast. They did note that the mothers' activities at this season separated them from their children for longer periods than in the preceding period. Thus nursing frequency may have decreased, although this was not reported.

Popular folklore claims that pregnant women tend to go into labor at the full moon. Analogous cyclic phenomena may influence conception. Cowgill (1969), reviewing historic and contemporary birth records, postulates that meteorological factors determine season of birth in the Old World and

South America and that cultural factors determine birth season in Puerto Rico, the United States, Canada and Mexico. The cultural factors cited in various studies include season of marriage, agricultural migration, coital frequency, and festivals and abstention periods, such as Lent. Certain cultural factors can play a role, and sometimes an extreme one: in Western Abelam, New Guinea, abstention from sex for up to six months per year is believed to provide magical protection of the growth of the yam crop (Scaglion, 1978). Chen and coworkers (1974) suggested that seasonal temperature affected sexual behavior in Bangladesh. La Leche League members report that amenorrhea is lengthened by sleeping with the baby and nursing at night, implying that olfactory cues may also play a role.

It has been suggested that the better nutritional status of wealthier peasant mothers may be the cause of higher fecundity with increasing social status in some traditional agricultural societies. Ajami (1976), studying differential fertility in six Iranian peasant villages, found a consistently higher number of children ever born to women of high than of low socioeconomic status. This relationship was strongest among the 87.4% of women who had never used birth control, in a culture where women sought methods of birth control only after their demand for children had been satisfied. After controlling for age at marriage and duration of marriage, he found high status women had given birth to an average of 5.4 children, versus 4.9 for medium status, and 3.8 for low status. He also cited studies from rural China (Notestein, 1963), Poland (Stys, 1957), Central India (Driver, 1963), and West Bengal (Nag, 1968), showing a positive relationship between fertility and land ownership. Similar positive associations exist between nutritional status and size of land holdings (Rawson and Valverde, 1976; Valverde et al., 1977), as well as nutritional status and other socioeconomic factors (Wray and Aguirre, 1969). Ajami (1976) postulates that "such variables as miscarriage, sterility, stillbirth, nutrition, lactation and postpartum abstinence" would explain these differences.

Although such findings are not consistent, and cannot be firmly attributed to nutrition, it is entirely reasonable to assume that in rural societies where the value of children to the family is high, affluent families will succeed in acquiring more of this form of wealth than will the poor, and that some portion of income or nutritional transfers to the poor will be invested in acquiring children.

e. Policy and Program Implications

Improved maternal nutrition per se does not appear to have as large effects on maternal fecundity as does a reduction in the duration or frequency of breastfeeding. However, the size and nature of the effects on fecundity that do occur are not sufficiently understood. Moreover, the demographic impact of such effects is impossible to predict independent of social context.

As an example of the importance of social factors, improved maternal nutrition is known to produce larger infants and may increase risks of maternal and infant deaths during childbirth (Sambhi, 1973; Mtivalye et

al., 1974; Bagchi and Bose, 1962). In the absence of modern maternity services, the impact of a potentially higher death rate would have to be counterbalanced against any increase in fecundity of the mother. (As noted in section 1c, maternal nutrition programs operated through maternity services ideally are targeted to those mothers at risk of producing low birthweight babies and should not have the effect of increasing the size of all newborns.) As another example, it may be virtually impossible to improve maternal nutrition in some social settings without changing lactation style, because mothers may share their improved food supply with their infants and thus decrease breastfeeding, and because infants of better nourished mothers may not need to nurse as intensively to get sufficient milk.

As in the case of breastfeeding versus bottle feeding, social and cultural factors linking good nutrition to small family size exert stronger effects than biological linkages in the other direction, for individuals and populations participating in the mainstream of development. Similarly, as in the case of lactation, there undoubtedly exist groups whose lifestyles are little influenced by the modern sector, or who, because of poverty, have limited access to modern service structures and may experience adverse population growth in response to nutritional assistance programs. Such groups tend to be the target groups that assistance programs seek to serve. For this reason, programs should be examined individually to attempt to estimate whether their nutritional or other components have the effect of increasing population growth rates.

It probably is possible to generalize concerning the types of social and developmental situations in which nutritional improvement could lead to increased fertility. The !Kung Bushmen provide a documented example of a situation in which an improved food supply, gained by changing from a nomadic to an agricultural lifestyle, leads to higher body weights and heights, to a reduction in birth seasonality, and to increased fecundity. This results in part from adopting the breastfeeding and infant supplementation patterns of their Bantu neighbors, on whom they model their new sedentary lifestyle.

Populations changing from a nomadic to a sedentary life probably should be considered at high risk of instability of population growth rate--that is, either of increasing fecundity for ecological reasons that are in part nutritional or of dying off, as occurred with Australian aborigines and some American Indian tribes. Agriculturalists have much higher fertility rates than nomadic pastoralists in the Sahel. The sedentary society optimizes its nutritional odds for survival in time of drought by colonizing as large a geographical area as possible, because the chances that at least one section of this tribal territory will remain agriculturally productive is thus increased. Nomadic groups who depend for food on the size of their herds have a greater advantage in keeping population growth commensurate with herd size. The increased fecundity of the Eskimos, following adoption of bottle feeding, may also be associated with their change from nomadic to settled living conditions. Agencies organizing food assistance to pro-

grams settling nomadic populations probably should carefully consider ways that integrated program structures can motivate family planning among these groups.

Economic or nutritional assistance to traditional agricultural societies may also result in population growth unless the assistance "package" includes family planning. Increased fertility could be predicted if fertility were positively correlated to income within the group receiving assistance.

Urban migrants have been found to experience a drop in average fertility consistent with urban lifestyles (Ribe, 1980; Goldstein, 1973) which also reflects family disruption occurring with migration. Poor urban families, however, whose access to modern sector opportunities and whose general competence may both be low, also are at risk of increased fertility resulting from government assistance programs. For example, Liebowitz and coworkers (1980) found that teenage girls in California who were recipients of the Assistance to Families with Dependent Children (AFDC) or Medi-Cal programs were more likely to become unwed mothers than nonwelfare recipients. In these cases, better nutrition per se was not the culprit, yet nutrition programs may have similar effects.

Thus, the evidence suggests that indiscriminant food assistance may increase fecundity under certain socioeconomic circumstances. The probability of this occurrence in most nutritional assistance programs is low, in part because the effectiveness of such programs in reaching the poorest and worst nourished 30% of developing country populations has proven extremely low.

It is important to integrate family planning services with nutritional assistance programs to offset possible increases in fecundity that may be associated with reductions in infant mortality (resulting from improved nutrition), with improved maternal nutritional status, and with reduced intensity of breastfeeding (resulting from supplementary feeding programs for malnourished infants).

4. Extent to Which Nutritional Assistance Programs May Affect Population Growth via Effects on Mortality, Lactation, and Fecundity

The answer to this question represents a bottom line that is impossible to calculate with precision, because the outcome depends on insufficiently understood interactions over time, between variables that range in value.

a. Review of Program Evidence and Projections

Few programs have measured and related changes in fertility, in nutritional status, and in mortality. The Imesi project in Nigeria, which offered health and nutrition surveillance to "under-fives," calculated that 0 to 5 year mortality of program participants was 37 per thousand, com-

pared to 91 per thousand in a control village, and that the general fertility rate in Imesi was one third higher than in the control village (228 versus 171 per thousand)(Gwatkin et al., 1979).

Engel and Caedo (1975) estimated the impact of nutrition and family planning programs on population growth in Bulacan Province, Philippines. They found that family planning alone and combined family planning and nutrition programs both succeeded in decreasing population growth by 11% to 12%, as compared to the control area, but that the combined program also decreased infant mortality by 19% and 1 to 4 year mortality by 10%, whereas the program offering family planning only decreased infant mortality by 10% and had no effect on 1 to 4 year mortality.

What may be said with some certainty is that low-cost, integrated programs can control both mortality and population growth, whereas inaction or withdrawal of nutritional assistance will not prevent population explosion. Low-cost, integrated primary health care, nutrition and family planning schemes, at their best, are capable of replicating in technologically underdeveloped settings the same favorable reduction in mortality, improvement in nutrition, and reduction in fertility that occur with economic development in industrialized countries. Lowering of mortality, by whatever means, to levels that are consistent with development goals, automatically brings with it the need to lower birth rates to between 2 and 3 children per couple in order to stabilize population growth. Permitting endemic malnutrition to continue will not lower the population growth rate to the extent needed. The degree of malnutrition that would be required to keep net reproduction rates at such low levels would approach famine conditions. Such malnutrition would be incompatible with the changes in personal motivation that are necessary for voluntary adoption of the 2 child family. Thus maintenance of low fertility by nutritional means would be inhumane in the extreme and would be likely to be counterproductive in the long run.

Venkatacharya (1978) has published a simulation model study of the influence of variations in child mortality on population growth rates. Differing levels of lactation amenorrhea and fecundity, and different strategies of family size limitations are built into the model. Interested readers are urged to refer to this study as an example of the type of simulation process required to attempt to estimate the range of effects that nutritional change may exert on population growth.

The simulation shows that under conditions of relatively low fecundity, as in India, where postpartum amenorrhea lasts an average of 11 months, and where family planning is consistently practiced according to typical rural family size goals, population growth rises rapidly above acceptable levels when mortality decreases. Thus, if families are assumed to stop childbearing when they have two living sons (with provision for further childbearing if the family has experienced more than one son death), the net reproduction rate (NRR) still rises above 1.5 as soon as infant mortality (IMR) and child mortality drop below 100 and 50 per thousand, respectively, and life expectancy rises above 50 years. With similar lactation and fecun-

dity assumptions, if families place no limits on fertility, NRR rises above 1.6 as soon as IMR drops below about 230 and childhood mortality below 146 and life expectancy rises above 34. Reductions in mortality do appear to lead eventually to reductions in fertility for psychosocial reasons (presented in Chapter 2).

Braudel and Gwatkin (1980) recently have developed projections of long term effects of accelerated mortality declines on population growth. They base their calculations on the United Nations document (1979) entitled "Demographic Estimates and Projections for the World, Regions and Countries as Assessed in 1978," which extrapolated current mortality and fertility trends linearly beyond the year 2000 until a maximum life expectancy of 77.5 years for females and 73.8 for males was reached. These projection procedures based on the Coale-Demeny West model life tables lead to the achievement of stationary population size in all geographic regions by the year 2100.

Braudel and Gwatkin conclude that even if infant mortality rates in developing countries decline twice as rapidly as predicted by the United Nations, which would mean an overall drop to less than one third of current levels by 1995 (to 24/1000), the stable population achieved in year 2100 would only be 8% larger than projected at current mortality rates. They further project that such an increase would not have adverse economic consequences.

In all of these scenarios, however, world population size will about triple, from 2,894 million in 1975 to 8,457 million (with current mortality declines) versus 9,162 million (with twice as rapid declines) in the year 2100. The amount of hardship experienced by marginal socioeconomic groups attempting to support this increased population can be expected to be severe. The reader should realize, however, that no demographic prediction to date has accurately forecast actual population growth.

b. Policy and Program Implications

Nutrition assistance programs may induce significant reductions in mortality. Their direct effects on fecundity are not well documented but probably are much less than effects on mortality, except in special circumstances. If adequately managed, nutritional assistance should not shorten lactation amenorrhea since an avowed goal of nutrition intervention in general is to reverse secular trends away from breastfeeding.

The above simulations indicate that relatively small decreases in mortality have large adverse effects on population growth. However, the momentum of population expansion worldwide is such that current declines in mortality that roughly equal the changes that can be achieved by nutrition programs at their current best performance levels, have been predicted to have a negligible effect on ultimate population size.

The effectiveness of integrated nutrition, family planning, and primary health care programs in increasing contraceptive use and in decreasing mortality rates simultaneously suggests that such programs should have priority. If well managed, they hold out hope for transforming highly vulnerable areas into locations where population growth can stabilize and mortality decrease to acceptable levels well before the year 2100.

B. Ways in Which Fertility Change Affects Nutrition and Mortality

1. The Negative Effects of High Uncontrolled Fertility

The fact that uncontrolled fertility has detrimental effects on nutrition, mortality, and on child development is uncontroversial and holds true in developing countries and also in industrialized countries to a slightly lesser degree. An understanding of the reasons for the detrimental effects that occur is important for the design of integrated programs. These reasons also constitute the rationale for introducing family planning into health and nutrition programs in pronatalist countries, where increase rather than limitation of population growth is desired. This section draws on a review by Wray (1971) of the effects on families of family size and child spacing.

The need to control fertility in order to produce healthy children has been recognized in many traditional societies where the value of children is high and where couples wish to produce as many offspring as they can. The frequently fatal protein deficiency disease, kwashiorkor, was recognized in Ghana as the illness of children displaced too soon from the breast by a younger sibling. long before Dr. Cecily Williams identified its nutritional cause in the 1930's (Williams, 1953 and 1963).

Subsaharan African cultures have traditionally had rituals and taboos that served to regulate fertility. Postpartum sexual taboos commonly last for 1 to 2-1/2 years while the child is being breastfed and sometimes longer as in New Guinea (Malcolm, 1970) . In other cultures the wife returns to her mother's home for childbirth and thus avoids sexual relations. In Africa and in Indonesia the belief reinforcing abstinence is that sexual relations affect the mother's breast milk and make the infant ill. The same cultures that practice prolonged sexual abstinence frequently also perform female genital mutilation which involves removal of part or all of the clitoris and labia minora. These operations, which are common only in Africa and Indonesia (Hosken, 1979), generally reduce the woman's sexual desire. Cultures practicing abstinence usually are polygamous, so that abstinence is required of the wife only. Some African cultures such as the Yoruba of Nigeria (Caldwell, 1977) and the Dinka of the Sudan (interviewed by the writer) also require women to abstain from sexual relations when they become grandmothers, and thus avoid high risk births at the end of the reproductive cycle.

Uncontrolled fertility may take the following forms: births too early or too late in the woman's reproductive span; too many total births (excessive parity and large family size); and births spaced too closely (excessively short birth intervals). All of these forms commonly lead to poor nutritional status for mother and child, to increased infant and child mortality, and (to a lesser degree) to increased maternal mortality. While some studies have looked both at nutrition and mortality, many of the studies of one factor have not documented changes in the other. However, the mechanisms by which malnutrition would be expected to contribute to mortality in these cases are known. In this section we will review evidence for detrimental effects by situation. Some of this material is drawn from a review by Huenemann (1975) and some from Austin and coworkers (1981).

a. Births Timed Too Early or Too Late

Teenage girls tend to be subfertile in the first years following menarche because of a high incidence of immature anovulatory cycles with short luteal phases (Montagu, 1957). However, they can and do conceive before their own growth is completed. Babies born to teenagers have lower birth weights, reflecting poorer intrauterine nutrition, and higher mortality rates than do babies born to women between the ages of 20 and 30, even in industrialized countries. Two factors are at work. On one hand the teenage girls are competing nutritionally with their infants' fetuses in order to complete their own physical growth, and thus their nutritional needs during pregnancy are higher than those of older pregnant women. Even if these needs are filled, the teenager's uterus, ovaries, and breasts have not finished growing and maturing so that the physiological structures designed to maintain pregnancy and transmit nourishment to the fetus and infant do not function as efficiently as in mature women.

Butler and Bonham (1963) reported in Britain that mothers under 20 years of age had a 23% greater risk of perinatal mortality than 20 to 24 year olds. A Pan American Health Organization survey of birthweight, maternal age, and birth order (Puffer and Serrano, 1975) showed irrefutably that teenage pregnancy entails heightened risks. In São Paulo, Brazil, for example, 104 of every thousand babies born to teenage mothers died before their first birthdays, compared with only 53 per thousand born to mothers between the ages of 25 and 29. Kandeh (1979) found that very young mothers had high infant and child mortality rates in Sierra Leone. Wishik and Van der Vynckt (1974) found in El Salvador not only that infants of young mothers had poorer nutritional status and survival, but that regardless of the present age of the mother her youngest child was more likely to be in poor nutritional state if her first pregnancy occurred before she was 18 years old.

As maternal age increases above 35, intrauterine and infant mortality and the incidence of defective children increases progressively, due to age alone, in both developing and developed countries. As menopause approaches, the oocytes decrease in number (Gray, 1977) and degenerate to an abnormal state (Jones, 1975). The incidence of genetic defects detected by amniocentesis increases from about 1.5% at age 35 to about 10% at 44 (Fuchs,

1980). Perinatal mortality also increases because of increasing maternal complications of childbirth. The risk of low birthweight increases with maternal age for primiparous but not for multiparous women under satisfactory nutritional conditions (Niswander and Gordon, 1972).

Malnutrition and maternal age interact in the following way. The efficiency with which the body utilizes nutrients, and particularly proteins, tends to decrease with age. Thus where diets are only marginally adequate, milk volume of lactating mothers appears to decrease with maternal age (Morley et al., 1968). Although this phenomenon has not been carefully studied, it is a common personal observation of clinicians working in developing countries.

b. Too Many Births: High Maternal Parity

It is difficult to separate the effects of maternal age from the effects of repeated childbirth, or high parity. The nutritional drain of repeated births may be cumulative if diet and time between pregnancies are not sufficient to permit the mother's nutritional stores to be replenished. Jelliffe and Maddocks (1964) referred to this phenomenon as the "maternal depletion syndrome." Particular nutrient deficiencies, such as iron deficiency anemia, goiter, and osteomalacia may become more severe with each birth.

It appears less likely than previously thought, however, that even malnourished mothers progressively lose weight with each birth. According to Malcolm (1970), maternal weight loss, which formerly was thought to progress with parity in severely undernourished populations in Highland, New Guinea, actually progresses with maternal age, and not with parity after the first birth. Jelliffe and Jelliffe (1978) propose that such lack of weight loss may be due to natural adaptive calorie-sparing mechanisms, including decreased physical activity.

Omran and Stanley (1976) reviewed the effects of increasing parity on maternal health in developing countries for the World Health Organization, using large, representative samples of women in Gandhigram (India), Teheran, Beirut, Manila, and Ankara. They found no average decrease in body weight for height (as measured by increasing ponderal index) with increasing parity in any group. Decrease in hemoglobin level with parity occurred only in the Philippines, although the mean hemoglobin levels reported from India were very low (between 7 and 8 g/100 ml). While the study samples were not selected specifically to represent the lowest income and most malnourished groups, they also were not selected to represent the elite. Thus major effects occurring among the malnourished should have been represented by suggestive trends in the representative populations. Such trends failed to appear.

Rao and Gopalan (1969) found that anemia became more severe with increasing parity (in contrast to the Gandhigram data just cited). In South

India, 17.5% of women in their first to third pregnancies had hemoglobin readings less than 10 g/100 ml as opposed to 27% of women in their fourth or higher pregnancy. The proportions of women with severe anemia also increased with parity--less than 8 g/100 ml were 3.2% and 8.5%, respectively.

However the fact that undernourished mothers appear to maintain their weight with increasing parity does not mean that they necessarily avoid depletion or that their infants are not progressively deprived of nutrients. Morley and coworkers (1968) found in Nigeria, for example, that both well nourished and malnourished women gained weight with increasing parity. The well nourished, who had an average non-pregnant weight of 117 lbs, added an average of 2.3 lbs with each birth, whereas the malnourished, who averaged 107 lbs, gained only 1 lb per birth. The malnourished group had a high prevalence of low birthweight infants and also were unable to produce adequate amounts of breast milk.

These findings could imply that the mothers should in fact gain a minimum amount of weight with increasing parity to compensate for decreased nutritional efficiency with age or because some dimensions of the mother's own body may grow larger during pregnancy (e.g., her feet?). In this case mothers who merely maintained prepregnancy weight or gained minimal amounts would be depleted.

Birthweight, like maternal weight, appears to have a natural tendency to increase with parity, which persists in countries with endemic preschool malnutrition, as in Ghana (Zeitlin et al., 1981), so long as maternal nutrition is relatively adequate. At very high parities, however, the incidence of low birthweight tends to increase (Petry and Pearson, 1955).

Child growth, as measured by height in adulthood or later childhood tends to decrease with increasing birth order and with large family size in both developing and industrialized countries, except in social classes in which nutrition is particularly adequate (Wray, 1971). These effects are more pronounced in developing countries where malnutrition rates are high. Rao and Gopalan in the previously cited study estimated that 61% of malnourished children were of birth order 4 or higher, although these higher birth order children comprised only 34% of the child population.

Infant and child mortality tends to be high for first births and for births of parity 5 and over, as demonstrated in Table 5 from Wyon and Gordon (1971) and as found by Radovic (1966), Roberts and Tanner (1963), and many other researchers.

Parity above 5 also is associated with increased maternal as well as infant mortality (Omran, 1971; Eastman, 1940). Petry and Pearson (1955) in Kentucky found that baseline maternal mortality rates doubled after parity 6, that infant mortality was three times as great as in parities 1 through 6, and low birth weights twice as frequent as in parities 1 to 3.

Most studies of parity have not separated the effects of age from parity. Oxhorn (1955) surveying 63,140 women delivered in Canada, did sepa-

Table 5

Mortality of children in Punjab village
by parity of mothers (1955-58)

	Parity of mother							Total/average
	1	2	3	4	5	6	7-12	
Number of births	230	209	210	197	165	136	326	1473
IMR	172	117	145	124	172	164	206	161
Second-year mortality (deaths/1000 population)	76	16	24	92	96	77	95	68

Source: Wyon and Gordon, 1971.

rate these effects and concluded that age over 40 was more important than parity in pregnancy complications, but that high parity alone also affected fetal and maternal mortality.

Wishik and Van der Vynckt (1974) estimated that maternal age and parity accounted for a full 83% of the family variance in child survival in their study sample in El Salvador, while variables of maternal weight and height accounted for 12.3%. That mortality rates have actually been reduced on a population basis by concentrating births between the optimal ages and at the best parities is claimed by Mardones (1976) as an explanation of the 22% decrease in infant mortality from 71 to 55 deaths per thousand that occurred in Chile between 1972 and 1975. During this period Chile experienced more births in mothers aged 20 to 34 and proportionately fewer births of high birth order. Mardones produces evidence to support the claim that these birth placement effects alone reduced mortality, rather than changes in the standard of living.

c. Too Many Births: Large Family Size

The effects of large family size also are difficult to separate from those of parity and maternal age. The consistent conclusion to be drawn from studies of parity and family size is that the birth of too many children is detrimental to maternal health and to child health and development. Mudhedkar and Shah (1975) found that in India 50% of families with more than 3 children consumed less that 80% of their reference protein requirement versus 15.6% of families with 1 to 3 children. In families with 1 to 3 children, 47% had weights for age below 70% of standard. This percentage increased to 52% with 4 to 6, and to 63% with 7 or more children. In addition, 23% of single children suffered from anemia versus 54% of children in 3 child families. Child mortality also was about doubled when there were more than 3 children per family. Family size effects held true for both rural and urban families, although the rural group as a whole had much higher rates of malnutrition. Wishik and Van der Vynckt's previously cited study in El Salvador found two thirds of better nourished preschoolers to be from families of 4 or fewer children and two thirds of the worse nourished to be from larger families.

Wray and Aguirre (1969) found that as the number of living children increased, the proportion of malnourished preschool children increased, and the amount spent per person on food declined. Orraca-Tetteh (1970) reported from Ghana decreasing per capita expenditure on food, decreasing per capita adequacy of calories and protein, and increasing percent of household expenditure spent for food as total family size increased from 1 to 14.

Engel and Caedo (1975) noted in the Philippines that minimum daily food cost increased from 41% of the minimum wage for a family of 3 to 101% for a family of 7. They reported from the same study that families with 1 child averaged a 36% preschool child malnutrition rate versus 49% for families with 3 children, and that 55% of preschoolers who had a sibling

less than 18 months younger were malnourished versus 29% of those who were 31 or more months older than the next born child.

d. Short Birth Intervals

The negative effects of high parity and large family size are reduced if the intervals between births are long (they are not eliminated because of the inevitable effects of increasing maternal age). From the point when children start contributing more labor or money to the family than they take from the family, they may make a positive contribution to the nutrition and development of younger siblings and to the well being of the mother. Well-spaced births also permit the mother to recover nutritionally before embarking on a new pregnancy.

Negative nutritional effects on the younger children occur even in industrialized countries when birth interval is less than a year. However, short birth intervals are likely to be more detrimental to long term development in developing countries, where infant feeding and weaning diets do not promote catch-up growth. Holley and coworkers (1979) paired 25 United States infants born less than one year after their older sibling with infants of similar sex, race, and socioeconomic status born after 2 to 5 year birth intervals and found lower birth weights and slower psychomotor development in the short birth interval group. Bishop (1964) found in studying 16,000 consecutive deliveries in Philadelphia that incidence of prematurity was 18% for intervals less than 12 months, compared to 10% for 12 to 23 month intervals and 8% for intervals two years and longer.

Zeitlin and coworkers (1981), using multiple regression analysis to study data from the preschool clinics in Ghana, found that birth interval was a highly significant determinant of nutritional status as measured by weight for age during the first three months of life and during the second year, and of infant morbidity up to the second year. This was a population in which strong maternal depletion effects did not appear to occur, since birth weight increased with parity. Wray and Aguirre (1969), looking at the older child in sibling pairs, found that only 27% of those with a birth interval of three years or more were malnourished versus a 40% of those with 2 to 3 year intervals and 53% with intervals of less than two years.

Short birth intervals also consistently increase infant and child mortality rates in developing countries. Swenson (1978) found in Bangladesh that childhood mortality is significantly higher among children whose birth is followed by another pregnancy in less than 12 months, whether or not the second pregnancy results in a live birth, but that likelihood of the first child's dying increases if the second child lives. Wolfers and Scrimshaw (1975) found among low income women in Equador that both the older and younger child spanning the birth interval risked higher mortality if the interval was shorter than about 2 years, and that mortality risks were lowest for intervals of 3 years.

Risks of miscarriage and stillbirth also were low with 3 year intervals. They estimated that if measures were taken to prevent the occurrence of pregnancy intervals shorter than 27 months, spontaneous abortions might be reduced by one third and infant mortality by one half in similar populations. Short birth intervals result in many dependent preschoolers demanding their mother's attention. Since the youngest is the most helpless and usually also breastfeeding, the mother tends to neglect the "deposed" child or children, who may be at the most critical growth and infection period from 12 to 30 months (Morley, 1973).

e. Policy and Program Implications

Effects noted in this section are large, universally relevent, and not subject to dispute. A further uncontested finding, which is not directly related to nutrition but is of importance to policy makers, is that children of high birth order and children of large families perform less well intellectually than children of small families from the same socioeconomic class (Wray, 1971; Stein et al., 1975). Most of the studies documenting this conclusion have been conducted in industrialized countries where family size has a minimal effect on nutritional status. What is meant by this last statement is that children of small families in industrialized countries still grow slightly more rapidly than children from large families, but that the shorter children from the large families are not short enough to fall below the third percentile, which defines the lower limit of normal.

The amount of time that parents are able to spend with each child individually appears to be a key factor in the development of intelligence. Children of large families and high birth order inevitably receive less attention. For the same reason, twins also average lower results on intelligence tests than single children. This means that no amount of nutrition, health, and educational investment on the part of the government can make large family size as beneficial as small family size for the development of human resources.

At the program level, the negative effects of uncontrolled fertility on nutrition, health, and intellectual development should be taught as a part of nutrition, health, and family planning education. Education at this level, however, to low income program participants, is not an effective first step in engineering social change. A reason for this is that social factors such as age of marriage, that are important determinants of family size, are not determined by low income individuals, but by social norms set by tradition, by policy makers, opinion leaders, and the mass media.

National policy makers need to have estimates of the size of the reductions in mortality and improvements in nutritional status and child development that could reasonably be achieved by later marriage, longer birth intervals, and smaller total family size. They can then use this information for planning population strategies that are consistent with

other development goals. Such strategies might include legislation concerning the age of marriage, mass media campaigns promoting long birth intervals and small family size as a means of improving child health and intellectual development, and various schemes for enriching the family planning components of existing primary health care and nutrition programs. Pronatalist policy makers can focus on reducing mortality and improving nutritional status and can select a subset of the above strategies that achieves these goals without limiting population growth.

Individual program strategies should ideally be tied to larger national strategies so that services provided by the program are reinforced by the mass media and supported by reliable program supplies, including teaching materials coordinated with a larger national campaign. Yet even in the absence of such support from the center, the negative effects of high fertility on child nutrition and development remain a key theme for individual one-to-one counseling and group education at the community level.

Chapter 2 Psychosocial Interactions Between Nutrition and Population Growth*

The preceding chapter considered the involuntary relationships between population growth and nutrition, including the physiological links between nutrition, reproduction, and survival. This chapter looks at the conscious and subconscious behavior of individuals and societies with respect to nutrition and population growth.

A. Psychosocial Basis for Inverse Correlations Between Nutrition and Population Growth

Improved maternal and infant nutrition reduces infant and young child mortality and may increase fecundity in some groups for physiological reasons. As noted in the previous chapter, these physiological effects result in increased population growth in the absence of effective family planning designed to achieve small family size. Actual correlations between nutritional status and fertility level, however, usually run in the opposite direction, except among groups and individuals whose participation in modern sector development is marginal. On a world wide basis, the best nourished population groups have the lowest fertility levels. The reasons for this inverse relationship are psychosocial and are strongly linked to economic development.

The most direct psychosocial connection between nutrition and fertility is believed to operate through the effects of nutritional improvement in lowering infant and child mortality rates. As noted in the previous chapter, malnutrition has been implicated as a causal or contributing factor in up to 50% of deaths of children under the age of 5 years in developing countries. Moreover, integrated nutrition and primary health care programs have proven their ability to lower mortality rates of under-fives by about 50% in the first few years of operation in several rural developing country settings.

A number of theories link psychological and social responses of such decreases in mortality to changes in fertility behavior. The first part of this chapter will review and critique the models proposed to describe fertility responses to varying levels of mortality. Most of these models are the subject of continuing research and debate, and are not mutually exclusive. Since most appear to be applicable in describing behavior under certain socioeconomic and cultural circumstances, they are important to an understanding of the varieties of psychosocial mechanisms by which nutritional change may affect fertility.

Nutrition and fertility also are linked inversely but directly through a range of development indicators and correlates that include level of education, urbanization, per capita GNP, percent GNP from the primary sector, women's employment, and cultural infant feeding practices.

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*This chapter was written by Marian Zeitlin and Michael Meurer.

Some of these less direct linkages are highly important in determining program opportunities for integrated nutrition and family planning projects. As an example, mothers who must work outside the home show increased receptiveness to family planning, while their infants and preschoolers are at high risk of malnutrition. They are, therefore, a priority target group for combined nutrition and family planning programs.

A key development correlate of nutritional status and fertility is the value of children, which changes with development, and which plays a major role in determining ideal family size. This chapter contains an extensive discussion of theories concerning the value of children, because these theories serve as underlying assumptions for the models that describe parental responses to decreased mortality. For example, the hypothesis that parents will compensate for high mortality by extra births assumes that they attach a value to having a specifiable number of surviving children. The other development correlates that have implications for the design of integrated nutrition and family planning programs tend to exert their effects through changes in the perceived value of children to the family unit. For this reason, they will be discussed in the section on program design implications at the end of the chapter.

The reader of this chapter should bear in mind that much of the research presented has been conducted at the areal rather then the microlevel. Generalizations from macrolevel relationships to the actions and motives of individuals should be made with great caution. Macrolevel data sets usually cannot be constructed to contain many of the variables that would be needed in order to partial out spurious relationships. The interested reader is referred to Hannan (1971) and to Alker (1969) for a discussion of the problems inherent in microlevel interpretation of macrolevel findings. To understand the complexity of our investigation the reader is also encouraged to examine his or her own personal motives for child bearing.

B. Demographic Transition Theory

Social scientists have proposed a comprehensive theory of the relationship between mortality and fertility known as the demographic transition theory (Notestein, 1945). The theory of the demographic transition postulates that there are three stages that societies invariantly follow during the course of their evolution. During the first stage, the pattern typical to preindustrial societies, there is a period of high fertility and high mortality, and the net reproduction rate is relatively low. During the second stage, mortality falls, but fertility remains high, and population growth is rapid. During the third stage, fertility falls, and the rate of population growth diminishes. The onset of economic development lifts the country from stage 1 to stage 2, where mortality falls quickly in response to development (including public health measures), but fertility slowly responds to the changing social environment.

The theory was proposed on the basis of analysis of European demographic patterns. Some European countries do not precisely fit the model, and its applicability to developing countries in Africa, Asia, and Latin America is not at all certain. Most Third World countries are in the second stage, and we cannot be certain they will enter the third stage as the European countries did. On the hopeful side, the demographic history of Japan, the most highly industrialized country with a non-European culture, is in accordance with the theory. Moreover, developments in South Korea, Taiwan, and Puerto Rico have shown that under favorable conditions, fertility may fall within 2-4 years of a fall in death rates, or much more rapidly than previously occurred in Western countries (Wray, 1975; Schultz, 1969; Schultz, 1971).

Long time-series, cross-national data relating mortality to fertility provide some interesting results. Schultz (1976) found that the rate of decline of the birth rate was correlated with the rate of decline of infant mortality, while Taylor and coworkers (1976a) found that the faster the decline in infant mortality, the smaller the gap between the decline in infant mortality and the onset of fertility decline. Both found that these relationships held for almost all countries studied. This provides strong evidence for the applicability of the demographic transition model to lesser developed countries. As noted in the first chapter, interventions in the form of integrated community level nutrition, primary health care, and family planning programs have proven their ability to contribute to fertility decline by increasing contraceptive use very rapidly.

According to Preston (1978), the early 1970's was a period of almost unguarded optimism about the ability of reductions in child mortality to induce major declines in fertility through pre-existing social mechanisms. The United States National Academy of Sciences (1971), the United Nations Department of Economic and Social Affairs (1972), and the Bucharest World Population Conference of 1974 all produced policy position papers affirming that reduction of infant and child mortality was a prerequisite for fertility control. The World Population Conference stated, moreover, that it is "agreed that the following development goals generally have an effect on the socio-economic context of reproductive decisions that tends to moderate fertility levels: (a) The reduction of infant and child mortality, particularly by means of improved nutrition, sanitation, maternal and child health care, and maternal education . . . ." (United Nations, 1974).

Since this time, it has become evident that a fall in birth rates is not an automatic or reliable short term response to mortality decline.

The theory of the demographic transition per se is a crudely sketched empirical model that does not tell us anything about the underlying mechanisms responsible for the relationship noted between mortality and fertility. Several ad hoc explanations have been advanced, all of which are plausible. Economic development is the cornerstone of these theories. Development gradually leads to a reduction in mortality, improved nutrition, increased education of the population, the introduction of birth con-

trol technologies, migration from rural to urban areas, the shift from extended to nuclear families, and other social and technological changes.

Teitelbaum (1975), in a critique of the relevance of the demographic transition theory for developing countries, concluded that the basic causal structure of the transition theory is sound at high levels of generality, but difficult to apply to explain fertility ranges in individual countries. Teitelbaum concluded from a careful examination of 19th Century European data by Coale (1973), that high levels of development are sufficient to bring about fertility decline, but that decline in birth rates is not pegged to any given threshold of development and in fact sometimes precedes development as it is commonly measured. Perhaps most importantly, he called attention to the fact that the development in many countries is not expected to rise in the medium-term future to the high levels that would be sufficient to induce fertility decline, based on evidence from the European experience.

Teitelbaum drew together two lists of differences between 19th Century Europe and modern developing countries. The first list of factors works against rapid fertility decline in the developing world; the second favors rapid decline. These factors are shown below in tabular form:

Factor	Europe 19th Century	Developing countries	Effects on fertility decline
Mortality decline	Slow	Rapid	-
Fertility before decline	Moderate	High	-
International migration	Outlet for population growth	Not substantial	-
Average doubling time	90 Years	As low as 20 years	-
Momentum for further growth	Moderate	Very high	-
Occupational and rural/urban mobility	In equilibrium with population growth	In disequilibrium	-
Opportunities for female employment	Higher	Lower	-

Factor	Europe 19th Century	Developing countries	Effects on fertility decline
Provision of universal education	Feasible	Difficult because of population explosion	-
Pace of development	Slower	Faster	+
Methods of fertility control	Poor	Effective	+
Latitude for deferring marriage	Already deferring marriage	Large changes possible	+
Legitimacy of small family norm	Not legitimate	Increasingly acceptable	+
Government inputs to family planning	None	Substantial	+
Government ability to reach cultural subgroups	Poor	Fairly good, with mass media, etc.	+
International assistance	Nil	Available	+
Pace of fertility decline	Slow	Rapid in some countries	+

The fact remains that most developing countries in the world are in the second stage of the demographic transition, that they have falling mortality and high fertility, and that the current world population explosion continues. For example, Latin American countries generally (Hout, 1980) and Mexico in particular (Seiver, 1975) have maintained high fertility in spite of rapid economic development. Other countries with high fertility are not developing rapidly.

Politically powerful family planning programs, as in Indonesia, also provide encouraging evidence that widespread fertility control may precede mortality decline and nutritional improvement if family planning acceptance generates sufficient social and political approval. In the apparently not untypical hamlet of Pulo in the mountains in Central Java, Zeitlin found in 1979 in perusing the hamlet records with the headman that 51% of the children under five suffered from malnutrition but that 63% of childbearing couples were family planning acceptors. The chief of the village in which this hamlet was located had one 8 year old daughter and planned to have no more children. As it is generally agreed that contraceptive practice by 65% of potentially fertile couples is sufficient to stop population growth, this hamlet probably has succeeded in controlling fertility without solving the problems of malnutrition and high mortality.

Pressure on the land and high aspirations for education in rural Indonesia also may make this country situation unique. Anecdotal evidence suggests that rural families are quite candid in expressing mixed feelings about childrearing, consistent with impressions that current theories concerning motivations for fertility behavior are somewhat oversimplified. Low income families frequently admit that they do not want more children if they cannot feed them, and that they are unable to provide adequately for the children they already have. Yet the same families may note that in old age they will be dependent on their children for support, and that they cannot be certain that the number they have currently will survive.

An underlying assumption of the theories relating mortality to fertility is that parents have mastered some means of controlling fertility, so that they have the capacity for conscious regulation of family size. The fact that fertility fell prior to development in parts of France (Coale, 1973) and simultaneously with development in South Korea (Repetto, 1978), in both cases before the widespread availability of modern contraception, suggests that when motivation to limit births is high enough, couples will succeed in using technologically inferior birth control methods. The existence of herbal or mechanical abortifacients and traditional birth control techniques (such as a cervical cap made from opium ash in China) attests to the fact that a range of high risk and low satisfaction birth control methods have always existed.

The number of illegal abortions obtained may be far higher than acknowledged by the family planning establishment, and in this respect the people may be well ahead of the professionals in their actual practice of family planning. When Wray first went to Cali, Colombia, in 1961, the university hospital delivered 600 babies and treated 200 cases of complicated abortions per year. Abortion complications had become the leading cause of death in women aged 15 to 45. Yet the hospital physicians were largely unaware of the implications of these figures for family planning. The Chileans first examined the abortion problem when they became aware that the treatment of complicated abortions had become a major proportion of national health costs.

C. The Value of Children

The central tenet of the theories that relate infant mortality to fertility is that childbearing is goal directed; that is, that parents do not bear children inadvertantly or for the pleasure of the childbirth experience but for the rewards expected to accrue from surviving children. If the net reward per surviving child declines below zero as the number of surviving children increases, then it is reasonable to expect parents to set numerical targets for surviving children. If the economic value per additional child remains high throughout the achievable range, as is apparently the case in many developing countries, then the appropriate strategy is to continue childbearing as long as possible regardless of mortality rates (Preston, 1978).

Economists analyze fertility decision-making from three perspectives: the child is an investment good, the child is a consumption good, or the child is a by-product of marital relations (Cochrane, 1975). Although economic considerations are only one factor determing fertility, they are a crucial factor. It seems likely that families living at subsistence levels may be strongly affected by the economic costs and benefits of bearing children. The investment model assumes that parents have children because as the children mature they will work and contribute to the parents' income. The consumption model assumed that parents have children because they like them. But parents must weigh the cost of children against the cost of material goods in order to decide how many they want. The by-product model assumed that children are by-products of sexual activity, and so children represent the cost of sexual relations (without contraception), and this cost must be weighed against the cost of other goods.

1. The Investment Model

The investment model, which has received the most support from empirical studies, shows that the cost of educating children, the cost of childrearing, and maternal opportunity costs (i.e., the value of the earnings a mother foregoes by not working) are important determinants of ideal family size.

If, as in modern industrialized countries, each child is a large net drain on family income, many adults will view childbearing as an unprofitable investment. In the United States, for example, the director of the Office of Population Research at Princeton University, Charles F. Westoff (1980), has predicted that 30% of American women now of childbearing age will never have children because of perceived high personal cost.

One variant of the investment model was proposed by J. C. Caldwell (1976). He contends that, contrary to the belief of many demographers and economists, the fertility behavior of families in the Third World is quite rational. The formation of the desired family size goal is determined primarily by the net flow of wealth between generations. If parents can

expect to receive more wealth from their children than they give to them, desired family size will be large; otherwise the desired family size will be small. In this model the demographic transition is caused by socio-emotional change in developing societies.

Caldwell (1977) shows that economic factors in rural areas do not favor small family size in Nigeria. Nigerian children remit large portions of their income to their parents; the more children, the larger the remittance. Large family size is favored by socioeconomic conditions in Bangladesh also. Barhat-e-Khuda (1977) found that almost half of parents surveyed in rural Bangladesh believed that boys who did not attend school earned more than they cost by age 11 to 14. One-third believed the same concerning girls. Cain (1979) found in Bangladesh that a parental strategy of fertility maximization tended to increase the chances of upward intragenerational economic mobility.

A rough inverse comparison between the economic value of children in rural Nigeria and Ghana versus the United States illustrates the extreme changes that occur with the development process. Caldwell discovered from household surveys that Nigerian and Ghanaian children began to work productively for the household at about the age of 5, and that parents estimated each child born would remit an amount of money to the parents equivalent to 10% of household income in addition to providing old age and disaster security. In the United States, on the other hand, the cost of rearing a child is very roughly equivalent to four years of total household income (when it is considered that lower income families tend to invest correspondingly less per child in higher education). This would be equivalent to a cost of 10% of family income per child per year over 40 years, with no guarantee of old age or disaster security.

Caldwell believes that cultural changes in family structure are inevitable with urbanization and the adoption of modern sector aspirations. He argues that "a movement toward monogamy, a strengthening of the conjugal bond over all others, a strengthening of the parent-child bond over all relationships external to the nuclear family, and ultimately an emphasis on what parents owe children rather than what children owe parents" is in fact bringing about a change in the net flow of wealth between generations in urban West Africa. Indeed "if economic change were to be halted now, the crumbling (of the old social order) would continue."

So it is the acceptance of modern sector values rather than industrialization per se that brings about increased parental obligations to each child and hence fertility decline. These values include competitive aspirations for success in modern professions and careers, to which only the few gain admission. Competition for the positions at the top of this narrow pyramid requires heavy investment in the development and education of the child. Supporting children in modern sector lifestyles also requires major investment in consumer goods and consumption activities for the child.

Few developing countries have adequate pension plans to support the elderly. Therefore couples in these countries may desire to produce a

sufficient number of children or a sufficient number of sons to guarantee them support in their old age. The need to guarantee support at a time when parents can no longer earn their own living leads to an asymmetry in the costs of bearing children. Parents who need surviving sons to support them in their old age incur a high cost if they produce too few children and do not have enough sons who survive into their old age.

On the other hand, the cost of having more children than is necessary to insure support is relatively small in subsistence economies and declines with additional family size. In the absence of educational expenditures, the cost of an additional child declines because the family has already made fixed investments in housing and child care, so the major additional expenses incurred by the family are only for food and clothing. Furthermore, food preparation and other household tasks are more efficient when operated on a larger scale (Schultz, 1975). The risk of infant mortality introduced uncertainty into the process of fertility decision-making, so parents are likely to take advantage of economies of scale by having more children than they would desire under conditions of certainty (Schultz, 1975).

John Stuart Mill anticipated the investment model when he advocated peasant proprietorship. Mill argues that landless peasants would produce the maximum number of children possible, thereby maximizing the return from the work of their children. However, unlimited population growth has external costs. As the number of laborers grows, while land is held constant, labor produces diminishing returns. Therefore, the average wage paid each worker falls. A single family is not aware of this though, because the addition of a single child to the work force has a negligible cost in terms of diminished returns. It may be rational for individuals to have as many children as possible, but irrational for society as a whole. The problem is known as the tragedy of the commons (this term originated by Garret Harden is discussed by Bush, 1973). The solution in the simplest case is to grant every peasant ownership of a plot of land so he will directly experience the diminishing returns to labor.

2. The Consumer Good Model

Freedman (1963) proposed an interesting model of the consumer good type. In her model it was assumed that the cost of raising a child is determined by a family's socioeconomic status. The costs of raising a child increase with rising status. Families with low incomes relative to other members of their class should have fewer children than wealthier people in their class. In the short run, though, prices of children do not rise with income because neither one's reference group nor the norms of groups change radically. In the longer run, the cost of children rises as norms about how to care for children change (Cochrane, 1975).

The consumer good model may be appropriate in urban areas of Third World countries and in industrialized countries. Caldwell's work, cited above, might be rephrased to state that the change in values with urban-

ization involves a psychological shift from viewing children as investments towards viewing them as consumer goods. Aghajanian and Tushakkori (1979) studied the value of children in Shiraz, Iran. The most frequently mentioned value of children to parents was the pleasure and stimulation that they provide, although one-third did mention that the economic value of children, especially for old age security was important. This finding may not be completely reliable, though, since it is based on a survey of high school students, who did not yet have economic responsibilities.

3. The By-product Model

In the by-product model, parents are assumed to be noncontracepting, children are not assumed to have consumption or investment value. The parents must choose the proper trade-off between years of sexual activity and their material standard of living. Parents maximize their utility given the constraints of income and the need for a subsistence diet. This model predicts that an increase in income will increase fertility if sexual relations is a "normal" good (i.e., when income increases, people spend part of the increment on material goods and part on prolonging sexual relations).

D. Cultural Norms for Desired Family Size

The economic cost-benefits of childbearing probably set the upper limits of family size norms within a society. Yet, at the family level, ideal family size also is shaped by cultural norms and personal preference (Cassen, 1976; Anker, 1978). Other determining factors and correlates of cultural fertility norms include religion, ideology (a country may be pronatalist or anti-natalist), economic organization (farm life typically leads to larger family size), family structure (extended families have a larger family size than nuclear families (Ryder, 1976)), and the role of women in society.

Cultural norms are internalized by the socialization process and become part of an individual's decision-making process. Personal values interact with an individual's environment to help shape preferred family size. Conscious calculation of the costs and benefits of children in economic terms against the level of a family's income and the need for children for support during a couple's old age also partially determine the number of children that a couple will desire. Furthermore, infant mortality in the community, among a couple's siblings during their childhood or during their previous married life, affects desired family size according to a study in Guatemala (Pebley et al., 1979). Desired family size may operate in terms of one sex only. In many cultures, parents have a strong preference for male children mainly because males bring greater economic return to the household (May and Heer, 1969; Heer and Wu, 1975). Males often bring in a dowry when they are married; in patrilineal societies sons pass on the family name and property; and sons are more likely to provide economic security for their parents in old age than are daughters. Males also are necessary to perform religious rites in some religions.

It is important to the mortality-fertility theories that ideal family size be relatively stable over the course of a marriage and that a couple act on the basis of their desires. Empirical work is very difficult unless ideal family size has these properties. Research by Rodgers (1976) shows desired family size to be stable over a couple's reproductive span. Although it is possible that infant or child mortality could reduce ideal family size--a couple could be disillusioned with the experience of bearing children and reduce their desired family size--evidence from Thailand suggests that this is not the case. In 1969 and 1972 the same group of 678 married women were asked their ideal family size. The responses were stable and unaffected by infant mortality (Rodgers, 1976). Knodel (1973 and Prachnabmoh (1973), also in Thailand, investigated the internal consistency of desired family size responses and found them to be meaningful. However, Pullum (1979) found that desired family size increases with births after the initial desired family size is reached in Sri Lanka. If desired family size did fall when infant or child mortality was experienced, we would not expect to find a correlation between mortality and fertility.

It is also possible that the target family size is beyond a couple's fecundability. In that case, after infant mortality, the number of live births produced would be the same as if there had been no infant mortality. In other words, the couple continues reproducing at the same rate regardless of infant deaths. This is the case in rural areas of Africa according to Kocher (1976), who estimated supply and demand equations for number of children born in rural Tanzania. He found that the supply equation did well in explaining the variance of children ever born, but the demand equation did not. This indicated that fertility was determined by supply constraints. This also appears to be the case in Pakistan and Bangladesh (Chowdhury et al., 1976).

E. Fertility Responses to Infant and Child Mortality

Given the above conditions and assumptions, parents tend to desire a certain completed family size or a certain number of sons. The theories presented in this section contend that parents will respond either consciously or unconsciously to infant and child mortality in order to attempt to adjust the number of live births that they produce during their reproductive span to compensate for child deaths, so that the net number of surviving children will equal their desired family size (Taylor et al., 1976a).

Three decision-making strategies have been proposed that could account for this behavior. The first is called the child replacement hypothesis. It postulates that parents respond to the death of a child by shortening birth intervals or by delaying the use of contraceptives in order to replace the lost child and to achieve a desired number of surviving children. The second, called the insurance hypothesis, holds that parents consider infant mortality levels in the community and produce a number of children greater than their desired family size in order to hedge against the risk that one or more of their children may die. The third, or investment strategy, calls for reduced fertility and increased expenditures per

child as mortality falls, the reason being that the probability of making an "unprofitable investment" (i.e., a child dying) declines as mortality falls (Schultz, 1975). These three strategies will be explained, and the evidence for them will be discussed.

1. The Child Replacement Hypothesis

The child replacement hypothesis has been the basis for more empirical work than the other two. See Schultz (1976) for a review of these studies. This research presumes that parents have a fairly certain idea of the number of children or the number of sons that they want or can afford. In the event of the death of a child, the child will be replaced. Replacement occurs either by the birth of an additional child at the end of the "normal" reproductive period or through shortening of the birth interval. It was explained in the previous chapter that a physiological mechanism already exists by which infant mortality results in shorter birth intervals. When an infant dies, breast feeding is cut short, and lactational infertility ends. The replacement hypothesis claims that in addition to this mechanism parents deliberately attempt to conceive again more rapidly than they would if the previous child had lived. According to this hypothesis, a decrease in child mortality will result in a major decrease in total births because a large proportion of these births occur only to replace dead children.

Recent work studying the replacement effect suggests that it is not as important as originally believed. Preston (1978) reviewed studies of the replacement effect and noted that in no population studied is the replacement effect achieved by both physiological and volitional mechanisms combined larger than 50%, when proper statistical controls are instituted. Moreover, because of statistical problems the measured rate of compensation is likely to be biased upward. He concludes that "the picture is not attractive for those who look to mortality reduction as a means of reducing fertility through replacement effects...."

Many researchers finding a replacement effect had not controlled for the biological interval effect due to breastfeeding. Based on work in Egypt, Risk and coworkers (1980) report that "initial differences in birth intervals between women with and without child mortality experiences are largely eliminated when appropriate controls are introduced for variations in lactational amenorrhea. This finding is consistent with a growing body of research indicating little behavioral response to child mortality for birth intervals when biological factors are controlled." Evidence from Bangladesh also indicates that no replacement effect is found when lactation amenorrhea is controlled (Chowdhury et al., 1976).

Rizk and coworkers did find child mortality to be significantly related to number of additional children desired and to the use of contraceptives, and the level of community child mortality to be related to contraceptive use. Interestingly, in South Korea it was found that prior to the introduction of family planning only physiological effects, not behavioral effects, determined birth intervals. But after contraceptives became widely available and used a marked replacement effect was present (Park et al., 1978).

Studies showing a replacement effect report that first born children that die are replaced quickly (Schultz, 1976). This may be due to the importance of producing a male heir in the case where the child was a boy. The social pressure on a woman to be fulfilled by raising a family may also play a role. It is not certain whether subsequent infant deaths are compensated for during the middle or late years of the reproductive span. The timing of replacement during a woman's reproductive span is an issue that bears on the use of contraceptives.

Modern contraceptives are used by a minority of the population in lesser developed countries although it is still a significant number. Contraceptives can either be used to limit family size or to space births. Contraceptive use for the purpose of limiting family size could be significantly affected by infant mortality if the replacement hypothesis is correct. If couples are motivated to replace lost children during the late years of their reproductive span, there will be a delay in the use of contraceptives. Curiously, it was found in Taiwan that infant mortality experience was uncorrelated to attitudes about contraceptive use, but it was correlated with contraceptive behavior. It was found that couples that had experienced infant mortality delayed the initial use of contraceptives when compared to similarly situated couples that did not experience infant mortality (Rutstein, 1974).

At least two fundamentally different contraceptive strategies appear to exist among traditional groups adopting contraception. In much of Subsaharan Africa (Ware, 1976) contraception appears to be common before marriage and in the postpartum period as a substitute for abstinence in order to prolong birth intervals. In most other areas, contraception is used primarily to terminate childbearing after ideal family size has been achieved (Potter et al., 1965b; Ajami, 1976).

Replacement is common in societies in Subsaharan Africa, Indonesia, and New Guinea, that practice contraception in the form of postpartun abstinence. Although this practice is becoming obsolete where it is widespread, it significantly reduces fertility. If an infant dies, the parents resume sexual relations often with the intentional goal of replacing the lost child. The birth interval is much shorter than if the child had survived and the period of abstinence were maintained (Cassen, 1976).

- Son Preference

Evidence for the effects of son preference on child replacement is conflicting but generally fails to support the theory that son preference is translated into greater replacement of deceased sons in most societies. A few studies have shown that families having a strong preference for sons do act on this preference when it comes to replacing a child that has died (May and Heer, 1969; Heer and Wu, 1975). Rutstein (1974) conducted a multiple classification analysis of data from 2277 Taiwanese couples. He found that "experience of child mortality generally increases the likelihood of having another birth when a boy has died and increases it to a lesser extent when a girl has died."

A larger number of studies have found no sex difference in terms of replacement or in terms of the sexual composition of the families of contraceptive acceptors. Balakrishnan (1978) analyzed data from Costa Rica, Colombia, Mexico, and Peru and found that the deceased child's sex had little influence on subsequent fertility. Repetto's (1972) study in Morocco found that women who were contraceptive acceptors did not have a larger number of sons than other women. He also reported that large family size tended to be correlated with a larger proportion of sons in the family in India, Bangladesh, and Morocco, suggesting that better care for sons rather than replacement or insurance effects had led to higher survival rates for sons than for daughters. This finding is consistent with the higher female mortality rates noted earlier.

The Pearson Commission (1969) also found that large family size generally tends to be correlated with a large proportion of sons, consistent with the fact that sons provide more contribution to the family's income and hence are more affordable. Rather than encouraging replacement of deceased sons, son preference appears to lead to heightened rates of infant mortality among females. Parents may intentionally or, more likely, unconsciously invest less adequate food and care in their daughters and increase the risk that they will be victims of infant mortality. Scrimshaw (1978) finds evidence of this sort of neglect from Ecuadorian data. She found that "the sex ratio for the first child was unrealistically high in favor of males--68 males to 32 females.... The statistical probability of the observed ratio occurring by chance is less than .01.... Several in-depth anthropological studies in the same region indicated that female neglect or even infanticide occurred occasionally, and that it was considered very important that the first child be a male."

Cook (1964) presents data from Jordan, Lebanon, Syria, and Palestinian Arab populations that document consistently poorer nutritional status and higher mortality rates for girls than for boys from ages 1 to 5. Kimmance (1972) found equal numbers of male and female infants malnourished at 3 months but that 62% of malnourished infants were girls by the age of 6 months. Historic data from England (Cowgill, 1969) also shows higher mortality for female than for male children.

In addition, research in India found that boys received more food and medical care than girls (Singh et al., 1963), and that during the first five years of life the female death rate was 74 per thousand compared to 50 per thousand for males (Wyon and Gordon, 1971). Research from India shows that female infants have higher survival rates in families where women work for wages outside the home and thus have higher economic value to the family (Schultz, 1980).

Evidence from Africa indicates that underinvestment in children is sensitive to economic factors. Bride price systems in much of Africa favor the value of female children. A study by Zeitlin and coworkers (1981) in Ghana found female infants to have a higher average nutritional status than males. In Upper Volta, child care improves when children are scarce (Retel-Laurentin and Benoit, 1976).

2. The Insurance Hypothesis

The insurance hypothesis suggests that couples will give birth to more children than they actually desire during the course of their reproductive years in order to guarantee that their desired number of children will survive to adulthood. This hedging is not necessarily conscious, though. Retherford (1975) contends that in pre-industrial societies the cultural norm for family size is much greater than actual family size--the consequence is that hedging is pre-programmed into the lifestyle of the people in these countries. Families attempting to reach the ideal family size suffer infant mortality and end up with a slightly lower actual family size but one that is still large enough to provide security for the parents in their old age, or to provide sons. Data from India shows that most people surviving to the age of 65 do have surviving sons, but this study may suffer from a sampling bias (Preston, 1975). Those that do survive to 65 are likely to have higher incomes, be better nourished, and perhaps have a better understanding of health and nutrition than those that died earlier. These advantages may also be responsible for a higher rate of survivorship among their children.

As mentioned before, there is an asymmetry in the costs of bearing children. As a result of this asymmetry, desired family size in many countries is stated in terms of a minimum acceptable number of children rather than as a specific target. This formulation of family size intention lends itself to insurance behavior (Ridker, 1976; Schultz, 1976; Preston, 1975; Retherford, 1975).

The degree of hedging should be related to the rate of infant mortality in a society and should decrease as mortality declines. Empirical studies have attempted to relate fertility to different measures of infant mortality to prove the existence of an insurance effect and have met with some success. Pebley and coworkers (1979), in a study of Guatemalan families, correlated mortality of women's siblings in their childhood with the number of live births these women produced during their reproductive span and found a significant relationship. Rutstein's (1974) study in Taiwan found that fear of infant mortality as measured by survey responses was also correlated to family size. Furthermore, Heer and Wu (1975) found in rural Taiwan and urban Morocco that the actual community level of infant mortality was correlated to family size when comparing different communities. However, the Pebley study found a negative correlation between community mortality levels and family size.

In the developing world the mortality rate may be high among children as well as among infants. A child must survive for several years before his parents can be confident he will survive to adulthood. May and Heer (1969) analyzed the incidence of mortality in India and concluded that, on the average, a mother is not sufficiently assured of son survivorship until she is 32.6 years old. Much of a woman's reproductive span is over by that time. Consequently, couples may plan to have more children than their ideal family size because of the difficulty of replacing deceased children after this age. The relative importance of the replacement versus insur-

ance strategies may depend on the age that children must reach before their parents feel confident that they will survive.

At any point during their reproductive span a couple can stop and consider the number of children they have given birth to and the incidence of infant mortality that their family has experienced and decide whether or not they should produce more children (Schultz, 1978). The insurance effect may be attenuated by the fact that fertility decision-making is sequential, but it should be remembered that fecundity becomes less certain as a woman advances in age. Furthermore, the survival of the child through the first few years of life does not necessarily mean that the child will survive to adulthood. Strong evidence of sequential decision-making would be consistent with the replacement hypothesis.

To the extent that a replacement effect is the primary behavioral relationship between infant mortality and fertility, couples should respond directly to an increased survival rate for their children by limiting fertility. Where the insurance effect is the more operative relationship, people may not be immediately aware of a decline in infant mortality. It is safe to assume, however, that no single model will fully describe any country. Couples within any given society will exhibit a range of decision-making strategies with respect to childbearing, and a longer lag time would be expected between the drop in mortality and a change in family size norms. Certain patterns will predominate within each setting.

3. The Investment Hypothesis

A changing investment strategy may go together with either of the above models. The investment hypothesis contends that the type of investment that parents make in childbearing changes as mortality rates decrease. Reduction in the rate of infant mortality reduces uncertainty in fertility decision-making and reduces the fatalistic attitudes towards childbearing that are common in subsistence communities (Retherford, 1975). Decreased child mortality also reduces the cost of childbearing in the sense that it reduces the number of unprofitable investments that couples make (Schultz, 1975; Nerlove and Schultz, 1970). As mortality falls, each individual becomes a more secure investment; parents will have fewer children and provide for them better. Couples may be encouraged to concentrate more on quality than on quantity when they are making an investment in a child (Schultz, 1975). They may be more likely to send their children to school and spend more money on fewer children.

Schultz considered the investment strategies parents could use, and contended that, given reasonable assumptions, the most likely investment strategy leads to a reduction in fertility if child mortality declines. This conclusion is consistent with Caldwell's more comprehensive theory of social and emotional change and the changing value of children.

4. Size of Psychosocial Effects of Mortality Reduction on Population Growth

A plethora of statistical analyses have been conducted assessing the relationship between infant mortality and fertility. They use different time periods, different aggregations, different groups of people, different measures of mortality and fertility, and postulate different mechanisms by which infant mortality is related. Three comprehensive reviews of the empirical work on relationships between infant mortality and fertility have been written by Preston (1978), Schultz (1976), and Taylor et al. (1976b).

A useful summary statistic that can be derived from empirical analysis of the relationship between infant mortality and fertility is a measure of the degree of compensation that occurs. Compensation is a percentage change in fertility that will be produced by a given change in mortality in the same direction. Zero percent compensation is the state where the mortality rate falls but the fertility rate remains constant. One hundred percent compensation would occur if a decline in the rate of mortality was matched by the decline in the rate of fertility.

Preston (1978) shows that the maximum compensation due to the replacement effect alone has never been found to exceed 50% when proper statistical controls have corrected for the role of lactation in physiological intervals.

Studies have found the total percent of compensation to range from 0 to 150%. Over-compensation (that is, a rate of compensation greater than 100%) is made possible by the insurance effect and/or a human investment effect. Taylor and coworkers concluded that compensation generally occurs but is significantly less than 100%. Schultz, on the other hand, found that one half of the studies he surveyed showed rates of compensation over 100%.

Compensation values do not give a complete picture of the effect that mortality reduction has on population growth. Since a mortality reduction usually increases survival prospects for people at all ages, it is necessary to achieve a compensation rate of about 130% for a given mortality reduction in order to cause no increase in rate of population growth (Schultz, 1976).

Most of the studies reviewed indicate that both behavioral and biological relationships exist between infant mortality and fertility in contracepting populations. But it is impossible to generalize from

one society to another concerning the size of the compensation effects. One important reason for the variability of the empirical estimates of compensation is that different countries are in different stages of the demographic transition. One would expect to see little compensation in a country like Bangladesh, for example, where the majority of couples are at maximum fertility.

Furthermore, there is a lag between reduction in mortality and the time when the effect on fertility becomes apparent. The lag between a decline in infant mortality and its effects on fertility through lactation effects may be one to two years, through replacement effects five to ten years, and through insurance effects it may take any number of years depending on how long it takes to reshape people's attitudes about infant mortality levels and make them aware that infant mortality has in fact declined (Preston, 1975).

The previous chapter discusses the extent to which mortality declines may increase fertility by physiological mechanisms and includes projections that attempt to take aggregate effects of compensation into account (Brandel and Gwatkin, 1980). The exact size of psychosocial effects of reduced mortality on fertility is impossible to project meaningfully. However, the nature and direction of such effects in any given location will be important for policy formation and program design.

F. Policy and Program Implications

A number of the policies that appear to be most effective in promoting family planning and nutritional improvement via the mechanisms discussed in this chapter are not directly related to family planning or to nutrition programs. We mention these policies briefly and elaborate at greater length on the ways in which nutrition and fertility-related programs can be made consistent with them.

1. The Value of Children--Changes in Family Structure, Aspirations, and Emotional Attachments

To the extent that Caldwell's theories hold true concerning the psychological and emotional changes that accompany the changing value of children, the desirability of encouraging such changes has major implications for national policy and for the design of integrated nutrition and family planning programs. This section will discuss these implications in some detail because of their importance for achieving both nutritional and family planning goals.

According to Caldwell (1976) the quality of parental attachment to each other and to the individual child must change as the family becomes nuclear in structure, and makes the decision to change its investment in children to a strategy consistent with small family size. Sexual relations become a more important part of the parents' bond to each other. Middle class Nigerian women, for example, perceive the postpartum taboo on sexual intercourse to be a hardship, while lower class women do not (Caldwell and Caldwell, 1977).

The social approval of traditional society, which is expressed through the extended family, becomes less important to the modernizing family than the emotional closeness of the nuclear unit, the approval of modern sector friends, and the status symbols that win this approval. Having a child achieve professional status becomes an important status symbol.

These changes in personal values lead to investment in the best food, health care, and education that the parents can afford for each child, and to limitation in family size in order to invest at a level that will make each child capable of competing for high quality schooling. The amount of money required to acquire and maintain modern sector housing, appliances, and recreation also tends to limit the number of children the nuclear family can afford.

In traditional rural cultures, on the other hand, the extended family rather than the nuclear family is the major economic and social unit. These cultures tend to deemphasize parent-child intimacy. The weaned child frequently is handed into the care of siblings to free the mother for farm and other labor and for the next pregnancy. The traditional family structure disfavors good preschool nutritional practices as much as it disfavors small family size.

The writer has found rural traditional mothers in West Africa and Indonesia equally reluctant to spoil the young child by giving ample quantities of prestige foods, such as meat and dairy products. While much of such reluctance is economic, it also reflects the fact that the social system requires that the child be indoctrinated to understand that he or she is humble and low in priority and must exist mainly to serve the interests of the respected and privileged older family members.

So long as the child's main role is to contribute to the welfare of adult society, the notion of investing beyond the minimum required to produce physical well-being of the child may be viewed as a reversal of social and economic priorities. (It should be noted that children are not valued <u>less</u> in the traditional setting, but rather that they are valued <u>differently</u>, in that the value attached to bearing many children does not usually express itself in high levels of investment in individual children.)

The peasant family in transition towards the modern sector sends children to primary school hoping that one or more may make the leap into higher schooling and into a modern occupation that will earn amenities for the parents in old age. They have little reason to limit family size be-

cause most of their children will remain in the traditional sector. However, they may be very amenable to the idea of investing in better weaning foods and longer birth intervals in order to improve their children's chances for modern sector status.

At the national level, major policies that change family structure, aspiration, and the style of investment in childbearing are to:

a. Modernize the countryside: Modernization of rural areas requires decentralization of industry, infrastructure, and services in order to decentralize modern sector employment opportunities and the availability of modern consumer goods.

b. Extend new agricultural technology: New appropriate technology is needed to increase crop yields in order to feed growing populations. Current agricultural methods used in many countries cannot be employed more intensively without destroying the soil. At the same time, new technology permits rural subsistence farmers to enter the modern market economy. The complexity of the new technology motivates increased investment in education.

c. Increase the equity of income and land distribution: Households that lack access to the means of generating adequate income lack the means of changing their lifestyles.

d. Encourage modern sector aspirations: The image of the integrated program should appeal to the desire to belong to the modern sector without removing the program benefits from the economic reach of needy target groups. It is important to note here that the term modern should be defined to correspond to the country's development ideology. Modern socialist imagery and goals, for example, differ from those of relatively more capitalist governments. Both share in common an emphasis on broadening the horizon of the traditional community beyond the confines of the extended family to identification with national goals and values. Both encourage aspirations towards professional status and other types of excellence that require nuclear families to invest in the education, nutrition, and health of children. Most importantly, both put an end to the economic incentive for unlimited childbearing by reversing the traditional child to parent investment flow.

Product packaging, facilities, uniforms, etc., should be as modern and fashionable as program resources permit. Both nutrition and family planning education should stress the fact that the well-nourished infant, whose parents have a long enough birth interval to care for him or her well, will perform more intelligently in school. They should also stress the fact that the small family has the resources to pay for more education or vocational training and to feed the older school children the balanced diet they need for good performance.

Program workers, both in family planning and nutrition, should ask mothers and fathers about their hopes and plans for their children's future and should encourage them to invest in modern sector plans to the

best of their abilities. Such a dialogue, incidentally, was found to be successful in motivating the purchase of the nutripak, an inexpensive weaning food, in the Philippines. The program should motivate modern sector planning by enlisting local people who have succeeded and other celebrities to be guests at program functions, and by becoming involved with sponsorship of school scholarships and awards for prominent achievement. Modern sector imagery does not imply the need for modern sector technology when this is unaffordable and unmaintainable. Appropriate technology also is modern.

e. Encourage investment in the child: Program education should stress to traditional parents the fact that additional investment is needed in order to enable their children to meet modern sector demands. The analogy that the new high-yield varities of grain require more fertilizer and irrigation may be helpful. Evidence of investment in foods, health care, and birth spacing should be reinforced by social approval. Other forms of investment (in clean, mended clothes, neatly groomed hair, shoes, books, and toys) should also be noticed and praised if they are not already the norm. Village level workers should be encouraged to set the example by dressing, feeding, and educating their children well (but not ostentatiously).

f. Encourage nucleation of the family: Rural couples tend to form nuclear families when they migrate to the city, away from extended family ties. But both in rural and in urban settings a whole range of living arrangements exist. The integrated program can do little to alter such arrangements. However, it can encourage the nuclear family to cooperate and to think as a unit, whenever possible.

The program should, for example, discourage the practice of sending very young children to be cared for by grandmothers and aunts since such children usually suffer nutritionally and psychologically (Welbourne, 1963; Bowlby, 1951), and their dislocation disrupts the nuclear family unit.

The program should organize some functions related both to family planning and to nutrition that parent-couples are motivated to attend as a unit, even if social customs demand that men and women divide into separate groups after arrival. It should require some participation of fathers (for those families with reasonably stable liasons) as a prerequisite for services for infants and children, such as enrollment in food distribution programs and maternity programs. Fathers may be required to donate blood as a part of the maternity procedure or to contribute other services, both because these services are needed and as an expression of the father's commitment to his nuclear family unit.

g. Promote parent-child bonding: Childbirth is a time when intense emotional bonding should occur between mother and child and between the father and the mother-child pair. Such bonding can enhance the value of the child and the strength of the nuclear unit.

Maternity facilities that permit the mother to breastfeed her infant in privacy immediately after birth create the maximum amount of instinctive

bonding between the mother and her infant. An experiment in Guatemala, which allowed low income mothers to spend the four hours immediately after delivery with their naked infants found that these infants had fewer episodes of illness during the first year of life than infants that were given to their mothers in the usual manner after 12 hours (Sosa et al., 1976). The timing was more important than the nursing and skin contact. Another group of mothers for whom four hours of nursing and skin contact began 12 hours after birth did not experience the same bonding as those who nursed their infants immediately following birth. The International Planned Parenthood Federation (IPPF) Medical Bulletin recently has endorsed obstetric practices that favor bonding (Franklin, 1980). Nursing immediately after birth also has been claimed to be correlated with prolonged lactation amenorrhea.

The father's bonding to his new baby is less instinctual than the mother's. However, programs that involve the father in prenatal preparations for the birth and involve him in the actual birth procedure, as much as local customs permit, do create a high level of bonding and of commitment of the father to his wife and infant. This initial investment of time and interest in the baby is the first step in the continuing investment in the child's development.

Overcoming colostrum taboos is important both for bonding and for establishing breastfeeding. Colostrum is the yellowish secretion of the breasts during pregnancy and after birth before the mother's milk comes in. It is richer in protein, antibodies, and some vitamins than the white milk that fills the breasts starting from 2 to 4 days after birth. Many traditional cultures in all areas of the world hold the belief that colostrum should not be given to the baby. Some believe that it is stale (having been in the breasts through pregnancy); some claim that it is pus. Many insist that the colostrum be expressed and thrown away.

The baby's first meal may be ceremonially prepared and may include clarified butter with brown sugar (Punjab), young coconut water or jelly (Java), the milk of a friend or relative (Egypt), boiled water with glucose or sugar ("modern"), or a wide variety of other substances such as powdered wolf's liver (Central Tunisia). In the Punjab, for example, the first meal is ceremonially given to the infant by the grandmother, and is believed to create a spiritual bond between the grandmother and the child.

Colostrum taboos prevent the early nursing recommended for bonding. Additional benefits of giving the infant colostrum are that it is hygienic, and is excellent nutritionally and immunologically. Early nursing also prevents painful breast engorgement when the mother's milk comes in.

It is tempting to speculate why so many traditional cultures appear to deliberately prevent maternal-infant bonding. As in the Punjabi case, it may have been culturally more important to establish bonds between the infant and other extended family menbers in order to strengthen the extended family structure. In much of Africa, the mother is expected to

disassociate herself emotionally from the infant by the age of about 2 years, when it is weaned from the breast and may be sent to live with other relatives. So many infants die that a strong maternal-infant bond might disrupt the mother's psychological equilibrium by heightening the pain of loss. However, feeding unhygienic mixtures to the newborn may actually increase the rate of neonatal mortality.

In some locations, the milk companies take advantage of the colostrum taboo to introduce the infant to formula in the days before the mother's milk comes in. In Indonesia, midwives in private practice distribute free samples of a variety of brand name formulas in their maternity wards and at home deliveries and instruct the mothers to give this formula in a bottle in place of the traditional coconut water.

Since the colostrum taboo applies immediately after birth, the effort to overcome this taboo and to increase bonding focuses on maternity services, and implies the need to restructure maternity clinic services so that:

--the infant is put to the breast in the minutes following delivery

--the baby sleeps with or by the mother

--the mother is instructed to breastfeed each time the infant cries

--there are disincentives for bottle feeding; e.g., mother must provide her own formula, bottles and sterilizing pans; she must prepare all bottles and cannot give food to baby unless this procedure is hygienic; she is not permitted to store bottles in the hospital refrigerator, unless she has refrigeration at home, etc.

The need to establish breastfeeding also implies the need to retrain the modern and traditional midwives conducting home deliveries to put the baby to the breast at birth, and to encourage demand feeding from birth on. Whether or not items with high symbolic importance, such as the wolf's liver given in Tunisia to make the infant brave, should be discontinued require careful thought. If additional reasons for putting the newborn to the breast are needed, it should be explained that the child's sucking stimulates the third stage of labor, or the delivery of the placenta and the contraction of the uterus to prevent bleeding.

h. End Postpartum Sexual Taboos

A Christian school teacher in Upper Volta, known to the writer, forced his wife to spend the night in the chicken coop because the baby was one year old and she still refused to have marital relations with him because she feared it would spoil her milk. A college educated mother in Lagos, Nigeria, who worked as a secretary for her husband, an engineer, bottle fed her babies from birth because she explained she didn't wish sexual abstinence to interfere with their close relationship. A market trader in

Ibadan, Nigeria, decided to wean her nine month old baby to the bottle because her husband was running around with other women. She was persuaded to accept an IUD and keep breastfeeding when it was explained to her that semen would not spoil her milk so long as she didn't become pregnant.

Postpartum sexual taboos which were also discussed in Chapter 1 appear to function well as part of rural traditional lifestyles that include polygamy, expansible farm lands with need for extra wives to provide farm and household labor, a separate house for each wife and her children, and an adult diet so poor in protein that prolonged lactation is important for child survival.

Sexual abstinence is not compatible with the close nuclear family bonds that foster small family size and high quality nutritional investment in the child and is in fact eroding with modernization. As noted earlier when Nigerian women were surveyed concerning their attitudes toward sexual abstinence, women in traditional roles claimed not to miss sex during abstinent periods whereas middle class and educated women found sexual separation from their mates to be a hardship (Caldwell and Caldwell, 1977).

The sexual taboo is based on an incorrect belief that if the mother engages in sexual relations, the infant will be harmed. This implies that the staff of programs that integrate nutrition with family planning should teach an appropriate corrective message. The following example of such a message is used in Liberia (Ministry of Health and Social Welfare, n.d.):

> "When a mother sleeps with a man, is the breast milk spoiled? For many generations, this has been a common belief. This is still very strongly believed by most people. There is a Liberian saying, 'The thing is not the thing; the thing behind the thing is the thing.' We need to look at the thing behind this belief. Usually when a woman starts to sleep with her man again, it is not too long before she gets pregnant. Then she takes the baby from the breast, and if he is still young and needs the milk, he is likely to become sick. It is quite natural to believe that the milk the baby got before he was taken from the breast made him sick. The real reason he is sick is because he is not getting milk again. The old people taught parents not to sleep together soon so that the woman would not get pregnant and the baby would not get sick. It is very difficult for couples today to stay apart for 3 to 4 years as the old people taught. Still there is a way to allow the baby to breast feed and prevent his being sick. This way is by using some method of child spacing. There are many methods. If families are encouraged to space their children, their children will be healthy and breastfed and they can all live together happily."

Such a message tends to be incredible unless it comes from highly respected sources of information such as the midwife, backed by mass media messages, for example.

The program should also discover and promote contraceptive methods that make it easiest for couples to discard the taboo. The condom, for

example, might be most reassuring to husband and wife in Nigeria because it prevents the sperm from actually touching or entering into the mother's body. On the other hand, condoms tend to be unacceptable in Indonesia, where postpartum abstinence also is found.

The sexual taboo should be eradicated not only in urban areas, but also in rural districts where it does not yet appear to cause major social problems. A compelling reason for this policy is the need mentioned in Chapter 1 for family planning programs to take advantage of the protected trial and error period provided by lactation amenorrhea to teach the couple to use contraceptive methods. A second reason is to take advantage of the fact that the inducement of being able to resume sexual relations can strongly motivate even traditional couples to learn to practice family planning. There is evidence that the postpartum taboo always has been perceived as a hardship by young couples (although they may not admit this publicly) and that the taboo is reinforced by strong public disapproval of women who become pregnant while lactating. Morley and coworkers (1968) reported that women in the rural Nigerian village of Imesi who became pregnant while lactating were often so ashamed that they would leave town until after the birth of the new baby.

This section has focused at some length on program characteristics designed to promote emotional and psychological changes that lead to the adoption of modern sector values Although these factors may not seem to have immediate relevance to nutrition and fertility, the writer has included them out of the conviction that it is not possible to stabilize world population growth while maintaining rural traditional social and economic structures. As noted in Chapter 1, reduction of mortality to acceptable levels automatically implies the need to reduce ideal family size to a replacement level of 2 to 3 children only, in order to avoid unsustainable population growth. The notion that such small family norms can be introduced to traditional peasant societies by "sanitizing" traditional procedures without introducing major social changes appears to be improbable.

2. The Value of Children--Social Security for Old Age

Even parents who have high aspirations for their children and invest heavily in them may not feel they can afford to limit their family size to two or three so long as they depend on their children to look after them in old age. In order to provide old age security without excessive childbearing there is a need at the policy level to:

a. Create social welfare policies favoring the elderly: All policies that decrease the dependence of the elderly and the costs of caring for them stand to benefit both nutrition and family planning goals.

b. Provide subsidized foods for the elderly: This should decrease their cost of living, and thus decrease their dependence on their children.

c. Provide feeding programs for the elderly poor: These programs, such as the Meals on Wheels in the United States, which brings cooked food to the elderly in their homes, succeed in allowing the elderly to live on their own at a time when they might otherwise be forced to move in with their children.

d. Provide free or subsidized primary health care and nutrition services for the elderly: Such services analogous to those commonly provided for mothers and infants probably are more effective in reducing their dependence than nutrition services alone because of the very high costs of medical treatment in developing as in industrial countries.

3. The Value of Children--Son Preference

Son preference appears to have deleterious effects both on family size goals and on the nutritional status of girls, as discussed earlier. It is particularly hard to reduce family size to 1 to 3 children if parents must continue childbearing in order to have at least one son. A national policy of sexual equality reinforced by equal employment opportunities for women removes the economic incentive for preferring sons.

4. The Value of Children--Women's Employment

Income generating opportunities for women make time they spend outside the home more valuable to the family than time caring for preschoolers who may not contribute to the family for some years. Such opportunities are an incentive for limiting family size. They also tend to increase the woman's level of aspirations for herself and her children by increasing her experience outside the home and her earning power.

Employment of the mother outside the home exposes her children to a high risk of malnutrition if it prevents her from breastfeeding in an environment where safe artificial feeding is difficult. Older preschoolers also suffer from malnutrition and neglect when adequate child care is not available for working mothers. On the other hand, the increase in the mother's income can have a positive effect on her family's nutrition if infant feeding and care arrangements are favorable.

The value of children to the mother changes, since the job gives additional purpose and meaning to her life. Her sense of self-worth and personal achievement does not depend so heavily on her role as a childbearer. This is important for family planning. So long as motherhood is the woman's only source of fulfillment, she may be persuaded to invest in her children, but not to limit their number to one or two.

The families of low income working women are a priority target group for integrated family planning and nutrition programs because these families have increased receptiveness to family planning combined with increased nutritional vulnerability. For these reasons the program should:

a. Promote the establishment of new day care facilities for nursing mothers in all cases where mothers of young infants must work in structured settings outside the home. Large employers in government or industry may be more easily persuaded to create such facilities in-house if the program includes family planning services that will reduce the drop-out rate of experienced women workers.

b. Introduce integrated services into existing day care facilities. Existing day care centers for low income urban mothers frequently do not serve the best diets. A nutrition program may be introduced in such centers. This program may also make family planning counseling and services available to the mothers by encouraging them to attend an associated family planning facility.

c. Introduce integrated services into income-generating development programs for women. Small-scale cottage industry, sewing, handicrafts, or communal gardening programs do not always conflict with child care, although the crafts they teach tend to motivate women to invest relatively more time in cash producing activities and less in child bearing. The intimacy established within such women's groups can be a favorable setting for teaching nutrition and introducing family planning. The program should similarly seek to link integrated family planning and nutrition services with women's community development activities.

d. Provide special services to women whose working conditions force them to bottle-feed, which produces the double risk of malnutrition and ilness in their infants and of short birth intervals. If possible, the program should have special outreach efforts targeted to these women, to enroll them and their infants into regular weight-chart nutrition surveillance and family planning programs that operate at hours when they can attend.

5. The Value of Children--Formal Education

Extended education of children changes their value to the family in a manner that favors good nutrition and small family size. An increase in number of years of education simultaneously delays the age at which the child can contribute financially to the family, increases the amount the family must invest in the child, and potentially increases the eventual amount that the child can return to the parents. Good nutrition is necessary for optimal academic achievement. Thus parents may be persuaded to invest nutritionally in the child who will continue in school by the argument that they will receive returns from this investment. Increase in educational opportunities and norms therefore can be expected to have beneficial effects on nutrition and family planning. The school also is an important setting for nutrition and family planning education.

6. The Replacement, Insurance, and Investment Strategies

In the natural course of events the time lag between reduced mortality and reduced fertility usually is too long for programmers to act on the assumption that reducing child mortality per se will serve as a sufficient short term method of controlling fertility by any of the three above mechanisms.

The child survival hypothesis (Taylor et al., 1976a) links these three theories into a general statement of belief that reduced mortality leads to reduced fertility. It stresses the importance of looking at development as a process whereby a wasteful and inhumane method of keeping the population in balance (excessive child death rates counterbalanced by excessive birth rates) gradually yields to a desirable pattern in which each child lives and only enough children are born to perpetuate the population. Transmission of awareness of this new potential by the program to its participants is important but requires sensitivity.

The rationale for using some variation on the theme of the child survival hypothesis as a part of integrated nutrition and family planning education is the belief that the time lag can be shortened by making individuals and society as a whole more aware of the demographic transition and by implanting in advance the social norms that society would have gradually evolved if development proceeded at a reasonable pace. At the national level, this involves creating national policy to:

a. Promote an ideal family size of one to three children and use social marketing techniques and incentives to make this small family size appear attractive to the community.

At the program level, it is necessary to:

b. Inform people that mankind now has the power to substitute a humane for an inhumane form of population control.

Making people aware of their power to control population size by humane methods involves thought processes that are not really complicated but that may be too lengthy to communicate in post-natal counseling sessions with mothers or in radio spots, for example. This information could be transmitted at two separate levels: that of the nutrition-family planning worker training course, and secondly at the popular target group level.

The complete message that should be transmitted to workers during training is presented here schematically in quotes in order to illustrate how simply it can be stated:

"It is no longer necessary for people to have six children so that three will survive, as it used to be in the old days. When good nutrition and health care are introduced to prevent child deaths, and when people practice contraception, the human race can afford to have exactly the number of children it needs and to give the best care and education to each child. It takes time before people realize that

the old days are over. It is our job as workers to help them to realize this and to teach them to practice good nutrition and health and family planning. When people learn these skills, they will no longer have to mourn for dead children, and they will have no more than the number of children that they can feed and care for properly."

The messages, of course, must be elaborated with discussion and illustrations.

The workers should be encouraged to share this understanding with opinion leaders and with individuals who express an interest in intellectual discussion. They need not attempt to explain the whole process to most of their clients unless it can be made concrete in the form of a folk tale, for example. Instead, they may present the following simple messages:

The most complicated sequence can be broken into two simple separate thematic components. The first is "good nutrition and good health care can protect your children from dying." The exact translation of this theme into messages should be culture specific. It may be most appropriate not to mention death directly but rather to say that "well nourished babies do not get sick easily" and that "when well nourished babies do fall sick, they recover rapidly, particularly when they receive good health care."

The second component is that "fewer children allow the family to enjoy a better life." Part of the underlying message here is that society as a whole cannot afford to have the population growing faster than the growth of food supplies and other resources. However, the average target family probably will not be motivated to limit family size by an appeal to higher social consciousness. Even in China, where the ideology of serving the masses is generally accepted, the family planning program has appealed to the self interest of individual families in order to motivate reduction in family size.

G. Need for Further Research

Motivations for limiting family size and for improving the quality of investment in children are in reality more complicated than the theories discussed in this chapter. Most of the studies conducted in the past have not taken development correlates and culture-specific attitudes into account in attempting to describe multivariate phenomena. Many of the behavioral studies of the relationship of mortality to fertility also have ignored biological mechanisms, just as the physiological studies have tended not to control sufficiently for contraception and abortion and their psychosocial causes.

Recent research, most of which is carried out in industrialized countries, is increasingly imaginative. There is, of course, a need for such research, just as there is a need for further testing of refinements of the major economic models.

At the program level, however, research is a less urgent priority than local needs assessment and implementation. Far more already is known about the ways in which nutrition and family planning programs can be beneficially combined than is put into practice. Most of the program design recommendations in this chapter do not rest on a single research finding but are overjustified and overdue when viewed from a variety of perspectives.

Chapter 3 Integration of Nutrition and Population Programs*

This chapter describes and discusses strategies for integrating nutrition, family planning, and health services. Some of the illustrations are taken from reviews which deal specifically with evaluation of integrated projects (e.g., Gwatkin et al., 1979) or with aspects of implementation (Pyle, 1979). Three sources cataloguing projects worldwide have been helpful in locating integrated projects and defining trends in service opportunities: the HIID Annotated Directory of Nutrition Programs in Developing Countries (Austin et al., 1978), A Compendium of Clustered Service Projects in Latin America and the Caribbean (Stillman, 1978), and the UNFPA Inventory of Population Projects in Developing Countries Around the World, 1977/1978 (UNFPA, 1979).

The first section of this chapter examines community based interventions, focusing on procedures and community structures that are important for successful project implementation regardless of the agencies directing the community level efforts. This is followed by the health and nutrition based approaches. The third section deals with family planning based projects where the major goal is to decrease fertility rates. The fourth discusses integrated rural development schemes aimed at improving the quality of life of the participants and increasing self determination in the community as a whole. A final note mentions other strategies linking nutrition and family planning services.

Since there is ample literature on the rationale for service integration (Aitken, 1977; Austin and Levinson, 1974; Wray, 1972, 1973, 1974; Huenemann, 1975; Jeliffe, 1974; Johnston and Meyer, 1978; Meyer, 1976; Perkins, 1977; Taylor et al., 1976b; Van Balen, 1976; Winikoff, 1978), we will open with a rapid summary of the rationale underlying the integration of services.

A. Rationale for Integrating Nutrition and Population Programs

Since about 1970 there has been widespread agreement that integrated health, nutrition, family planning, and environmental health services should be developed to meet the needs of low income populations in developing countries. The United Nations System has stressed the need for integrated maternal child health services that include family planning. More recently, the proponents of primary health care and of a basic needs approach to development have elaborated on the importance of integrated services and on methods for developing community level worker programs that enable rural village communities to play an active role in extending and managing their own service delivery systems. The main arguments for integration are:

1. More Effective Treatment of Overlapping Problems: Nutrition and fertility constantly interact. Breast feeding, for example, simultaneously

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*This chapter was written by Nina Schlossman and Marian Zeitlin.

provides the best nutrition for the infant and also delays the resumption of ovulation. A good diet during pregnancy produces an infant that is more likely to remain healthy and live to satisfy the family's desire for surviving heirs. A major reason for spacing children is to permit each to be properly nourished. Because of these and other essential interrelationships, field workers who are trained only in nutrition or only in family planning cannot provide counseling and services, even in their own subject area, as effectively as those who have been trained to provide both types of services. As discussed in Chapter 1, spacing of children reduces malnutrition rates, and provision of integrated nutrition services has proven effective in increasing family planning acceptance.

Health, nutrition, and family planning services have mutually reinforcing effects on the health of the individual which curative medicine by itself cannot always accomplish. Modern medical technology introduced to Many Farms, a Navajo Indian Reservation in 1955 proved ineffective against the pneumonia-diarrhea complex which caused about 50% of infant deaths in that year. By 1960, this figure had not changed. It was concluded that this disease pattern was resistant to "modern," hospital-based medical treatment (McDermott et al., 1972).

The synergy between malnutrition and infection was not well established at that time, and the project did not include nutritional rehabilitation in the treatment of infectious desease. Treating a malnourished child for infection or diarrhea is only temporarily effective if he/she is returned to a poor nutritional environment. A factor frequently contributing to poor nutrition is the presence of too many young children for the mother to feed and care for adequately.

2. More Efficient Outreach at Reduced Cost: Target families most in need of nutrition services also tend to be most in need of family planning, since malnutrition is most common in poor families with too many young children. Mothers in these families frequently lack time, transportation, and freedom of movement to attend health facilities. When they can receive both nutrition and family planning services at the same facility, or at nome from the same village level worker, outreach is improved. When the same channels and outlets can be used to deliver both services, the costs of maintaining parallel infrastructures may be reduced, particularly if these systems are underutilized or are capable of sufficient expansion to accommodate both services.

3. More Rapid Adoption of New Practices: Both family planning and dietary practices are intimate and heavily determined by culture and tradition. People of all cultures tend to fear that changes in their diet or in their reproductive behavior may cause ill health or other negative effects. The credibility of the institutions and persons suggesting such changes is a key ingredient in producing change. Nutrition and health services provide an excellent channel for establishing trust.

The low income mother is much more likely to take the family planning advice of the primary health care worker who safeguards the health and nutrition of her children, or of the midwife who counsels her during pregnancy and delivers her baby, than of an unfamiliar person who approaches her only for family planning. Similarly, where family planning services have preceded nutrition programs, as in Indonesia or Tunisia, family planning acceptors will be more likely to adopt new weaning foods and different diets during pregnancy when these are suggested by a trusted family planning field worker.

In proof of this last point, numbers of birth control users have been found to increase dramatically when health and nutrition have been integrated with family planning in community level programs cited in the first chapter.

B. Overview

Whatever the umbrella agency for program integration, the packages of services offered are flexible, and the specific combination of components responds to the needs of the community. Components also may be added or deleted over time as the public health situation changes and regional development progresses. Existing infrastructure, such as health clinics, maternal child health (MCH) centers, nutrition units, family planning clinics, day care centers, and other community centers can be expanded to include the new services.

Given the basic biologic and psychosocial relationships between nutrition and reproduction (see Chapters 1 and 2), certain components of combined nutrition and family planning services will be relatively constant. The following basic core of services should be provided in a coordinated manner in each project area, regardless of the forms of integration or program structures within which integration occurs: prenatal care for pregnant women with emphasis on nutrition and on contraceptive planning; postnatal care, encouraging mothers to breast feed their babies and to begin appropriate contraception early in the postpartum period; treatment of anemia; special nutrition education for and surveillance of women using IUD's or taking oral contraceptives which may affect the utilization or the metabolism of certain nutrients; surveillance of infant nutrition and weaning diets and of new contraceptive users; special nutritional education for mothers of preterm and low birthweight babies, as well as for mothers who cannot or will not breastfeed their infants. If oral contraceptives are used, it is critical to use progestagens rather than estrogen preparations during lactation because estrogen decreases breast milk. Fathers and community opinion leaders also should be involved in family planning and nutrition program activities. Contraceptives and nutritionally superior foods also should be sold through appropriate outlets.

C. Community Based Programs

Community involvement appears to be important for successful program implementation irrespective of program approach. It is a key ingredient if

the program needs to rely on community resources for large scale service delivery. Local or external voluntary agencies are often more successful community organizers than are government programs, possibly because some communities perceive these agencies to be less threatening than government (Pyle, 1979; Karlin, 1976). A "bottom-up" approach generates many variations in styles of community participation (Stillman, 1978; UNFPA, 1979).

1. Community Organization

Community organization is the backbone of the community based project. Local officials or chiefs and other influential members must support the program if it is to be successful. The needs of the community must be clearly identified, preferably by consulting community members, and taking felt needs, as well as observed needs, into account. Priorities must be set. The next step is to assess the extent of existing infrastructures and the social network of the community.

Techniques of group dynamics can be used for community motivation, needs assessment, and recruitment. Save the Children Federation has evolved village level group dynamic methods designed to make community members aware of their problems and to motivate self help (Sanghvi, n.d.).

2. Contribution of Community Resources

The project should insist on input of resources from communities and community members. The Jamkhed Comprehensive Rural Health Project (Arole and Arole, 1975) originally agreed to provide services only to those villages that would guarantee an access road, provide a building to house health activities, set aside land for growing food for preschoolers, and fulfill certain other requirements. Those villages that were unwilling to contribute these matching resources and services were simply ignored in the initial phases. When they saw the benefits that neighboring participant villages received, initially unmotivated villages became willing to contribute their share. A program strategy that started by providing free services when it encountered resistance against participation would not have achieved the long term goal of self reliance.

Initiating local involvement from the very first stage in a project's development gives the community a stake in it and opens an avenue for two-way communication: between villagers--most often through community leaders--and the staff and administrators of the services. Continuous feedback is especially important for success in community based and initiated integrated development projects. It is important, however, to avoid letting the involvement in health care, nutrition, family planning, meetings, etc., become a burden to local residents, especially women, who often have little spare time.

3. Building on Local Structures

A variety of local structures and clubs have been used for community based programs. Political frameworks can become vehicles for improving health conditions and reducing population growth rates at the local level. In the People's Republic of China, the commune and factory are basic work units which also provide health, nutrition, and family planning services to their members. Other social services such as day care and nursing breaks are also offered.

Cultural networks can serve the same function. In Indonesia, village involvement has a long history. The Banjar (village) is the basic unit in rural Bali. The village head, or Kelian, holds a monthly meeting with the village household heads to decide on community affairs. Since 1974, these meetings have included discussion of family planning practices. The "family planning status of each household," including type of contraceptive used, number of pregnancies, births, miscarriages, dropouts, and nonacceptors (of contraceptives), is noted on a map displayed in the meeting house (Population Council, 1977). This information can be compiled yearly and incorporated into national statistics. In this way, the community participates in primary data collection and updating nutrition, health, and population statistics.

The outcome of this program depends on the community network as the basic social framework of Balinese society. The network is traditionally ingrained in the Hindu society and revolves around customs and ceremonies. Family planning practices and nutrition education have been well integrated into village and family life on Bali (Ibid, 1977).

In China and in Indonesia the communities take full responsibility for management of the programs with excellent results. It is difficult to transfer such successful programs to societies without well developed political or cultural infrastructures, or where people live in dispersed rural homesteads as in Central Tunisia.

4. The Mother's Club

Several community programs show that basic awareness of nutrition and family planning concepts can be dispersed through diverse community channels.

Mother's clubs are emerging throughout the world. Women get together for a variety of activities, usually involving discussions on nutrition and family life. In Upper Volta, the focus is on nutrition (Zeitlin, 1981). The mothers learn to prepare weaning foods from local products. In Indonesia, family welfare clubs serve as resupply posts for contraceptive aids. Pilot self-help programs have taught mothers to detect pregnancy complications, to use oral rehydration for home treatment of diarrhea, and to supplement their diets during pregnancy and illness. In some cases, women have been instructed in vaccination techniques (Rhode and Northrup, 1977).

Indonesian and South Korean Mother's Clubs have been particularly innovative and active in the area of community development. A few groups began cooperative rice stockpiles as a buffer supply for the village in times of need. Others developed small savings and loan operations for starting community gardens.

5. The Day Care Center

Day care centers are also potential focal points for community involvement. Two programs, one in the Republic of Korea and the other in Venezuela, are noteworthy. The Integrated Day Care Program (IDCP)(Sung, 1979) incorporated family planning and nutrition in day care services in the Republic of Korea. In 1971, 500 rural and urban IDCP centers served low income working mothers. Six days a week, children were provided with one free meal and snacks at the Day Care Center. Mothers received informal classes, at their convenience, including nutrition education with demonstrations and discussions on such topics as weaning foods, home sanitation, balancing meals, and the nutritional value of local foods. This program enjoyed a high success rate as measured by increased practice of contraception by the mothers involved. Seventy-five percent used some form of contraceptive as against 55% of non-IDCP controls. The women also recruited their husbands and friends (Sung, 1979).

The Day Care Homes project in Venezuela began in 1964. By 1978, 2,000 day care units serving 5 children each were operating in Caracas and in other urban centers. A team, comprising 2 child care workers, 2 preschool teachers, and 1 supervisor, was in charge of 40 day care homes. The following services were offered: nutrition, family planning, health education and early mental stimulation of the child; food was also served. The day care mother and the biological mother met once a week to discuss the child. The team referred the mother to other resources and agencies for family planning, health care, and legal aid. The working mother contributed $25/month. The day care mother received a salary of $100/month (Stillman, 1978). In this case, nutrition and family planning services were not offered together. They were linked effectively though by the staff, through the center which served as a referral and resource center for the families as well as a day care center for the children.

6. The Creation of New Community Structures

In many cases the traditional structures will provide a context for the creation of a new committee selected to develop and manage the community level program. Save the Children Federation's community development strategies around the world generally begin with the establishment of community committees. In Guatemala, the Chimaltenango Project (Behrhorst, 1974) and Project Concern Guatemala (Stillman, 1978) both held local elections to form health committees. Save the Children has found in Upper Volta (Dobyns, 1980), however, that insistence on a democratically run community committee may actually retard progress in tribal cultures with

a top-down chieftancy structure, where all decisions traditionally are made by the chief. The Yako program (Zeitlin, 1981), also in Upper Volta, achieved extensive success by working directly through the chieftancy system.

D. Primary Health Care

Primary Health Care, as defined at the Alma-Ata Conference (WHO, 1978) "addresses the main health problems in the community, providing promotive, preventive, curative, and rehabilitative services accordingly. Since these services reflect and evolve from the economic conditions and social values of the country and its communities, they will vary by country and community, but will include at least: promotion of proper nutrition and an adequate supply of safe water; basic sanitation; maternal and child care, including family planning; immunization against the major infectious diseases; prevention and control of locally endemic diseases; education concerning prevailing health problems and the methods of preventing and controlling them; and appropriate treatment for common diseases and injuries."

Although primary health care workers must be able to refer patients to secondary and tertiary health care facilities, primary care itself may be carried out within a variety of infrastructures, which will be discussed later in this chapter. The basic services provided by primary health care are quite simple. These services may be organized and community workers may be trained and supervised by a range of agencies, including public health and maternal child health in the health sector, family planning, nutrition, rural development, agricultural extension, and other social services. The specific worker categories and job descriptions at the village level will be influenced by the lead agency organizing the services. This agency must ensure that its community level service package is integrated by coordinating its activities with other agencies and sectors.

At the village or neighborhood level, primary health care should be the responsibility of local workers who do not have high levels of education or professional training. Outreach is an exceedingly important component of primary health care, as most people do not have access to a formal health facility within reasonable walking distance. For the most basic services, outreach capability, continuity and simple competence are more important than professional qualifications. It has been well established that M.D.'s are neither cost-effective for the delivery of primary services (Fendall, 1972) nor interested in remaining in low income rural areas. Professional nurses and paramedics also will not be effective in providing primary care in villages or communities in which they cannot maintain the living standards and social contacts to which they are accustomed. Persons trained to provide regular primary care to remote communities must be content to live permanently in the communities they serve and be willing to actively reach out to their clients. These constraints greatly limit the level of education of persons available to be trained to provide primary care. Yet lack of education does not prevent the delivery of simple services. Illiterate "bare-foot doctors" have been found to be effective in delivering health services in West Africa (Zeitlin, 1981).

Retraining of personnel is an important part of any expanding primary health care project which uses the existing health, nutrition, or family planning channels as its base. Members of each sector should at the very least become familiar with the problems, concepts, and services of the other two sectors in order to enhance cooperation and avoid duplication of services. Zaire's hospital based pilot project, where workers from other sectors were trained in techniques of primary health care, showed promising results (Karlin, 1976). In some cases the unipurpose worker, originally trained by his/her lead agency, can be trained as a multipurpose worker. In other cases it is more effective to integrate the efforts of several categories of multipurpose workers. It is necessary to be realistic and to avoid overloading the personnel with responsibilities.

Four types of community level primary health care workers will be discussed: the village health worker, the traditional midwife, the family planning field worker, and the nutrition monitor. Most integrated services are provided by one or all four of these personnel. These worker categories correspond to four sets of services: curative care, prenatal care and midwifery, family planning, and nutrition. While these services should be integrated, they should not be provided by the same individual except under special circumstances; e.g., very small communities where the patient load is so small that several primary health care workers would be superfluous.

Although the last three service categories are the subject of this report, curative care cannot be ignored becuase it is the service category for which there is the greatest spontaneous demand. Only those workers who have the power to cure (greatly enhanced by simple antibiotics) will have high prestige in the community. Curative care may be provided by the midwife and/or family planning worker, who may or may not be the same individual. Cultural sex divisions may make it desirable for some curative care and some family planning services to be provided by men. Except in unusual situations, midwifery and nutrition services are more appropriately provided by women.

While the greatest spontaneous demand is for curative care, the second largest spontaneous demand is for preventive care in the form of maternity services. All mothers seek health care providers at the time of childbirth. This is one of a number of reasons why childbirth is a focal occasion, surrounding which nutrition, family planning, immunization, and other services should be organized in order to reach the entire at-risk population. Because of the importance of the maternity services as a lead infrastructure for providing prenatal and postnatal nutrition and family planning counseling and services, it is important to have a highly respected and senior community level worker in charge of maternity services. This person should be a woman, and preferably a midwife with literacy skills.

The worker categories and division of services appropriate to any given program and region will depend on the following considerations:

--Population Density Relative to Means of Transportation: In most situations a worker should be able to reach all of her or his clients on foot within about a one-mile radius. Availability of bus, bicycle, car, animal, or other transport will naturally make it possible to cover a wider area.

--The Number of Hours per Week That Workers Can Devote to Their Job: In rural farming communities it may be most appropriate to train part-time workers, who provide services for their immediate neighbors as required and as their household and farm duties permit.

It is easier to enlist volunteers to work part time rather than full time. It also may be easier to get the community to remunerate part-time services since the total to be paid, through a health insurance scheme for example, is lower.

--The Worker Categories and Service Times that Generate the Most Enthusiastic Support from Within the Community: (See the previous section on community based programs.)

The goal in the apportionment of service tasks to worker categories is to provide integrated, or at least coordinated, services to the entire population at least cost, both to the community and to the service structure. New community-level primary health care programs must be flexible enough to make continuing adjustments in the service package until the program works smoothly and effectively.

The four worker categories described below represent a simple disaggregated manner of apportioning tasks. The reader should realize that the tasks described may also be performed by fewer persons; e.g.:

--One integrated health worker, a woman who performs all functions. (A man would not be an acceptible midwife.)

--A village health worker (male or female) plus a midwife, both of whom have family planning and nutrition duties.

--A village health worker, a midwife, and a family planning worker, male or female (or a male-female family planning team), all of whom have nutrition duties.

--A village health worker, a midwife, and a nutrition monitor, all having family planning duties (at least to provide education and motivation).

a. Village Health Worker (VHW)

For a longer discussion of VHW's and the integrated services they can best provide, the reader is referred to a review of the literature by Austin and coworkers (1981). A danger in selecting male VHW's, as found in

Burma, is that they spend up to 80% of their time treating adult aches and pains rather than life-threatening conditions of infants, such as diarrhea. VHW's should be trained in 2 to 4 week training courses conducted in the field, to diagnose and counteract the effects of the most prevalent and debilitating illnesses. Illness conditions and medicines that VHW's use to treat these conditions may include the following (Austin et al., 1981):

Diarrhea - packets of glucose electrolyte, or baking soda and potassium chloride (to add to local sugar and salt), or simple salt-sugar solution

Fever/Pain - aspirin

Infections - sulfanomides and/or penicillin or ampicillin

Worm Infestation - piperazine (round, pin, thread)--liquid form often easier, especially for preschoolers; thabendazole (hook)

Vitamin/Mineral Deficiencies - iron
folic acid
vitamin A
iodine

Malaria - pyremethamin (for pregnant women and preschoolers), chloroquine (for fever)

Eye Infection - antibiotic eye ointment (tetracycline)

Skin Infection - 1% gentian violet (also for umbilical cord and stump)

Cough - cough medicines do little good, but people expect them. Therefore, they are necessary to maintain credibility.

Although literacy is a desirable prerequisite, illiterate workers can dispense simple medicines and treat wounds using pictorial symbols and color-coded containers. Illiterate workers have been found to provide excellent services in areas where literates could not be recruited (Zeitlin, 1981). Training is of a practical nature and regular retraining sessions should take place on the job. Two-way communication is essential (Pyle, 1979; Gwatkin et al., 1979; Taylor et al., under review). Programs with lowest drop-out rates for workers use mature community residents selected and paid or recompensed by the community, or recompensed by the community in other ways, such as through communal farm labor.

b. The Traditional Midwife

Traditional birth attendants, recruited for training in nutrition and family planning, can improve nutrition practices and birth spacing, especially during pre- and postnatal visits, when the mothers are most receptive to new ideas.

This approach has been successful in rural Malaysia and in the Philippines, where most deliveries take place at home. Among the three types of midwives available to rural Malay women (nurse-midwife, semitrained, and untrained lay midwives), a survey in 1978 disclosed that the untrained lay midwives achieved the "highest level of rapport" with the women interviewed. Forty-five percent of these women also quoted "geographic proximity" as their reason for selecting the untrained midwives who resided within the rural community. The untrained midwives' popularity was based on their wide range of traditional services (83% of the interviewees cited this reason), such as "washing dirty linen or clothes." Only 28% of the rural women interviewed wanted the "modern and safe services" provided by the trained midwives, unless they happened to live in close proximity (18% gave distance as the reason)(Chen, 1976, 1978).

A three-year study on the role of traditional birth attendants conducted in the Philippines (1971-1974) disclosed similar findings: 76% of deliveries took place at home; at least 50% of total births were attended by local lay midwives (hilots); and rapport and geographic closeness were major determinants in the preference of hilots over trained personnel. Because of their great popularity, 482 hilots were given a 5 - 8 day training course in pre- and postnatal care. It was demonstrated that hilots, given suitable training in maternal and child health care and family planning can, with adequate supervision, provide decent care and can encourage family planning through appropriate birth spacing (Del Mundo, 1975).

Rapport with and proximity to the local health worker are critical. They are primary determinants in the increased acceptance of nutrition and family planning services or concepts. Training auxiliary health workers can be useful in the expansion of MCH services. The Lampang Health Development Project was started in 1974 in rural Thailand by its Ministry of Public Health in order to improve peripheral level service delivery (see Health Based Programs). This was accomplished by making extensive use of traditional lay midwives, together with focus on MCH, family planning and nutrition (WHO, 1976; Lampang Project Personnel, 1979).

The health care delivery system can sometimes learn from traditional birth attendants and local healers. In Nepal, for example, one health project adopted the tradition of not cutting the umbilical cord immediately at delivery. This procedure decreased the incidence of neonatal tetanus. The rural practice among Gualtemalan midwives (Comadronas) of allowing the cord to pulse and the cord blood to flow into the baby after delivery increases the neonate's iron stores and staves off anemia.

Trained nurses and midwives can also be taught to insert IUD's and/or prescribe oral contraceptives (provided they have a short list of contra-indications). Results have been favorable. In Pakistan, Barbados, and the Republic of Korea, statistics show a low rate of complications (comparable to those for IUD insertions by physicians.

The Bohol project in the Philippines is presented here to illustrate how both trained nurse midwives and trained birth attendants (hilots) work together to improve basic health, nutrition, and family planning practices. It is an MCH-based program relying on trained midwives and trained hilots to deliver primary health services. There is one midwife/45,000 population in the project area. Midwives provide most of the family planning services: insertion of IUD's during home visits, injections of Depo Provera four times a year, and prescription of birth control pills. Condoms and birth control pills are available at no cost to the patient. Midwives also provide sanitation, nutrition, and family planning education in the villages. Trained hilots assist with caring for pregnant women.

A report evaluating progress during a two-year period (April 1975 - September 1977) showed marked improvement in maternal care: deliveries by untrained hilots declined from 16-18% to less than 5%. Eighty-one percent of children under the age of four were seen at least once. The child-immunization campaign had no impact on infant mortality rates. Neonatal tetanus decreased, due to hilot training and to the use of tetanus toxoid inoculations for pregnant women. There was a substantial increase in the rate of contraceptive users: IUD users increased from 369 to 1,927, female sterilizations from 112 to 444, Depo Provera from 0 to 249, and male sterilization from 59 to 313. Data on the pill, condom usage, and rhythm method are less accurate (Williamson, 1979).

In the area of family planning, only 35% of eligible women between the ages of 15 to 44 were reached. The total fertility rate dropped from 6.4 in 1975 to 5.8 in 1977, but this was not due to the influence of the program. Differential results were obtained according to ecological trends in the study area. Age at marriage was a significant factor in the differential fertility rates: by age 20-24, 60% of urban women (Tabilgaran City) had never been married, as compared with less than 20% on the offshore islands. Contraceptive prevalence was highest in Tabilgaran City and lowest on the offshore islands. Malnutrition was more prevalent on the islands (12% severely malnourished children vs. 2% in Tabilgaran City) (Williamson, 1979).

c. <u>The Family Planning Field Worker</u>

The family planning field worker usually is responsible for distribution of contraceptives within the community, follow-up of contraceptive users, recruitment of new acceptors, and referral of problem cases to the family planning clinic. In general, these workers do not treat problems, insert IUD's, or prescribe contraceptives.

Despite a fairly routine role, the family planning worker is trusted in Indonesia, and it has been proposed that she become the interface between the sub-district level and the village level where the community takes over. Family planning workers now also are being trained in nutrition in Indonesia in what may be the most rapidly expanding community nutrition program in the country (Beiby et al., 1979).

In Tunisia, community level family planning aides (aides familiales) have provided primary health care services, including treatment with simple antibiotics, first aid, and nutrition counseling in a number of rural localities. These aides are young women with primary to secondary school education.

d. The Nutrition Monitor

The nutrition monitor is usually a woman, elected by her community. She may have a minimum of schooling. If literate, she weighs babies and instructs mothers in the use of growth charts. Even if non-literate, she provides nutrition education, recognizes early signs of malnutrition and common diseases, and refers more serious cases to local health facilities. In some instances, she distributes supplementary foods and contraceptives. In parts of Bangladesh, the nutrition monitor instructs mothers in the use of oral rehydration techniques. Such home rehydration projects have reduced diarrhea-related morbidity. In Upper Volta (Zeitlin, 1981), nutrition monitors changed weaning habits and virtually eradicated severe malnutrition in the Yako area.

In the Philippines, any young village woman (age 18-25), with primary school education, is eligible to be trained as a Barangay Nutrition Scholar (BNS), provided she is chosen by her peers. In this case, her duties are restricted to nutrition surveillance and education. The BNS was instrumental in the national child weighing campaign, Operation Timbang.

In many developing countries where local people customarily consult indigenous healers, the latter can be recruited for training in health and sanitary practices in addition to diagnosis of malnutrition (with referral when necessary) and its treatment with oral rehydration in mild cases. These indigenous healers also may receive instruction in family planning concepts and can be provided with contraceptives for distribution.

Mothers themselves can be trained as primary care workers. In Indonesia and South Korea women are recruited and trained as village health workers, responsible for preventive services and early detection of disease and malnutrition (Karlin, 1976; Population Council, 1977). The mothers are influential in bringing about behavioral change and in recruiting peers.

E. Health Based Integrated Programs

United Nations Report ST/SOA/Series A/51 (1972) indicated that most countries had begun to integrate family planning into the existing health services by the early 1970's. This trend is reflected in the reogranization of top level government ministries to incorporate integration at the planning level. In the early 1970's, nutrition was not yet incorporated into the development planning of most countries, but certain countries had already started family planning efforts. India, Nepal, the Republic of Korea, Indonesia, and Tunisia are some examples.

India included family planning and maternal child health care under the aegis of the Ministry of Health. This made it possible to add nutrition in the mid-seventies and to expand the program within the framework of the Ministry of Health (UN/ST/SOA Series A/51, 1972). The Integrated Child Development Services Program in India was a spin-off directed at child health and welfare (Ministry of Education and Social Welfare, 1975).

The Republic of Korea included family planning under MCH, which, in turn, came under the responsibility of the Ministry of Health. Thus, from the beginning of the program's inception, family planning was considered an integral part of health care for women and children, primarily through encouragement of birth spacing. Other policies were also adopted to reinforce this concept, such as delaying age of marriage and bringing women into the work force (UN/ST/SOA Series A/51, 1972).

Two broad categories of health based nutrition and family planning combinations can be distinguished. Nutrition and family planning are offered through the existing public health channels or through expanded MCH services. In the first case, emphasis is on improving the health of the entire family; in the second, focus is on the "high risk" group: pregnant and lactating women, and children under five years of age. Prenatal clinics, childbirth and maternity clinics, pediatric clinics, well-baby and MCH clinics, and family planning clinics all represent potential entry points for women into the formal health care delivery system, where nutrition and family planning services have been effectively provided together. Although clinic-based combined programs are not necessarily parts of larger development schemes, they must also have the support of the community, and services must be geared to local customs and to the felt needs of the residents.

At the sub-regional or district level, both the public health based and the MCH based programs operate out of a clinic or health center, staffed by full or part-time physicians, nurses, auxiliary health personnel, and paramedics. The clinic acts as home base and referral center for the village level primary care personnel described in a following section.

1. Health Based Programs

Clinics operating integrated health programs offer a wide range of services. In a recent state of the art survey of low cost health services in the developing world, Karlin found the following services (listed in descending prevalence) in more than 80% of the projects: health education, maternal health, child health, medical/surgical treatment and care, nutrition, environmental sanitation, family planning, specific protection (immunization, prophylactic medicine, etc.), early detection of disease, and diagnosis (Karlin, 1976).

Several models for planning expanded health services have been proposed, but one of the most comprehensive is the Development and Evaluation of Integrated Delivery Systems (DEIDS). In 1973 guidelines were developed to "assist countries to demonstrate that within seven years a health delivery system can be developed to provide services including but not limited to MCH, family planning, and nutrition, which are accessible and acceptable to 2/3 of a target population in predominantly rural areas" (Rice, 1975). The following major components are included:

--use of indigenous health practitioners

--sensitivity to cultural practices and attitudes

--community involvement: for needs assessment and volunteers, and resources such as buildings, local foods

--integrated systems: maximum integration between MCH, family planning, and nutrition programs (different in each country due to varying government structures)

Health education, as well as coordination and timing of services must be incorporated:

--expansion to include agricultural extension, mothercraft, community development, and home economics

--use of non-professional workers: "well-trained auxiliaries, aides and volunteers"

--use of multipurpose workers since trust develops, but avoid overloading them

--training, supervision, emphasis on prevention, outreach and evaluation components

This model is comprehensive but implies a high degree of coordination and management not often found in developing countries. Resources are also problematic. Conceptually, it provides a useful framework for considering integration of services and a useful goal towards which to aim, when working from the bottom-up or the top-down. Training of personnel at all levels in the health delivery system is necessary when adding components: the new orientation and strategy should be clearly understood.

The Miraj project in Maharashtra, India, succeeded in combining preventive and curative services within the existing health infrastructure. At first, the medical officers heading the three primary care centers in the project area received one week of training. The unipurpose workers, who had been responsible for one function such as immunization or water sanitation, followed a six-week training course to become multipurpose workers. Their new tasks included nutrition education, immunization, examination of all children under five years of age, with special attention to the malnourished among this group, provision of "simple medical care" with referral of the severe cases to the primary health care centers, family planning, and yearly examinations of school children.

In this project, expanding services tended to "overload" the auxiliary workers by saddling them with too many responsibilities, actually diluting their effectiveness. Nevertheless, results of the 1976 evaluation were favorable: there was a decrease in infant mortality and a 60% decrease in the incidence in diarrheal disease (Ram, 1977).

Health based integrated services can link family planning with other services important to nutrition. For example, Malaysia, Indonesia, Thailand, The Philippines, and Sri Lanka have integrated nutrition and family planning with parasite control through the village level health services (Aziz and Subbiah, 1977).

In Thailand, the Lampang Health Development Project has incorporated family planning into the health services. To meet the large demand for vasectomies by rural males, the Ministry of Public Health's National Family Planning Project began a nationwide mobile vasectomy program. In Lampang, the responsibility for operating the program was accepted by the Community Health Department of the provincial hospital. Initially, the clinic sessions were confined to vasectomies, but due to heavy response and requests, out-patient curative care, immunizations, nutrition education, and a food supplement program were added.

Outreach is provided by a mobile team, visiting two locations per month. A week in advance of the visit, a Health Educator and a Health Post Volunteer (HPV) inform the villages and motivate people to attend. The mobile staff consists of one or two surgeons from the provincial hospital, and nurses or wechakorn (paraphysicians). Working with the team provides the center staff with on-the-job training.

The mobile clinics are popular and have stimulated interest in local health care activities. The number of vasectomies has also increased. In the first year of operation, the clinics (mobile) performed more than one thousand vasectomies, gave over three thousand immunizations, and treated almost seven thousand as out-patients. Often, the HPV's set a good example by being among the first to seek a vasectomy (Lampang Project Personnel, 1979).

2. Maternal and Child Health (MCH) Based Programs

The expanded MCH program is generally more focused than the integrated health, nutrition, or the family planning program. MCH is considered to be the "interface" between nutrition and fertility regulation. Family planning efforts aimed at increasing birth intervals and limiting family size have numerous proven beneficial effects on children and on mothers (see Chapter 1). Better nutritional practices for infants and children improve their chances of survival and open the door for family planning acceptance. Consequently, nutrition and family planning should be equally important parts of the MCH package (WHO, 1976).

While the target group in expanded MCH projects is more limited than that of the health based programs (i.e., the whole population), it is worth noting that women and children comprise approximately 2/3 of the total population in developing countries and that more than 50% of total deaths usually occur in children under 5 years old.

Expanded MCH services can be more cost-effective than their health based counterparts. The Narangwal Project in India was the first to point this out. The cost of combined nutrition and health care services to children under three was approximately 14 rupees/capita/year, comparing favorably with the per capita cost of primary health care provided by the Department of Health. This study also demonstrated the mutually reinforcing effect of nutrition and women's health and family planning services (Taylor et al., 1976b).

Most expanded MCH programs are variations on the same theme offering services in health care for women children, health and nutrition education, and family planning as a basic core. Staff includes nurses and midwives, and sometimes traditional birth attendants. There is usually one maternity center or clinic in the project area and several smaller MCH posts serving sub-areas. The target population is visited at home by the outreach personnel who are also members of the community. In this way, cases of malnutrition, disease and complications associated with pregnancy or contraception can be detected early and referred to the MCH clinic for treatment.

Karlin and coworkers (1977) found that some type of MCH service was offered by almost all of the projects surveyed, regardless of the orientation. Vaccinations, immunizations, and examinations were the most prevalent child health services offered. The most frequent maternal health services were health education and prenatal care.

Zaire has taken a novel approach. Hostels with cooking facilities are available for expectant mothers, in areas where transportation is a problem. The health-care worker has the opportunity to provide prenatal health and nutrition education and proper delivery supervision (Karlin, 1976).

The Candelaria project, in Cali, Colombia, offered expanded MCH services from 1968-1973. During that period, neonatal tetanus was eliminated, the incidence of diarrheal disease decreased, the overall birth rates decreased due to increased family planning adoption, and the infant mortality rate dropped (Stillman, 1978). Similar results have been found elsewhere.

Few health or MCH based programs have been carefully evaluated. Ten pilot field projects were designed with an evaluation component and have recently been examined by Gwatkin and coworkers (1979). The projects were reviewed for their effect on infant mortality, nutritional status, and general effectiveness. Four out of ten included nutrition and family planning: Etimesgut, Turkey; Narangwal, Punjab, India; Jamkhed, Maharashtra, India; and Kavar, Iran. The authors' conclusion is that the integrated approach is viable despite the dirth of "hard" evidence.

"Taken together, they (the ten projects reviewed) presented a persuasive case that in the hands of able investigators and in populations of up to 60-70,000, infant and child mortality can be reduced by one-third to one-half or more within one to five years, at a cost of under the equivalent of 2% of the per capita incomes, an amount no greater than that currently being allocated to health.... The principal need is to move effectively from pilot project to the larger service program." (Gwatkin et al., 1979) This is not a simple task.

All of the successful projects were community rather than hospital based and relied heavily on paramedical personnel and village health workers for the delivery of the services. The Jamkhed and Narangwal projects included an outreach program delivered by local village women trained in basic health, nutrition, and family planning concepts. The services were well tailored to the communities' individual conditions and needs. The target population was well defined, and the program was addressed to it. Feed-back between the residents, workers, and supervisors was especially effective in Narangwal and provided the basis for new components and growth; communication was bidirectional (Gwatkin et al., 1979).

Despite the success of various pilot and field experiments, not all health/nutrition programs are currently integrated with family planning. Out of the 201 respondents to the HIID survey (Austin et al., 1978), 95% of the nutrition programs were integrated with health. Only 44% of these combined programs included a family planning component.

F. Population Based Programs

Population pressures in parts of the world have motivated governments to adopt policies of fertility reduction. Southeast Asia and India, in particular, have high population to land ratios. West Africa has been a pronatalist region, and the limitation of family size has not been popular there, although birth spacing is an important part of traditional culture.

Family planning efforts have been successful in Indonesia, Thailand, South Korea, Taiwan, and the People's Republic of China, to cite some examples. The infrastructures developed in these largely community based distribution programs serve as frameworks in which nutrition services, sanitation, parasite control, or community development activities can be incorporated.

Two major family planning strategies contribute to reducing family size and fertility rates. Birth spacing requires that the couple practice contraception regularly and implies commitment on their part. The target group is the couple during most of its reproductive cycle. A second approach is permanent: sterilization (tubectomy for women and vasectomy for men). This is more appropriate for couples who have already attained their desired family size.

1. Addition of Nutrition Services Through Population Programs

It became obvious in the early to mid nineteen-seventies that a majority of family planning programs that had been adopted purely for demographic reasons were failing. The number of acceptors had reached a plateau. Supplementary food distribution was tried as a recruitment incentive in India in the hope that the undernourished families would derive combined benefits from both services. Data from South India where food was given to family planning clinic attenders demonstrated that there was no improvement in family planning motivation or nutritional status of pregnant and lactating women. Lack of nutritional improvement was largely due to the fact that the supplements were shared with other members of the family. Lack of success in this case may have reflected problems with program management and with community acceptance rather than inherent lack of feasibility of this approach.

Other problems with the family planning/nutritional supplement type programs in India (Uttar Pradesh) have been noted: optimal composition and quantity of an adequate supplement has not been determined (energy vs. protein, what minerals and vitamins to include, etc.). Distribution channels and high cost also posed problems. The concept has been pursued, however, in Uttar Pradesh and Karnatak States (Tandon, 1975).

Nutrition should be included in family planning services because contraceptives can affect the nutritional status of women. Oral contraceptives have been known to interfere with B6, B12, and folic acid metabolism (Huenemann, 1975). Likewise, anemia can be aggravated or precipitated in iron deficient women using IUD's, since blood loss is often heavier. These interactions point out the need for follow-up visits among contracepting women living under marginal conditions. While IUD's and pills can be inserted or prescribed by nominally trained health workers or midwives, the complications must be detected early. This can be accomplished with adequate supervision by professionals. Complications can be referred to the regional center.

Adding a nutrition component to family planning efforts has only recently been considered. In the United States, Planned Parenthood clinics have begun to investigate the feasibility of including nutrition education with their services. In a recent survey of 92 Planned Parenthood (in the U.S.A.) counselors only 5 reported that infant and child feeding information was available at their clinic, while 27-30 said that some literature on nutrition in contraception and general nutrition was available (Smiciklas-Wright, 1979). In countries with solid community based distribution, like Indonesia, nutrition has been incorporated in family planning programs.

A closer association between nutrition and family planning education is necessary. Messages and educational channels must be properly coordinated with service delivery in order to get the best benefits for the recipients. Educational thrusts should also be aimed at including husbands and older children in the nutritional aspects of family planning so as to prevent tapping of the women's supplements by other members of the family. Men should be encouraged to take a more active part in family planning and child care.

2. Community Based Distribution (CBD)

Community based distribution of family planning supplies and educational materials has been extremely successful in Indonesia and Thailand. Both programs emerged in response to inadequate outreach, personnel, and management at the family planning clinics. In Indonesia, nutrition services are being successfully integrated into the distribution system. Thailand may do so in the future.

A handful of countries, inspired by the Indonesia CBD program attempted similar projects on a pilot scale. None are currently integrated, however. In Egypt, 302 rural villages in the Menoufia Governorate are participating in an integrated system for household level delivery of contraceptives, basic health services, and social welfare services. Nutrition may be added later, when the system is well established (Stillman, 1978).

El Salvador and Argentina (Stillman, 1978) both introduced youth promoters into the CBD programs. The Contx/Technical Support (food and nutrition) program in El Salvador trained 1400 youth leaders to teach principles of good nutrition and health, pre- and post-natal care, community organization, personal and environmental hygiene, care and feeding of children, and responsible parenthood in 280 communities. The project's goal was to improve nutrition among women, infants and children under 5 in rural El Salvador.

Including men in the family planning efforts in Indonesia has improved effectiveness and adoption of contraception. The same is true in Thailand, where contraception was "demystified" and became a component of daily life. Following the success of the family planning program, efforts were coordinated with parasite control, installation of latrines in houses, water purification, immunization, and treatment of malnourished children (d'Agnès, 1979, in: David, H. P., 1980). The Community Based Family Planning Services (CBFPS) began in 1974, and by 1978, 158 districts including 16,236 villages (36% of the country's villages) were reached. Distribution channels include local shopkeepers, farmers, teachers, and housewives. CBFPS Surveys showed that between 1974 and 1976 pregnancy rates had declined by 40%, twice the decrease in the non-CBFPS districts (David, 1980).

G. Integrated Rural Development Programs

"Potentially all the components of basic needs intervention--adequate food consumption, education, health services, suitable water, environmental sanitation, and decent shelter--make significant contributions to the achievement of good health and low levels of mortality" (Kocher and Cash, 1977). The basic needs approach addresses the "deprivation syndrome" by a multifaceted attack, assuming that poverty is caused by a host of economic and social factors. Health is not considered only as an end in itself, but also as an indicator of quality of life in the area. Health services, including nutrition and family planning, provide support for the improvements in other areas, such as agriculture, land reform, income generating programs, education, sanitation, etc.

In the following discussion, integrated rural development is defined to include health, nutrition, and family planning components, along with agricultural extension, income generating activities, and other social sector improvements.

The "grass-roots" approach to community/rural development has been adopted as part of national development schemes in several countries. The People's Republic of China, Taiwan, South Korea, Sri Lanka, Thailand, and Indonesia provide successful examples. They have all been able to improve nutritional status, lower infant mortality and birth rates, and basically to improve "the quality of life" of their citizens in a relatively short period of time, with only a moderate change in gross national product. In the People's Republic of China, Taiwan, and South Korea, land redistribution formed a basic component of the development effort.

The successful reduction in fertility and improvement of nutritional status in these countries have inspired others to adopt integrated rural development schemes. The United Nations Economics and Social Commission for Asia and the Pacific (United Nations, 1977) recommends "the integration of specific development programs and activities such as parasite control or nutrition with family planning." This recommendation has been adopted by the member countries despite their different political, economic and sociocultural climates.

In Thailand, "grass roots" planning occurs at the subdistrict level. Government officials cooperate with elected village headmen to design development plans. These are submitted to the provincial government for approval and then to the Community Development Unit of the Ministry of the Interior. The local units "provide training and education, aid to agriculture, women's and youth's programs, family planning programs, roads and other infrastructure" (United Nations, 1977). This development strategy has high level government support in Thailand.

In South Korea and Indonesia, the community based distribution system providing family planning and nutrition services has become a framework for innovation. Income generating activities, such as chicken cooperatives or small credit schemes, are planned by the community members.

The Government of Sri Lanka launched a multi-disciplinary effort aimed at equalizing social benefits. It included an extensive food distribution system and small farmer development opportunities directed at food self-sufficiency. These have contributed to a decline in infant mortality to under 50/1000 and an improvement in the general nutritional status of the population. The health care system is geared toward improved family health. Combined primary health care, nutrition, and family planning services have been successful in keeping birth rates down and assuring an average life expectancy above 65 (ten years higher than the all-Asian average). Primary education has been extended so that literacy is above 80%, and relatively equally distributed between both sexes (85% for males, 75% for females). These improvements in "quality of life" indices have taken place despite Sri Lanka's only moderate economic growth rate of 1.5-2.0% per year, and its low per capita income of about $120 (Gwatkin, 1978).

While Sri Lanka adopted an integrated approach as part of a larger development policy, India launched the Integrated Child Development Services (ICDS) in response to her large population under age 14 (4/10 of

total population in 1971). In many areas child mortality was 100/1000 (Report of Ministry of Education and Social Welfare--ICDS, Sept. 1978, p. 67). The combined services include supplementary nutrition, immunizations, health check-ups, referral services, health and nutrition education, nonformal education for preschoolers, family planning, and care to expectant and nursing mothers and women aged 15-44 (see same report).

The Chimaltenango Development Project was begun in Guatemala when the high incidence of tuberculosis and high child mortality among Indians were recognized as symptoms of a larger problem: maldistribution of land. Ninety percent of land in Chimaltenango Province was owned by 2% of the population. The plantations were tilled by migrant Indian laborers who left home to work there. A physician, hired to set up health care facilities, instead started a modest project to lend money to small farmers: 86 families borrowed money under a five-year plan at 8% yearly interest in order to purchase 5-acre plots. Some farmers were able to increase corn production "at least four times" (Behrhorst, 1974). Other services were added incrementally at the request of the community.

The average family had 6 to 8 children, and there was an 80-85% prevalence of "moderate" childhood malnutrition. The Community Health Committee selected local people to become family planning motivators and to treat symptoms--they did not make diagnoses. Findings of an evaluation showed that "91% of patients were treated properly" by the local health workers. Supervision was based on class attendance and continuing education (at least three days a month, including examinations). The fee schedule was set by the Community Health Committee (elected by the villagers). Agricultural loans, extension programs, and marketing strategies were offered to "help the people help themselves." Primary health care services were provided as a support infrastructure since it was assumed that infant mortality and morbidity must be reduced before family planning was practiced. No rigorous evaluation of this project has been carried out (Behrhorst, 1974).

Community development projects have had a beneficial effect on the status of women. Women's Cooperatives for making textiles, crafts, pottery, for small animal or food production, bring women together and reinforce health and nutrition-related activities in the community. Discussions about family life and other exchanges are facilitated (Stillman, 1978).

Few descriptions of urban based combination projects are found in the literature. The low income urban family needs basic health improvements desperately. Housing conditions may be crowded and unsanitary, exacerbating health problems. Change from the extended family system in rural areas to a nuclear one in the city leaves young women without the benefit of tradition or of babysitters. Consequently, outreach workers are vital parts of urban service delivery. Services must also be offered at the convenience of working mothers, and nutrition messages geared towards them (i.e., those who must work away from home and cannot breast feed their children during the day).

H. Other Strategies and Service Options

Improving the quality of life by bringing food and development resources and population growth into balance is the ultimate goal of all the service options discussed. Other strategies which focus on the social relationships between the individual and society rather than on the biological relationships contributing to decreasing family size can also attain similar goals.

Income generating activities such as agricultural development and cooperative marketing or manufacturing can be linked to family planning and food efforts. On Bali, Indonesia, for example, the Government Family Planning Board cooperated with local banks to provide credit to pig raising cooperatives started by subvillage family planning groups. In the first year each family planning acceptor received enough credit to buy three pigs which were later sold for profit. Once the principle and interest are payed back, credit may be extended for other related activities, such as raising milk goats and pond culture of fish and frogs.

Policies generating employment for women outside the home tend to postpone the age of marriage and child bearing. The additional income derived by the woman improves her family's economic status. All of these factors correlate with decreasing fertility rates, especially in urban areas where money income is relatively more important to survival than in rural, subsistence areas. Rich (1973) cites Mauritius, Barbados, and the United Arab Republic as countries where extensive female employment contributed to declines in birth rates.

Educated women tend to have better employment opportunities. Education also allows for a more informed attitude towards family size. In Sri Lanka and Kerala (a state in India) birth rates have fallen simultaneously with increases in literacy rates, especially among women (Gwatkin, 1978).

Cottage industries such as light manufacture in South Korea and Taiwan or crafts production in parts of Latin America and Africa generate employment income and access to a more modern life-style, including fewer children and better opportunities for them. Policies directed at helping small farmers improve their agricultural techniques (by appropriate technology that does not require mechanized and expensive inputs) and get access to credit at reasonable rates, also lead to small family sizes in the rural sector.

Incentive and disincentive programs effectively encourage smaller families. Taxation rates can be geared to dissuade parents from having many offspring. Singapore (Rich, 1973) and the People's Republic of China have reduced subsidies to families with more than three children. Such taxation schemes are prejudicial to the nutritional status of children from larger families.

In countries such as India, where old age security has traditionally been provided by a person's children, policies geared towards replacing this by some other system will be effective. Rich (1973) describes one such example. Several tea estates in India have begun providing their female workers with a savings account, in addition to the benefits which they are required to provide by law. A sum of money is deposited by the management for every month that the woman is not pregnant. She can touch this money only at the end of her childbearing years. This fund compensates her for income that she might have received during old age from additional offspring.

I. Constraints to Program Success

It is important to note that, given the basic inefficiencies within each of the three sectors involved--health, population, and nutrition --there is no guarantee in any given country that an integrated program can be efficiently run on a nation-wide scale.

The success of all integrated schemes will be limited by two major factors or constraints. The first of these is management capability. The second is commitment to provide real services to the target group, or in a deeper sense to social equity. While it is not possible to pull a percentage figure out of the air, it is safe to say that in most developing countries the majority of people living in rural areas are untouched by any branches of central or regional government with the exception of the police force and the school system. To expect existing government infrastructures to manage rural programs in a comprehensive and coordinated manner in such circumstances is unrealistic unless strong national program leadership emerges.

Lack of income and access to the means of production may be the most important but unadmitted cause of malnutrition and high mortality. Table 6 from a major hospital in a developing country capital shows that infant mortality drops precipitously to industrialized country levels as per capita income rises to US$42 per month.

Lack of management capability may be an expression of lack of commitment to equity, when it stems from unwillingness to commit resources to project management. Psychologically, the two problems are mutually aggravating. Not infrequently, an elitist ruling class resists listening to the feedback from subordinates or from the target group that would be required for efficient management. The head of an institute for applied psychology that conducts management training for Tunisian business firms states that such inability to make use of information from workers belonging to a lower social class is a major management problem hindering the development of profit making businesses. Health care programs are particularly vulnerable to lack of feedback from lower level workers because

Table 6

Mortality rates by family income
1969 - 74

US Dollars/person/ month	Deaths/1000 livebirths		
	Neonatal	1-11 mos.	1 yr.
< 3	77.4	103.2	180.6
3 - 7	45.0	37.2	82.2
7 - 14	24.4	21.4	45.8
14 - 28	12.7	5.2	17.9
28 - 42	6.2	8.2	14.4
> 42	3.1	9.4	12.5

medical doctors in all cultures have elite status. The ideology of primary health care attempts to give equal respect to the village health worker or, as it has been said, "skinny Hercules." Even the most favorable ideology, however, cannot take the place of elemental management skills.

The success of community based programs often is based on their ability to tie in with local government structures, that may be archaic and unattached to the modern sector, but that do retain a working rapport with the populations they govern. Pilot programs run by outsiders have had few problems working with such structures. Central government personnel, however, who wish to extend these successful pilot projects may face psychological barriers to establishing successful working relationships. Under such circumstances management training programs using group dynamics techniques can both teach management skills and erode class barriers.

The implication of these constraints for program design is that local leadership and political initiative favoring program development are more important success factors than any particular program design format. Where such leadership evolves, it may then be guided by certain design considerations which in turn will be successful only to the extent that they increase rather than decrease the enthusiasm and initiative of national government or voluntary agency personnel who are developing the program. Where no effective local leadership evolves, outside pressure and initiatives probably are valuable in continuing to disseminate development ideas and expectations until the time when local initiative emerges. These outside forces cannot be expected to have large impacts because they are contributing token inputs of resources.

One important design factor is use of community based structures to extend outreach. The second is integration of services. Beyond these two basics, any variety of the programming tactics described in the first sections of this chapter may be highly effective depending on its appeal for local leadership and on the resources available for its development.

1. The Dissemination of Innovation

The third constraint to success is the time lag involved in engineering social change. The factors that favor the dissemination of innovation, or the spread of new behaviors and technologies, have been widely studied (Rogers and Shoemaker, 1971) and have implications for program priorities.

a. The Behavior Change Process

Dietary change and family planning acceptance both depend on the availability of opportunities for learning new, nontraditional behaviors. Both the level of socioeconomic development and the design of program service structures influence the ease, speed, and completeness with which new behaviors are adopted. Traditional cultures change slowly, in part because they lack exposure to modern communications and marketing, and to government service structures designed to educate the public. Traditional cul-

tures also reinforce the status quo by top-down authority systems that place decision-making powers in the hands of elderly guardians of tradition and by relatively unchanging food and medical belief systems that are passed down informally from one generation to the next. Modern industrial societies, at the other extreme, adopt a range of new health, family planning, and nutritional behaviors almost every season as new research results are publicized and taught and new products are marketed.

In both cases, however, the process of learning and accepting new behaviors is similar, although the process goes more rapidly in cultures that are accustomed to changing behavior frequently. Learning and adoption of new techniques almost always follows an S-shaped curve. The better educated, more aware, and economically more fortunate minority change sooner than the majority. At the other extreme a minority of laggards do not change at all or change very late under social pressure and with special assistance (Rogers and Shoemaker, 1971). Zeitlin and Formacion (1981) have reviewed the literature concerning behavior change with special reference to nutrition education integrated with family planning messages.

Three of the major factors influencing the rate of adoption of new practices have design implications for integrated nutrition and family planning programs. These are:

--the need to convince people that it is to their personal advantage to change.

--the need to overcome fears that changes will produce negative effects.

--the need for a practice period to learn the new methods.

Regarding the first two points, the sales task required to convince people that they should change their eating habits or their contraceptive (and sometimes sexual) habits is formidable. The advantages of change may not be immediately obvious and the disadvantages may include increased costs and occasional disastrous side effects. Mothers in traditional communities commonly fear that introduction of new weaning foods will give their infants diarrhea, which frequently does occur and may lead to dehydration and death if improperly managed. Most contraceptive methods involve inconvenience or side effects that touch on intimate aspects of health, sexual satisfaction, or self-image.

To overcome these barriers, the service structure and its personnel must establish a high degree of credibility, a record of providing services or benefits that satisfy perceived needs, a social or political network that reinforces change by social approval, and a communications network providing outreach, education, and promotion. Individual workers should have an authoritative image and be as similar in culture and social class as possible to those they are teaching (Zeitlin and Formacion, 1981).

Fortunately for the integrated program, nutrition, family planning, maternity, and maternal child health services serve the same target group in a sufficiently overlapping manner that credibility established by any one of these services can be used to promote behavior change in all of the other sectors. For example, a feeding program that has established a service record by rehabilitating malnourished children and has won the trust of their mothers will succeed more rapidly in persuading these women to practice contraception than an unfamiliar program. A careful and detailed study of the extent to which adoption of given service components affected the adoption of complementary components at Narangwal will soon be released (Taylor et al., under review).

Credibility and the means of enlisting social and political networks to support program goals can be elusive. Even with ample development time, not every program succeeds in creating structures that mobilize popular support.

Nutrition services or family planning services alone have less leverage for establishing a credible service record than if combined with maternity services. Not all children become malnourished (fortunately!) and not all couples perceive a need for family planning. But all mothers and their babies go through the experience of childbirth. Every birth is a potentially high risk, emotionally charged event--a time when both parents tend to feel vulnerable, and physically and emotionally dependent on the assistance they receive.

For these reasons, prenatal care and delivery services provide an opportunity for the health-nutrition-family planning structure to establish credibility with all families by proving their ability to prevent serious and intimate health risks. When all mothers experience successful deliveries under the care of the health-nutrition-family planning services, behavior change is likely to proceed rapidly. The Cameroon National Nutrition Survey (Government of Cameroon, 1978) found, for example, that children who were born in a modern maternity facility had a lower prevalence of malnutrition during the preschool period than those born without modern services. While many factors may contribute to this finding, it is probable that mothers whose infants were born in modern maternities were subsequently more psychologically receptive to the postnatal and family planning services linked to the maternity facility. The rapid spread of the new behavior of bottle feeding appears to be associated with its promotion by maternity services.

J. Policy and Program Implications

The points mentioned above suggest the desirability of the following strategies:

1. Add complementary program components to the most popular, powerful, and rapidly growing programs in family planning, nutrition, or primary health care. This means looking to see which of several infrastructures has already established credibility, combined with the most rapidly growing

social, political, and communications networks reaching into rural areas and into urban slums. Additional resources given to complete the service package already provided by this infrastructure will probably be more cost effective than the same amounts given to programs operating with fewer of the success factors required for rapid behavior change.

In Indonesia, for example, family planning acceptor clubs already have been established in most of the country's rural villages, whereas nutrition services reach relatively few. The family planning establishment currently is integrating nutrition into its program and is expanding rural nutrition services at a more rapid rate than any other service structure. Family planning also has been a leading force behind the creation of nutrition education materials for country-wide distribution. The investment of nutrition-related resources into family planning has had the further benefit of generating technical assistance for complementary activities by government nutritionists and health educators. In the Philippines, the situation is reversed, with the National Nutrition Council playing a far-reaching role in family planning education.

2. Focus on expanding community based maternity services with integrated nutrition and family planning to the entire population. A strategy of expanding combined maternity care and family planning services was first advocated by Taylor and Berelson (1968) for its potential for achieving behavioral change, noted above, and for other previously noted reasons summarized below. This strategy was elaborated into Guidelines by the Population Council (1973) but was difficult to implement before the development of community based primary care services.

The importance of monitoring the prenatal nutrition of the mother and the postnatal nutrition of the infant through the first two years of life were noted in Chapter 1, and also support a focus on improving and expanding maternity and postnatal services. Similarly, the need for initiating breastfeeding immediately after childbirth and for fostering parent-infant bonding, noted in Chapters 1 and 2, requires the restructuring of maternity procedures.

The postnatal period also is critical for reasons pertaining to the behavior change process. The need for a practice period to learn new behaviors applies both to infant feeding and to contraception. New practices generally cannot be learned in one trial. Complicated procedures, such as making bean curd, for example, or preparing infant formula and sterilizing baby bottles, are best learned by repeated practice with supervision (although formula feeding need not be taught in most cases, it is of critical importance to teach it to caretakers of infants that cannot be breastfed). Contraception, obviously, is too private to be supervised by outsiders. Nonetheless, a trial and learning period is needed to develop the habit of using contraceptives.

The learners need positive reinforcement during the practice period. One kind of reinforcement is constructive feedback, including social approval, and the opportunity to discuss side effects and other problems

with a health worker or a learning group. Another essential kind of reinforcement is experiencing the successful outcome of the new procedure. The mother must observe that weaning foods make her child gain weight and remain healthy. The couple must succeed in preventing conception.

Masnick (1979) has pointed out that contraceptive procedures and communications skills between husband and wife must be learned before contraceptive practices such as the pill or the use of condoms and foam, for example, will be successful. As noted in Chapter 1, the most fertile couples tend to be lost to family planning programs because they have no learning time. One mistake, and the woman is pregnant again. Masnick concluded that one key to success is the ability to reach the highly fecund woman immediately after childbirth before she resumes full fecundability. This implies that the high impact time periods for learning infant feeding and contraception are the same.

The fact that one of the best periods for learning contraception coincides with the postnatal interval when the infant should be seen frequently by the health services implies the need to institute contraceptive practices as soon after childbirth as possible, in order to give a protected time period for learning contraceptive use by trial and error without risking pregnancy. (The mechanisms by which breastfeeding delays conception were discussed in detail in the first chapter.)

It also implies that MCH, well-baby, surveillance, and nutrition education activities should be used to teach and reinforce family planning practices, and vice versa. The group solidarity created in the nutrition education class should reinforce family planning and provide the intimacy to discuss side effects and inconveniences of contraception. Similarly, the rapport between the individual worker providing well-baby surveillance and the mother should make it possible to discuss contraceptive practices and problems openly.

Frequent clinic or home visits are not easy to arrange or to justify during most periods of the life cycle. The postnatal period brings the mother frequently in contact with the health services. These contacts combined with postpartum amenorrhea create an ideal environment for learning contraception.

3. Assign responsibility for supervision of maternity services to a senior female primary health care worker. If maternity services are to play the lead role in the expansion of primary health care, the village level worker responsible for these services must be senior and must command respect in the community. Because of her midwifery duties this person must be a woman. She must be able to monitor maternal nutrition, weigh newborns, teach infant nutrition and provide family planning services. This worker will ideally be a literate married woman, aged 30 to 50. In order to gain community respect, she must be empowered to provide basic curative care, using simple antibiotics.

This person may be a retrained traditional birth attendant (TBA) or midwife, if the TBA's role can be redefined within the culture in a manner

that commands sufficient respect. In many cultures TBA's are postmenopausal women of advanced age and humble status who do little beyond catching the baby and cutting the cord. In some cultures TBA's are of low status because birth, like menstruation, is considered to be unclean. In such cases, if the TBA role cannot be redefined, a younger, higher status and literate female village health worker may be put in charge of supervising the lesser trained TBA's.

This lead worker for maternity services may also serve the entire community as a village health worker for all sexes and age groups. In societies with strict sexual segregation, as in some Moslem countries, she will be more effective working with a male counterpart. This is the case in Pakistan, where a man-woman team provides primary health care.

4. Develop systematic entry points for service integration. Integration of family planning and nutrition services into the MCH prenatal, maternity, and postnatal cycle has been found to benefit from systematic planning. The Narangwal Project in India (Rural Health Research Center, 1971-72) developed a system of "entry points" or obligatory occasions on which family planning advice must always be given. Eight such entry points and the manner in which family planning, health, and nutrition were integrated on each occasion are listed below (ibid.):

1) Routine Fertility Survey of non-pregnant menstruating eligible women in the community (according to F.P. profile--see below).
2) Confirmation of pregnancy visit.
3) Post abortion examination visit.
4) 36th Week antenatal examination by F.H.W. and F.H.S. together.
5) 14th Day postpartum examination (the topic of F.P. should be avoided before the ceremony on the 8th to the 14th day has been accomplished).
6) 6th Week postpartum examination.
7) Lactation: 7th month visit (re-establishment of menses).
8) Lactation: 9th to 10th month visit (weaning).

On the above occasions F.P. advice is not given on its own but integrated with other components of M.C.H. care as follows:

1) F.P. is given combined with enquiry about general health and menstruation at the time of Fertility Survey.
2) F.P. is given combined with 1st and 4th visit antenatal care examination at the confirmation of pregnancy visit, and 36th week visit.
3) F.P. is given combined with post-abortion care at post-abortion visit.

4) F.P. is given combined with postpartum and neonatal examination, as well as small pox and B.C.G. vaccination at the 14th day postnatal visit.

5) Postnatal examination is given as well as F.P. combined with feeding advice, weight of baby and well-baby check at the 6th week postpartum visit.

6) F.P. advice is given combined with dietary advice, well-baby check and weighing at the 7th and 9th month postpartum visit.

Appropriate spaces were marked for these entry points on the patients' fertility-cum-obstetric record card. Field workers were required to tick these spaces whenever the entry point was used. While different program structures would lead to slightly different entry points, a strategy of clearly defining such points for the field workers' benefit and insisting on their use would appear to be important to effective integrated education.

Chapter 4 Summary of Policy and Program Design Recommendations

The relationships linking nutrition and population growth in the three domains discussed in this report yield a coherent set of policy and program design implications. Up to this point we have interspersed policy guidelines throughout the text as they arose logically from varying lines of investigation. The purpose of this chapter is to bring these guidelines together in summary form.

Three levels of recommendations derive from our review of the literature. These levels in order of increasing specificity are: policy, program design, and educational content. A given policy may be expressed in a variety of programs and in market interventions that require little or no program infrastructure. Within programs, some designs are more effective than others. At the household level, both family planning and nutritional change depend on personal behavior and on the knowledge and attitudes that shape individual choices. Programs may influence household decision-making through education.

The following sections summarize conclusions at the policy, program, and educational level in outline form. A brief statement of rationale follows each policy recommendation.

A. Summary of Policy Recommendations

We conclude that the policies listed below are important for achieving family planning and nutrition goals. The evidence reviewed in this volume suggests that these policies are not merely desirable but that they are critical for preventing population growth from increasing faster than food supply. Although Malthusian disaster is not expected on a global level, it already exists in localized forms in the world's poorest regions. In these areas nutrition goals simply cannot be achieved without simultaneously reducing family size. The psychosocial interactions between nutrition and fertility discussed in Chapter 2 make it evident that nutritional improvement combined with family planning accelerates the critical transition to small family size.

The first four of the following policies relate directly to nutrition, family planning, and health. The interactions reviewed in Chapters 1 through 3 indicate that these policies can be expected to have direct impacts on family size and on nutritional status. The remaining six policies concern other development and social welfare objectives that are not directly linked to family size or to nutrition. The social forces linking these measures of development to nutrition and to family size are well documented. In empirical studies, these socioeconomic indicators frequently explain more of the variance both in family size and in nutritional status than is attributable to nutrition and family planning variables. Thus the evidence indicates that these policies also are instrumental in achieving goals of small family size and good nutrition.

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1. Integration of family planning with nutritional assistance programs

Rationale: Those groups most in need of nutritional assistance have insufficient opportunities to participate in the mainstream of economic development. For this reason they are not adequately exposed to modern influences and market forces that are associated with reductions in family size. These groups are particularly vulnerable to excessive population growth, which may be aggravated by interventions that improve nutrition.

2. Priority focus on community level MCH programs that integrate family planning and nutrition with primary health care, and on mass media education coordinated with these programs

Rationale: These programs represent the only approach that has been proven without a doubt to be effective in simultaneously reducing mortality, improving nutrition, and increasing family planning acceptance. The village level primary health care approach has been most effective in countries with equitable resource distribution. Primary health care programs, by definition, increase the equity of distribution of modern sector health care. Perhaps for this reason they also have had an impressive impact in countries in which other major resources, such as land and income, remain inequitably distributed.

3. Promotion of breastfeeding

Rationale: Lactation amenorrhea is still the major factor contributing to healthful birth spacing in developing countries. Mortality rates of breastfed infants also are lower than rates among bottle fed babies. In part because of commercial promotion, bottle feeding has been replacing breast feeding in urban areas throughout the world. Vigorous policies favoring breastfeeding are needed to counteract this trend. Lower income urban women who need to work may not be able to adequately breast-feed their infants unless employers are motivated to provide day care and nursing breaks.

4. Promotion of the two child family, under most circumstances

This policy should be expressed in a variety of ways, including: mass media and face-to-face educational campaigns, incentives for accepting family planning, and incentives for delaying the age of marriage. Disincentives may also be effective.

Rationale: Several separate lines of reasoning lead to this conclusion:

a. Large family size is strongly associated with malnutrition and with low quality intellectual development.

b. Average family size of more than two or three children leads to rapid population growth as soon as mortality falls to acceptable levels.

c. The fact that a country is relatively underpopulated doesn't mean that food production can expand to meet the needs of a growing population in the short term. The underpopulated countries of West Africa, for example, currently use agricultural methods that yield only about half as much per acre as farming techniques employed in Asia. Low yielding technologies, such as slash-and-burn agriculture, destroy the soil if they are practiced intensively in order to feed more people. Over the past 15 years, per capita food production has been decreasing steadily in most African countries. Although population growth may eventually be appropriate in these countries (and will occur even during the development of successful family planning programs), it is important in the short term to keep population growth proportionate to the expansion of new agricultural technology.

5. Social welfare policies favoring the elderly

Rationale: A common reason for large family size is to guarantee the presence of children to care for their parents in old age. As the elderly become less dependent on their children for care, such an insurance strategy of childbearing becomes less necessary. The elderly as a group also are particularly vulnerable to malnutrition as the fabric of the extended family breaks down with urbanization. These policies must be structured to safeguard the dignity of the elderly.

6. Expansion of free and compulsory education for both sexes

Rationale: A higher level of education is correlated with lower fertility and with better nutritional status independently of income. Increasing years of education decreases the financial profitability of large family size to the parents since children do not contribute to family income while they are still in school. Prolonged schooling delays the age of marriage and childbearing, increases aspirations for a modern sector small family life style, and improves ability to make nutritional choices.

7. Increasing income earning opportunities for women

Rationale: Two separate lines of evidence support this recommendation:

a. Mortality and malnutrition rates of girl infants are extremely high in countries in which women are denied access to most forms of paid employment. Under these circumstances investment in female children is relatively unprofitable because girls do not contribute to family income and often require expenditure for a dowry for their marriage. The family with several girls may have to extend childbearing in order to produce sons.

b. Employed women bear fewer children. Their time is more profitably invested in work than in child rearing. Difficulties in securing child care and in carrying the burden of both productive and reproductive labor motivate them to reduce family size. They also are less dependent on their children for their status in society. Employed women frequently can afford to spend more on food for their children, although this is a benefit only if child care is adequate.

8. Modernization of the countryside

Rationale: a. Adoption of modern sector aspirations plays a key role in influencing families to change their style of investment in childbearing. As families begin to wish their children to compete for entry into modern sector occupations, they limit family size and invest more in each child. This higher level of individual investment leads to better nutrition and health status. Modern housing and consumer goods also cost so much more than traditional amenities that families are induced to limit family size in order to invest in items denoting modern status.

b. Modernization of rural areas requires decentralization of industry, infrastructure, and services. Greater access to modern employment and services favors small family size by reducing dependency on the extended family network. So long as the extended family practicing subsistence agriculture remains the main unit of production and social services, large family size and a low level of nutritional investment in the individual child will remain profitable.

9. Expansion of new agricultural technology

In most cases such improved technology need not and should not be capital intensive. It should be appropriate to the locale and should be

integrated with traditional methods. New technology must be equally available to both women and men since women bear most of the responsibility for agriculture in many regions. Women often also are responsible for producing food for their children.

Rationale: New technology increases food production and plays a major role in modernizing the countryside. Adoption of any one form of innovation increases the rate at which other new practices will be accepted by villagers.

10. Equitable income distribution

In order of importance, this policy recommendation should be placed first. We have placed it last because it is least subject to change through the efforts of technical assistance agencies.

Rationale: It is generally agreed that in many locations malnutrition exists not because of inherent lack of food or inability of the earth to produce sufficient food but rather because of inequities of distribution of food stemming primarily from unequal distribution of income and of land and technological inputs required for food production. Countries with equitable income distribution also have been able to rapidly control population growth because the entire population has had access to the market forces that are associated with reduced family size and with increasing economic development.

B. Summary of Program Design Recommendations

Our recommendations for program design concern only those programs that have either family planning or nutrition components. Although other programs, such as land distribution or free and compulsory education for girls, may have more impact on both fertility and nutrition than family planning and nutrition programs per se, they do not fall within the scope of our study. Much of this section concerns the design of the MCH component of primary health care, since this program component is expected to provide the majority of family planning and nutrition services to the majority of the population.

1. Focus on improving the most popular, powerful, and rapidly expanding programs in family planning, nutrition, or primary health care by adding missing components

Rationale: Both family planning and nutritional improvement depend on change in deeply rooted personal behaviors. Such changes may be perceived as involving a risk of negative outcome or of lack of satisfaction. Popular programs, particularly those with charismatic leadership, achieve a level of trust that enables rapid personal change to occur. Less popular programs may make little or no dent in sexual and dietary habits, no matter how long they con-

tinue. Small, well-trusted programs that serve only a few and are not expanding also will make little impact on the overall problem. For these reasons it is important to build on the credibility and the infrastructure already established by the most dynamically expanding programs, although these programs may not be ideal in all aspects (no program ever is perfect). Dynamic outreach should be considered to be more important than relatively minor details of program design or philosophy.

2. Priority focus on improving and expanding village level maternity services to achieve complete population coverage

This is an extension of the Taylor-Berelson approach to the primary health care level.

Rationale: Several lines of reasoning lead to this major recommendation:

a. Childbirth is the one occasion or "window" through which all mothers and infants come into contact with health care providers for normal preventive services. With the exception of the time of birth, many families do not spontaneously seek health care unless a family member is seriously ill. Many families never spontaneously seek family planning or nutrition services. A strategy of adding nutrition, family planning, and primary health care components to maternity services takes advantage of the spontaneous demand for maternity care to disseminate important services for which demand is not well developed. Thus this strategy has maximum potential for reaching the entire at-risk population.

b. Every birth is a potentially high risk, emotionally charged event--a time when both parents feel vulnerable and physically and emotionally dependent on the assistance they receive. Delivery services provide an opportunity for the health-nutrition-family planning program to establish trust and credibility by preventing serious and intimate health risks. New mothers and fathers are particularly likely to follow the advice on infant feeding and on family planning that they receive from the maternity services (a fact well-understood by the infant formula companies).

c. Maternal malnutrition during pregnancy is the major cause of low birthweight and prematurity, which lead to high death rates in the neonatal period. Low birthweight infants tend to be disadvantaged for life in their physical and intellectual development. They

also are much more likely than normal weight infants to become malnourished at the weaning period. Maternity services can prevent low birthweight by identifying malnourished pregnant women and giving them special counseling and surveillance, with dietary supplements where appropriate.

d. The establishment of breastfeeding should begin at the moment of delivery. The child should be put to the breast immediately after birth and breastfed on demand without other supplements of any kind. It is inefficient to start the promotion of breastfeeding later in infancy after poor feeding habits and incorrect beliefs already have been established.

e. Maternal-infant bonding should occur at the time the child is put to the breast immediately after birth. This bonding can only occur if the maternity services provide a supportive environment.

f. Identification of high risk infants at birth enables the health delivery system to closely monitor the growth of these children to prevent them from becoming malnourished.

3. Giving responsibility for supervision of maternity services to a senior female village health worker

Ideally, this worker will be a literate, married woman aged 30 to 50. In order to gain community respect, she must be empowered to provide basic curative care, using simple antibiotics. She may be a retrained traditional birth attendant, or a traditional midwife, if this individual's role can be redefined within the culture in a manner that commands sufficient respect. In societies with strict sexual segregation, she will be more effective working with a male counterpart.

Retraining traditional birth attendants for the lead role will not be effective strategy unless the TBA commands respect within the community. In many cultures TBA's are elderly women of humble status who do little beyond catching the baby and cutting the cord. In other cultures, TBA's are of low social status because birth, like menstruation, is considered to be unclean.

Rationale: If maternity services are to play the lead role in the expansion of primary health care, the village level worker responsible for these services must be senior and must command respect in the community. Because of her duties as a midwife and as a supervisor of traditional birth attendants, this person must be a woman. She must be able to monitor maternal nutrition, weigh newborns, teach infant nutrition, and provide family planning services.

4. Restructuring prenatal care to include nutrition surveillance and family planning education

See Chapter 1.A.1.c. for a discussion of the design of prenatal nutrition surveillance programs.

Rationale: Prenatal nutrition surveillance targeted to at-risk women can reduce the incidence of prematurity and low birthweight. Pregnant women and their husbands have a personal interest in learning about how the baby is conceived and grows within the mother. This is an ideal opportunity for contraceptive education.

5. Restructuring of maternity procedures to promote breast feeding and maternal-infant bonding

See Chapter 2.F.1.g. for maternity procedures that encourage breast feeding and maternal-infant bonding.

Rationale: Initiation of breastfeeding and bonding occur simultaneously at the time of delivery. Evidence suggests that it is more difficult to recreate the bonding experience at a later time with the same positive effects on the mother-child relationship.

6. Restructuring of postnatal care to combine dietary and growth chart surveillance of the infant with surveillance of contraceptive practices of the parents

See Chapter 1.A.1.c. for the design of postnatal nutrition surveillance and Chapter 3 for postpartum contraceptive programs.

Rationale: The postpartum period is a time when the mother should bring the infant to the care facility regularly for surveillance. It is also a period when lactational amenorrhea provides partial protection from pregnancy. This gives parents the opportunity to learn to practice contraception at a time when they are in regular contact with the health staff to help them cope with side effects, fears, or inconveniences and when they have the latitude to make mistakes without immediately becoming pregnant.

7. Restructuring of integrated programs to encourage modern sector aspirations, investment in the individual child, and nucleation of the family structure

See Chapter 2.F.1.d. to f. for a discussion of program design characteristics that favor these social changes.

Rationale: All of these changes favor reduced family size and improved nutritional status of individual family members. (The term modern should be defined to correspond to the country's ideological approach to development.)

8. Introduction of integrated services into day care centers and into programs designed to provide income generating employment for women

Rationale: Working women are particularly receptive to family planning. Their infants and preschool children are vulnerable to malnutrition if particular care is not given to the diets they receive while separated from their mothers.

9. Creation of subsidized nutrition and health care services for the elderly

Rationale: A common reason for bearing a large number of children is to provide old age insurance. As some of the care of the elderly passes into the domain of public services, this pressure is reduced. The elderly in urban areas, removed from the extended family structure, are particularly susceptible to malnutrition.

C. Summary of Educational Content

The educational themes listed below lead to behaviors that benefit both family planning and nutritional goals. These themes are based on the biological relationships that hold true in all cultures and under almost all circumstances. The word "themes" is used in this context to refer to a general statement such as "eat protein foods." In this general form, the theme usually is not yet a "message," or a useful piece of advice, because it is not specific enough. "Themes" are the starting point for creating "messages" that differ in different cultures and locations. The theme, "eat protein foods," might be developed into the message, "eat more inexpensive small fish," in the Philippines and into "drink more buffalo milk" in India, for example. Readers interested in methods for involving communities in developing and pretesting messages or behavioral advice are referred to Zeitlin and Formacion (1981). An excellent set of prototype lessons in nutrition and family planning has been developed by the American Home Economics Association (1977) for use with villagers in developing countries.

Rationale statements applicable to most of the themes that follow already have been noted in the previous sections on policy and program design. Only a few new rationale statements are included below. They are in parentheses following the themes to which they refer. The themes are arranged by target group and followed by a list of suggested channels. The channels are intended to be illustrative rather than all inclusive.

This section on educational content is designed to function as a checklist for individuals who wish to determine whether existing educational programs include information required to make use of nutrition-fertility interactions in order to promote family planning and nutrition

goals. If comparison of this checklist with current programs reveals thematic content that should be introduced into the existing system, care should be taken to introduce this content in all systems at all levels. These levels are: national health policy, medical school, nursing school, other professional and paraprofessional training programs, community worker training, mass media health education, and other programs directly reaching the target groups.

Priority Educational Themes for
Achieving Combined Family Planning and Nutrition Goals

Target Group	Priority Themes (Rationale)	Channels
General public	Family Planning - Nutrition	All mass media.
	One to three children are enough (to ensure survivors under conditions of reduced mortality).	All face-to-face channels related to nutrition, health, or family planning.
	Fewer children result in a better life for the family, including better food (a change in investment strategy in the direction of investing more in each individual family member means an improvement in the family's standard of living).	Schools.
	Children are healthiest when they are spaced at least 3 years apart.	Adult literacy programs.
	Teenaged girls are too young to bear healthy children.	
	Nutrition - Child Survival and Development	All face-to-face MCH channels.
	Pregnant women need increased quantities of good quality food including protein foods and green vegetables in order to produce healthy babies.	Mass media.
	Infants and young children need generous quantities of good quality foods including protein foods, fats and green vegetables in order to grow to be strong and intelligent.	Adult literacy.
	All babies should be breastfed	Schools.

Target Group	Priority Themes (Rationale)	Channels
Pregnant women and their husbands	Maternal Nutrition (Prenatal)	Primary health care workers.
	Start seeing a trained midwife early in pregnancy.	All MCH, ob/gyn, family planning and nutrition departments and agencies.
	Gain at least 10 kg during pregnancy, more if you were thin when you became pregnant.	Teaching materials.
	Take iron pills, or preferably prenatal iron and vitamin supplements.	Special mass media efforts.
	Increase your intake of protein foods and green leafy vegetables or fruits.	Prenatal surveillance.
	Breastfeeding and Bonding	Face-to-face prenatal education.
	Prepare breasts for breastfeeding.	Selective mass media support.
	Colostrum is good for the newborn baby.	
	The baby should be put to the breast as soon after birth as possible and should not receive other foods or drinks.	
	The mother and father should take time to get to know the new baby in privacy immediately after the birth.	
	Family Planning	Prenatal classes for both mothers and fathers.
	Reproduction: how the baby is growing inside the mother, how it is nourished, how it was conceived, how conception can be prevented (this information usually is very popular and helps to motivate mothers to practice good nutrition).	Prenatal counseling.
	Choice of family planning methods for use following childbirth.	

Target Group	Priority Themes (Rationale)	Channels
Mothers and fathers of children from birth to 5 years	Infant Nutrition and Health (Postnatal)	Primary health care workers.
	Breast feed frequently on demand as long as possible. Sleep with the baby at night to make breast feeding easier and to prolong amenorrhea.	All MCH.
	Eat more food and drink 8 glasses of water a day while you are breastfeeding.	Pediatric health, family planning, and nutrition departments and agencies, "under Fives' Clinics," etc.
	Introduce transitional foods starting at about 4 months. (See Chapter 1 for more advice on weaning foods.)	Teaching materials.
	Give oral rehydration during episodes of diarrhea.	Mass media.
	Do not withhold food or liquids during illness.	
	Enroll the baby in a postnatal growth surveillance and immunization program.	
	Take a sick child for treatment promptly before the condition becomes serious.	
	Family Planning	Prenatal and postnatal counseling.
	Start using a family planning method as soon as you resume sexual relations after the birth.	Selective mass media support.
	Check any side effects or other problems with the method with your family planning worker and change methods if you are not satisfied.	
	Do not start a new pregnancy until the child you now have is 2 years old.	

Target Group	Priority Themes (Rationale)	Channels
	Postpartum Sexual Taboo (Mainly in Africa)	Postnatal counseling.
	If the mother has sexual relations, this will not make the baby sick so long as the mother does not become pregnant and stops breastfeeding.	Family planning education to fathers.
	Use contraception and resume sexual relations soon after birth.	Selective mass media support.
	It is better for the father's relationship to the child to resume sexual relations early.	
	Investment	Public policy statements.
	Have fewer children so that you can prepare each child for a successful future.	Mass media, entertainment, role modeling.
	Give them good food, good clothing, and a healthy environment so they will grow up to be strong and intelligent.	Schools, adult literacy.
	Save money for your children's education.	MCH.

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NUTRITION AND POPULATION GROWTH: THE DELICATE BALANCE

2. ANNOTATED BIBLIOGRAPHY OF NUTRITION-FERTILITY INTERACTIONS IN DEVELOPING COUNTRIES

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HARVARD-MIT INTERNATIONAL FOOD AND NUTRTION PROGRAM

MIT INTERNATIONAL POPULATION INITIATIVES PROGRAM

AND

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1. ALGERIA. Tabutin, D. Mortalité Infantile et Juvenile en Algérie du Nord. Population (France) 29(1):41-60, 1974.

After reaching a very high level at the end of the war (1960-62), infant mortality and child mortality dropped sharply following liberation. Between 1963 and 1968 no clear trend was discernible except for a slight decline in urban areas. In 1967-68 the urban IMR was 109 and the rural IMR was 132.

Endogenous deaths (caused by nonviability of the newborn or complications of childbirth) accounted for 25% of infant mortality. In Northern Algeria mortality in the first week was 2.7% and in the first month 5.4%. The age specific mortality curve showed an absolute increase between the tenth and fourteenth months, following the pattern of southern countries with high rates of diarrheal disease interacting with malnutrition. High parity did not significantly increase infant mortality until a birth order of 10 or more. Endogenous mortality was marginally higher for first and second births. It was not possible to establish that a decline in infant mortality exerted any traceable influence on fertility although fertility in Algeria had been consistently rising and infant mortality consistently falling during the preceding 25 years.

2. EGYPT. Abdou, I. A. and Amer, A. K. A Study of the Nutritional Status of Mothers, Infants and Young Children Attending Maternity and Child Health Centres in Cairo. Part II - Dietary Intake and Nutritional Status of Pregnant and Nursing Mothers. Bull Nutr Inst U.A.R. 1(1): 21-37, 1965.

Heights, weights, and dietary intake of pregnant and lactating women were studied among low income families in Cairo in 1957. Average per capita annual income was $95 compared to a national per capita GNP estimated at $112. The largest proportion of families -- about 36% had total monthly incomes of $6 to $9. Average height was about 156 cm (61 inches) or about 9 cm shorter than American women of the same age. Average weights of pregnant women were consistent with normal gains over normal baseline weights for height of American women, with an average 8.5 kg gain at 7.4 months of pregnancy. However, average weights of lactating women were 3.4 kg higher than averages for American women of the same height. Bread alone was the largest source of nutrients for all groups, contributing from 85% of both calories and protein in families with total incomes below $3 per month to about 55% in families with incomes above $15 per month. Broad beans (vicia faba) were the second most common item followed by a large variety of foods that changed seasonally.

Daily dietary intake of pregnant women averaged 2,200 calories and 76.9g total protein (including 11g animal protein). The authors suggest this low caloric intake was sufficient because pregnant women greatly curtailed their activities in order to prevent spontaneous abortion. Lactating women averaged a daily intake of 2,761 calories and 95.4g protein (including 13g animal protein). Diets of both groups supplied no more than 36% of calcium, 50% of vitamin A, 44% of riboflavin and 70% of vitamin C recommended by United States Food and Nutrition Board, National Research Council, Recommended Dietary Allowances for 1958.

3. EGYPT. Abdou, I. A., Lebshtein, A. K., and Kassim, T. A. A Study of the Nutritional Status of Mothers, Infants and Young Children, Attending Maternity and Child Health Centres in Cairo. Part III - Weaning Practices and Supplementary Feeding of Infants and Young Children. Bull Nutr Instit U.A.R. 1(1):39-47, 1965.

All women in this sample of mothers of 0 to 24 months old infants attending MCH centers in Cairo continued breast feeding up to the second year of life. No fixed time schedule for nursing was followed by 84% of mothers. About 70% of infants were weaned abruptly at the end of the 13th month with the application of bitter substances to the nipples. Ensuing pregnancy was the reason for weaning given by 72% of mothers. The protein food most commonly given to infants 12 to 24 months was stewed broad beans (foul medammes, received by 47%) followed by milk products, and most common starches were rice, bread, and potatoes. An analysis of the nutrient content of the weaning diet found it unsatisfactory in quantity and poor in calcium, iron, and vitamins.

4. EGYPT. Abdou Issa, Mahmoud S. Modernization and the Fertility Transition, Egypt, University of Pennsylvania, 1975.

The study indicated that the level of completed marital fertility in Egypt is still high (6.3 live births), with significant regional, rural-urban and socioeconomic status fertility differentials for women under forty years of age. Current marital fertility, however, is evidently under moderate deliberate control in the urban communities which comprise about 45 percent of the total population.

Both desired family size (C_d) and infant and child mortality are negatively correlated with modernization (the level of economic development and cultural change), while potential output of surviving children in the absence of deliberate fertility control (C_n), which is determined by the level of natural fertility and infant and child survival, is positively correlated with modernization. The level of motivation as measured by the difference between potential and desired fertility (C_n-C_d) and the extent of contraceptive use by both directly correlated with modernization.

The observed regional fertility differentials are consistent with the interpretations of Easterlin's 'synthesis' framework for social and economic determinants of marital fertility.

5. EGYPT. El-Minawi, M. F. and Foda, M. S. Postpartum Lactation Amenorrhea. Am J Obstet Gynecol 111(1):17-21, 1971.

Among 145 nursing mothers chosen at random, 86 were in the period of postpartum lactation amenorrhea, an incidence of 59.3 percent. The duration of amenorrhea ranged between 6 weeks and 26 months, and its incidence was higher among the fully breast-feeding mothers. A low pregnancy rate of 4.3 percent was observed among 139 postpartum lactational amenorrheic periods. Prolonged postpartum lactation amenorrhea was associated with uterine hyperinvolution. Postpartum lactation amenorrhea confers a substantial degree of infertility, as evidenced by the predominant anovular endometrial pattern of 96.1 percent of the women. The endometrial specimens obtained after one year of postpartum lactation amenorrhea present a triad of: (1) cystic dilatation of endometrial glands, (2) arterial hyalinosis, and (3) plasma cell infiltration of the stroma. Nursing mothers who experienced relatively long or short periods of postpartum lactation amenorrhea in connection with one baby tended to repeat the same pattern with a subsequent baby; the authors designated this as "habitual postpartum lactation amenorrhea."

6. EGYPT. Hanafy, M. M. et al. Maternal Nutrition and Lactation Performance. Environ Child Health 18(13):187-191, 1972.

An overall nutritional status index of 41 urban moderate to low income Egyptian mothers was constructed from the results of blood, urine, and milk samples. After overnight admission to hospital, 20 ml of foremilk and 20 ml of hind milk were taken from each woman at a 10 a.m. feeding. A test feeding on the 3rd day estimated total milk yield. The mothers were previously classified as healthy (24) or malnourished (17). Caloric intake was adequate, but only 5 mothers in the healthy group had adequate protein intake.

Milk samples from both groups were of suboptimal but acceptable composition. The protein and caloric content of malnourished mothers was lower (15% and 7%) than that of the well nourished group. Malnourished mothers produced 22% less milk. Correlation between nutritional status of the mother and milk volume and content was high (r=0.663).

7. EGYPT. Kamal, I. et al. Clinical, Biochemical, and Experimental Studies on Lactation: I. Lactation Pattern in Egyptian Women. Am J Obstet 105(3):314-323, 1969.

The investigators interviewed 120 Egyptian mothers retrospectively once each at a Health Center concerning their last 3 lactation periods occurring within the previous 5 years. The average age for weaning from the breast was 15.1 months, and for breast milk supplementation, 6 months. Maternal age and age at weaning were positively correlated. One-third of the lactating mothers reported resuming menstruation within 3 months of delivery, two-thirds within 9 months and 87% by 15 months. More than half reported pregnancy during lactation.

8. EGYPT. Kamal, J. et al. Clincial, Biochemical, and Experimental Studies on Lactation: II. Clinical effects of gestagens on lactation. Am J Obstet Gynecol 105(3):324-334, 1969.

In a double blind study, different combinations of gestagens were given to a total of 120 mothers 6 to 10 weeks postpartum divided into four groups (Lyndiol 2.5 mg; Lyndiol 1.0 mg; 0.5 mg Lynestrenol alone; and Deladroxate injections). A fifth group (control) was given a placebo and intrauterine devices. Follow-up continued until weaning. The criteria used in evaluating the effects on lactation were: age at supplementation, subjective impressions of the mothers, amount of milk yield as obtained by mechanical suction and test feeding, feed-to-weight adequacy (i.e., the adequacy of a test feed in relation to baby's weight), infant growth curve, and percentage changes in infant's weight with age. Although 50% of the sample were lost by attrition, and although trends were not clear with regard to some of the criteria, the small dose Lynestrenol pill alone showed the least detrimental effects on lactation compared to the control on a scale combining the 5 criteria, while the high dose pill and injection yielded the worst results. Average amount of milk yield measured by mechanical suction and feed to weight adequacy appeared to be the two most sensitive criteria for measuring adequacy.

9. EGYPT. Lebshtein, A. K. and El Bahay, A. M. The Extent of Breast and Bottle Feeding of Children in Cairo and its Effect on Their Growth. The Journal of the Egyptian Public Health Association 51(5):246-257, 1976.

The extent of breast feeding and bottle feeding was studied on a random sample of 250 non-working and 174 working mothers in Cairo. Breast feeding was practiced by 78.8% of non working and only 5.8% of working mothers. Bottle feeding was adopted by 7.6% of non working and 78.2% of working mothers. Only 13.6% of non working and 16% of working mothers supplemented the diet of their children. The mean body weights and heights were higher in the breast-fed than bottle fed children at all age intervals. But both groups were less than U.S.A. standards after the first six months of age. This growth retardation was attributed to the lack of diet supplementation.

10. EGYPT. Rifaie, M. R. et al. Menarche in Egypt. The Possible Modifying Factors. Ain Shams Med J 27 (3&4):331-338, 1976.

A study of the age of menarche among 1176 school girls in Dakahlia province indicated that the mean age of menarche in Egypt was 13.19±1.03 years, and was significantly higher in rural than in urban areas. Evidence suggested sexual maturation had accelerated since the revolution of 1952. Girls of higher socio-economic status got their period earlier. Late menarche was associated with protein poor diets and parasitic infections. Both parasitic infection and anemia were extremely common. Urinary bilharziasis and intestinal parasites (mainly ascariasis) delayed menarche. Girls with positive intradermal test for schistosomiasis (an estimated 20% of girls at puberty) got their first period about 1.5 years later than the mean. Mean weight of girls with menarche was significantly higher than for those without. Seasonal incidence was highest in summer and spring, lowest in winter and autumn.

11. EGYPT. Rizk, I. A., Stokes, C. S., and Nelson, M. R. The Influence of Individual and Community-Level Child Mortality on Fertility in Egypt. Paper presented at the Annual Meeting of the Population Association of America, 1980.

Variation in individual and community experience with child mortality is related to the reproductive behavior of a sample of rural Egyptian women interviewed in 1978. The influence of child mortality is examined for three dimensions of reproductive behavior: birth intervals, additional children desired, and use of contraception.

Initial differences in birth intervals between women with and without child mortality experience are largely eliminated when appropriate controls are introduced for variations in lactational amenorrhea. This finding is consistent with a growing body of research indicating little behavioral response to child mortality for birth intervals when biological factors are controlled.

In contrast to the findings on birth intervals, individual experience with child mortality is significantly related to the number of additional children desired and to the use of contraception. In addition, community-level child mortality is related to use of contraception. The findings suggest that child mortality does influence reproductive behavior, but the mechanisms through which such effects operate are more complex and less direct than has been assumed.

12. EGYPT. Sallam, A. M. Family Planning in Egypt. Statement, April 26, 1978. In U.S., Congress, House, Select Committee on Population, Population and Development: Status and Trends of Family Planning/ Population Programs in Developing Countries. Vol. 2. Hearings,

April 25-27, 1978. Washington, D. C.: U.S. Government Printing Office, 1978.

In 1953 Egypt established a national commission for population problems. By 1958 the commission had founded 24 experimental family planning centers, 12 in urban areas and 12 in rural areas. In 1962 political leadership in Egypt acknowledged that the high rate of population increase was the biggest obstacle to all efforts for social and economic development. By 1978 urban areas, with 45% of the population, had 1239 centers and rural areas had 2239 centers. Oral contraceptives were the most commonly used method. Both the Egyptian family planning association (EFPA) and the Family Planning and Population Organization have been diversifying their programs. In 1977 the EFPA began a nutrition services project to integrate family planning and nutrition services. This is a 5-year project in selected family planning centers belonging to multi-purpose social welfare voluntary societies.

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13. GAMBIA. McGregor, I. A. et al. The Health of Young Children in a West African (Gambian) Village. Trans R Soc Trop Med Hyg 64(1):48-77, 1970.

This study of all 215 children aged 0 to 5 years in the village of Keneba, rural Gambia, during 1962 to 1963, in an area where about 40% of children had been estimated to die before the age of 7, provides detailed information concerning seasonal patterns of morbidity and growth. The data provide stronger evidence that infection caused malnutrition than that malnutrition was causally related to prevalence of infection or to death. However, the study methodology did not analyze severity of infection, duration or frequency of recurrence of each type of infection per quarter. In Keneba, as in Subsaharan Africa generally, malaria was much more prevalent and severe than in other areas of the developing world.

14. GAMBIA. Thomson, A. M. et al. Body Weight Changes During Pregnancy and Lactation in Rural African (Gambian) Women. Br J Obstet Gynaecol 73:724-733, 1966.

About 73 pregnant women, 62 lactating women, and 14 non-pregnant, non-lactating women living under "bush" conditions in a rural village in The Gambia all tended to lose weight from late July to early October and to recover thereafter. Weight loss appeared related to hard physical work at the height of the agricultural season, combined with scarcity of food. At other times of the year weight was well maintained and pregnant women mostly gained weight.

The total amount of weight gained by pregnant women varied according to the season of birth. For births from mid-February to mid-August the average weight gain was about 12 pounds (5.5 kg), compared to roughly half as much at other times of year. The evidence for seasonal changes in birth weight was not statistically convincing.

Thirty-nine percent of the deliveries studied occurred between mid-November and mid-February, implying that conception had occurred when body weights were highest, from Feruary to May. Similarly, only 11% of conceptions had occurred when body weights were low, from November to February. Apart from seasonal weight loss lactating women did not lose weight, and did appear to produce sufficient milk to sustain normal infant weight gains during the first four months of life. The data showed marginal gains in maternal weight with age and parity.

15. GAMBIA. Thompson, B. and Rahman, A. K. Infant Feeding and Child Care in a West African Village. J Trop Pediatr 13:124-138, 1967.

In a study in 1962-63 of the growth and health of 224 children under 5 years old in Keneba, Gambia, it was found that infants were breast fed for 18-24 months. Sweetened rice water was introduced at 4-5 months with pieces of fruit, mangoes or oranges, when seasonally available. Boiled rice was given at 7 to 8 months plus steamed millet, maize or findo. At 11 months, ground nuts, sauces and fish were added to the diet.

16. GAMBIA. Weil, Peter M. The Staff of Life: Food and Female Fertility in a West African Society. Africa (London) 46(2):182-195, 1976.

The author examines the fertility situation among the Mandinka in Gambia where, as the food production became more a responsibility of females, childbearing increased in importance since children were a source of farm labor.

17. GHANA. Bleek, W. Spacing of Children, Sexual Abstinence and Breast-Feeding in Rural Ghana. Soc Sci Med 10(5):225-230, 1976.

18. GHANA. Gaisie, S. K. Levels and Patterns of Infant and Child Mortality in Ghana. Demography 12:21-34, 1975.

This paper attempts to measure infant and child mortality levels and also to determine their structure by utilizing the results of the 1968-1969 National Demographic Sample Survey which was conducted under the directorship of the author. Among the major problems encountered in the exercise are the adjustment of the current raw mortality data and the estimation of infant and child mortality from independent source material. The estimated infant mortality rates range from 56 per 1,000 live births in the Accra Capital District to 192 in the Upper Region during the late 1960's. The urban rate was 98 compared to 161 for rural areas.

A large proportion of the deaths among children aged 0-4 occur in the second year of life, and deaths in this age group account for the bulk of the deaths within the age group 1-4 years.

19. GHANA. Orraca-Tetteh, R. Effects of rapid growth in Ghana on nutritional needs, in Ghanaian Pop. Studies No. 3. pp. 57-68, 1970.

The author provides evidence that food production in Ghana did not keep pace with population growth from 1963 to 1968 and discusses the resulting nutritional problems. Nutrient adequacy was found to decrease with increasing family size as shown in the following table:

EXPENDITURE AND NUTRIENT INTAKE IN RELATION TO HOUSEHOLD SIZE
JAMES TOWN, ACCRA, GHANA, AUGUST 1967

Family Consumer Size	Total Expenditure per head per month N¢	Food Expenditure per head per month N¢	% Spent on Food	% Calories and Protein Requirement	
				Calories	Protein
1	78.00	8.00	10	101	153
2	9.11	7.05	82	81	140
3	15.59	9.00	57	90	72
4	30.25	8.00	26	71	106
4	43.75	5.00	11	79	108
6	17.05	6.07	36	67	73
7	12.43	3.00	24	72	114
8	12.48	8.00	64	59	84
10	8.66	6.00	69	82	108
14	7.60	5.00	66	73	72

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20. NIGER. Faulkingham, R. H. and Thorbahn, P. F. Population Dynamics and Drought: A Village in Niger. Popul Stud 29(3):463-478, 1975.

The paper reports the results of demographic research in a rural village of about 1500 Hausa-speaking farmers in southern Niger, during the winter of 1973-74. The research site lies at the heart of the Sahel-sudanic zone just to the south of the Sahara, where drought, and in some areas, famine have exacted a heavy human, animal, and economic toll since 1968. The study was designed to measure and explain the change in the size and structure of the population during the years 1969-73. Social anthropological field techniques were used to ensure full and accurate reporting by community residents on all census topics. Data on rainfall and crop yields, on health and sanitary conditions, and on the political economy, social organization, and culture of the village were gathered in order to interpret the demographic situation.

The analysis of this data yields the following conclusions:

1. The population of the village appears younger (mean age: 15 years) and growing faster (mean doubling time: 23 years) than reported for Niger as a whole in 1972.

2. Contrary to what the researchers expected, the crude death rate, while relatively high to begin with, actually declined during the drought period (mean: 14·81); the crude birth rate remained very high (mean: 46·01), and the crude rate of increase rose from 1969 to 1973.

3. There was virtually no family out-migration from the target village during the drought, although the number of adult males participating in seasonal migrations to large West African towns rose from 35% in 1969-70 to 75% in 1973-74.

4. Problems of food production and distribution were acute, but thanks to the availability of donated foods, these were sufficiently short-lived during this drought cycle to make no discernible impact on population, although prolonged protein/calorie malnutrition among the very young may affect future fecundity.

21. NIGERIA. Adelusi, B. and Ladipo, O. A. Preterm and Other Babies with Low Birthweights in Ibadan. Trop Geogr Med 28:316-322, 1976.

This study of birthweights in Ibadan, Nigeria produced evidence that low socioeconomic level, rather than peculiarities of geographical location or race, accounted for a high percentage of low birthweight babies. Various other factors associated with low birthweight babies in Ibadan, such as maternal anemia, were also highlighted.

The following table shows the incidence of low birthweight by socioeconomic class.

Socio-economic class	Total mothers		Total deliveries		Premature		Dysmature		Total low birth-weight		Incidence of low birthweights
	No	%	No	%	No	%	No	%	No	%	%
Upper	150	12.6	154	11.9	12	6.6	12	8.6	24	7.5	15.6
Middle	368	30.8	395	30.6	49	26.9	46	33.1	95	29.6	24.1
Lower	675	56.6	741	57.5	121	66.5	81	58.3	202	62.9	27.3
Total	1193		1290		182		139		321		24.9

Difference in overall incidence of low birthweights by class $X^2 = 9.51$ $P<0.001$

22. NIGERIA. Caldwell, J. C. The Economic Rationality of High Fertility: An Investigation Illustrated with Nigerian Survey Data. Popul Stud 31(1):5-27, 1977.

The author demonstrates that high fertility is rational in Nigeria and in Ghana by presenting results of studies measuring children's activities, parents' feelings about the balance of cost and return on children and all money flows between parents and children. Around age 5, children's imitative play gives way to activities that relieve others of work. The amount of money that a child is said to remit to parents averages 10% of both father's income and household income. This monetary return probably is understood. Moreover,non-monetary returns (in goods) may well outweigh the monetary ones. Children also provide security against disaster and in old age. Only 6% of farming families agreed that "children use up wealth," versus 25% of white collar workers in the larger urban areas. Changes in life style and values that make high fertility unprofitable are slowly occuring. With the adoption of the nuclear family, the direction of lifetime net flow of money now is from parent to child. The system in which honor was derived by activities and generosity within the local community is now being replaced by one in which the proudest achievements are performed in the wider community and are marked by examination results, appointments to new occupational positions, the achievement of high salaries, features in the press, and so on.

23. NIGERIA. Caldwell, J. C. and Caldwell, P. The role of marital sexual abstinence in determining fertility: a study of the Yoruba in Nigeria. Popul Stud 31:193-217, 1977.

This study draws on 1973 to 1975 data from five probability sample surveys of Yoruba women (2 studies also included men) in Nigeria having a total sample

size of 9,261. Postpartum abstinence that frequently lasted 6 months longer than lactation was the main control on fertility, which was estimated at 7 births per woman. In rural areas lactation continued longer than abstinence only for 5% of surviving children. The Yoruba believe that semen enters into and poisons breast milk and that the mother needs a period of time to recover her health after lactation and before the next pregnancy. By age 40-44 years, more than half of the women had entered the period of terminal abstinence. Three-fourths of those who were grandmothers had terminated sexual activity at this age as compared to one fourth who were not grandmothers. High rates of abstinence were common at all ages even among nonpregnant and nonlactating women and were compatible with a polygynous system in which husbands and wives did not frequently eat or socialize together and rarely slept in the same bed. Only about 15% of women claimed to miss sexual relations during postpartum and terminal abstinence. Measures of modernization, such as education, occupation, monogamous marriage and Christianity, were associated with attachment of greater value to the sexual union, shorter duration of postnatal abstinence and of lactation, and greater use of contraception. In the short term, contraception was not expected to be as effective as abstinence in controling fertility.

24. NIGERIA. Caldwell, J. C. and Igun, A. The Spread of Anti-natal Knowledge and Practice in Nigeria. Popul Stud 24(1):21-34, 1970.

In March/April 1969 the Demographic Training and Research Unit, University of Ife, surveyed 8,400 respondents of both sexes to investigate their knowledge and use of anti-natal practices and the sources of that knowledge. The area sampled was a stratified cross-section of Nigeria extending inland 500 miles from Lagos. Data are analyzed by age cohorts of respondents and by the date of change in knowledge or practice. It is shown that anti-natal knowledge and practice decline with distance from Lagos, that contraception is widely practiced amongst the richer towns and those with a higher proportion of educated people, and to a smaller extent among farmers than restricted knowledge or means would alone indicate. Recently the spread of both knowledge and practice has been faster than could be explained by socioeconomic change and has largely resulted from changing attitudes to anti-natal practice and increased discussion of the subject in the world as a whole. Within Nigeria this has been helped by rising levels of urbanization and education, which are the two major determinants of anti-natal knowledge and practice in the country. The spread of such practice has led to an increased employment of traditional anti-natal methods, but this increase is small compared with the much greater resort now being made to modern contraception and induced abortion. The mass media have been of particular importance in introducing new knowledge, while the spread of such knowledge has owed most to discussions between friends of the same sex.

25. NIGERIA. Caldwell, J. C. and Ware, H. The Evolution of Family Planning in an African City: Ibadan, Nigeria. Popul Stud 31(3):487-508, 1977.

Data drawn from a 1973 probability sample of 6,606 Yoruba females, 15-59 years of age in Ibadan City, Nigeria, are employed to analyze changing family planning practice over time. Usage and method rates are calculated for broad age groups from 1930 to 1973. Contraceptive practice is shown to have increased rapidly during the 1960s and early 1970s, from a very low initial base with a doubling period for the proportion of contraceptors of about four years, so that by 1973 one-sixth of the women had practiced contraception and one-ninth were currently doing so. The major determinant of contraceptive practice is

education. Oral contraceptives and IUDs account for an ever larger proportion of all contraception over time and together made up over 50% by 1973. The Ibadan data give strong support to a suggestion emanating from scattered findings elsewhere that there is a special pattern of sub-Saharan contraceptive use: it begins with use in pre-marital and extra-marital relationships; then is increasingly employed as a substitute for post-marital sexual abstinence, and only later becomes the means for limiting the size of the family. Hence, the success of a family planning programme is indicated by rising average parity among the acceptors. Most couples in Ibadan will probably be practicing contraception at some time in the 1980s, but even then such rates will probably still be low in rural areas.

26. NIGERIA. Goyea, H. S. and Johnson, E. J. Benin City Mothers: Their Beliefs Concerning Infant Feeding and Child Care. Trop Geogr Med 29:130-108, 1977.

One hundred and forty-three mothers living in Benin City, Nigeria, were interviewed concerning their beliefs about child care, nutrition, and their source of information regarding child care. All mothers believed that breast feeding should begin from birth. Eighty-one percent of the mothers believed that breast feeding should be continued for a year or more. However, 58% of the mothers would introduce artificial milk within the first month after birth. Only 19% of the mothers would give breast milk alone for the first three months.

27. NIGERIA. Hauk, H. M. and Tabrah, F. L. Infant Feeding and Growth in Amo Omamma, Nigeria. J Am Diet Assoc 43:327-330, 1963.

Infants in Amo Omamma were commonly breast fed for at least a year, often 18 months or longer. Some solid food was usually given from about 6 months of age. The first food was usually maize pap followed later by yam. Between 6-9 months mashed or prechewed foods were given 1-3 times a day. Infants 10-12 months old were usually given some soup with yam, but some had yam mixed with palm oil only.

28. NIGERIA. Longo, L. D. Sociocultural practices relating to obstetrics and gynecology in a community of West Africa. Am J Obstet Gynecol 89(4):471-475, 1964.

Information in this article that concerns nutrition and fertility follows. Traditional Yoruba sanctions prohibited meat, eggs, and other protein-rich foods both for pregnant women and for infants below about 2 years. Strenuous farm labor was continued until the last weeks of pregnancy and was resumed within several days after delivery. Sexual intercourse continued until the third trimester, sometimes with the thought that this helped to nourish the child, and was not resumed until the infant was weaned from the breast two to three years later. Semi-solid foods were introduced when their first teeth appeared.

This article presents an excellent photograph of femal circumcision of the newborn, in which the anterior portion of the labia minora and the clitoris are excised by using metal or bamboo scissors to remove a piece the size of a "date stone." (Editor's note: widespread excision of the clitoris in African societies is believed by many, including Yoruba women interviewed by the editor,

to make the woman less vulnerable to sexual temptation and more willing to accept abstinence.)

29. NIGERIA. MacLean, C. M. Yoruba Mothers: A Study of Changing Methods of Child-rearing in Rural and Urban Nigeria. J Trop Med Hyg 69:253-263, 1966.

A study of child-rearing practices in Ibadan, Nigeria, in 1966, showed that breast feeding usually began 2-3 days after birth and continued from 2-3 years, although male children might be kept on the breast a few months longer than female Occasionally breast feeding continued up to 4-5 years. Births were usually spaced at appoximately three yearly intervals, as intercourse was prohibited until the termination of lactation. Weaning was a gradual process, starting early with a thin corn meal pap given by hand and going on to a variety of mashed purees of adult foods. Yams, a staple article of diet, were considered to make a child sluggish and "heavy," delaying walking and healthy growth.

30. NIGERIA. Martin, W. J., Morley, D., and Woodland, M. Intervals between Births in a Nigerian Village. J Trop Pediatr 10(3):82-85, 1964.

The average interval between births in the Yoruba village of Imesi was found to be 35.5 months for 248 women whose previous child survived and 17 months for 34 women whose preceding infant was stillborn or died before the age of one year. Average interval in the absence of mortality increased from 32.4 to about 38 months as birth order increased from 2 to 7+. Only 16% of mothers conceived while breast feeding, in part because of strong public censure against cohabitation during breast feeding. (One woman who became pregnant before weaning was so disturbed by public opinion that she left the village until the second child was born.) Average duration of lactation was 23.2 months. Mean interval between the cessation of lactation and the next birth was 13.3 months, increasing from 11.4 months to 16.5 months as birth order increased from 2 to 7+.

31. NIGERIA. Matthews, D. S. The Ethnological and Medical Significance of Breastfeeding: With Special Reference to the Yorubas of Nigeria. J Trop Pediatr 1(1):9-24, 1955.

The author reports the average duration of breast feeding among Yorubas to be 18-22 months and the average length of lactation amenorrhea 16 months, but often lasting 2-3 years. He observed that the longer the suckling, the longer amenorrhea would last. Parturition occurred at 4 year intervals, but the first two years of the birth interval were accompanied by a prohibition on intercourse.

32. NIGERIA. Morley, D., Bicknell, J. and Woodland, M. Factors Influencing the Growth and Nutritional Status of Infants and Young Children in a Nigerian Village. Trans R Soc Trop Med Hyg 62(2): 164-195, 1968.

Two groups (A and B), each of 52 children, were selected from a study population of 405 children attending the under-five's clinic in the Yoruba village of Emesi, Western Nigeria. Group A were the children whose weights fell below the 10th percentile of the local study group (2.1 to 3.3 standard deviations below the 1978 WHO standards) at 6, 9 or 12 months of age. Group B were considered to be of satisfactory weight and were always above the 50th percentile, which ranged from -1.2 standard deviations below WHO standards at 6 months to about 0.2 standard deviations below at 12 months.

The children in the two groups were found to retain their relative weight position during the succeeding 4 years. A similar poor or satisfactory weight gain was also found in their younger siblings.

Mothers of group A children were not significantly shorter (62.2 vs 62.6 in.) but weighed at 3 months following delivery an average of only 107 lb., which was 10 lb. less than mothers of group B children. Mothers in both groups gained weight with increasing parity, but group A mothers gained an average of 1.0 lb. with each birth compared to 2.3 for group B. (No significant seasonal changes in weight had been found in this population.) Prevalence of malnutrition increased with birth orders above 7 and appeared associated with inadequate lactation in older mothers.

Although almost all infants were breast-fed on demand, 83% of group A and 35% of group B children had experienced at least one month of unsatisfactory weight gain during the first 6 months of life. The fact that about 10% of female and 25% of male children in the Emesi population fell more than 2 standard deviations below WHO weight standards at the sixth month of life also suggests inadequate lactation.

33. NIGERIA. Omololu, A. Nutrition and the African Child. Environ Child Health 18(2):144-149, 1972.

This is an overview article discussing factors leading to the malnutrition of African children. One factor not commonly mentioned in the literature is that pregnancy is viewed as entirely normal in Subsaharan African culture, so that the pregnant woman is expected to continue strenuous farm labor without extra food intake. Average pregnancy weight gain in one study in rural Nigeria was 5 kg, with 14% of full term singleton infants having birth weights below 2500g. Another factor is that traditional African education before the advent of Western culture systematically taught skills for living such as group maintenance of public amenities including roads, rivers and markets, birth spacing, child care, crafts and agriculture. The traditional education system has mainly been displaced by Western formal education that fails to teach living skills. The writer stresses the need for restoration of all forms of non-formal education together with development of communications, markets, agriculture, and health services.

34. NIGERIA. Ware, H. Motivations for the Use of Birth Control: Evidence from West Africa. Demography 13:479-494, 1976.

A conventional assumption in the family planning literature is that birth control in developing countries is first adopted by high parity women who wish to cease childbearing. The empirical support for this belief has mainly been drawn from interview surveys on the motivations for, and the timing of, the inception of birth control among married women in areas where there is no cultural precedent for birth spacing by traditional means. This study, on the other hand, is based on data drawn from an area sample of 6,606 primarily

Yoruba women, married or single, aged 15-59, in Ibadan, Nigeria, where there is a tradition for the practice of abstinence after a birth for the purpose of birth spacing. The Nigerian data revealed the following distinctive pattern: (a) although premarital sex is prevalent, levels of premarital contraception are high; and (b) within marriage, spacing is the most prominent motivation for contraceptive practice, more important than the limitation of family size.

35. NIGERIA. Weiss, Eugene and Udo, A. A. The Calabar Rural MCH/FP Project: What We Have Learned about Family Planning. Paper presented at the Annual Meeting of the Population Association of America, 1980.

The Calabar Project of Cross River State, Nigeria is an attempt to demonstrate the feasibility of providing basic MCH services to a rural population at a moderate cost, integrating FP services at all levels. The present paper describes a series of different types of research efforts carried out since 1975 by the Evaluation Unit of the Project.

The problems encountered in the translation into the local language of FP terms and concepts is described as are traditional methods of birth control. The results of a follow-up study of FP acceptors showing low continuation rates and a high degree of perceived side-effects is next presented. The paper concludes by suggesting that while FP, as childspacing, is traditionally practiced through postpartum abstinence, the use of modern contraceptives which permit sexual relations during childspacing is generally seen as undesirable. Widespread use of modern birth control is not envisioned in the near future in rural Nigeria, though many unanswered questions remain.

36. SENEGAL. Cantrell, P. and Terry, B. The Influence of Nutrition on Fertility: The Case of Senegal. In Nutrition and Human Reproduction, ed. W. H. Mosley. New York: Plenum Press, 1978.

The duration of breast feeding and postpartum amenorrhea in rural and urban Senegal was examined, as well as the relationship between food consumption and fertility. Data on the duration of postpartum amenorrhea and breast feeding for urban, semi-urban, and rural women were collected in two year, longitudinal studies in Pikine, Khombole, and Thienabu, and in a retrospective survey of 1460 Dakar women. The median duration of breast feeding ranged from 19.3 months in urban areas to 23.7 months in rural areas. The median duration of postpartum amenorrhea ranged from 12.4 months in urban areas to 17.9 months in rural areas. Furthermore, the duration of postpartum amenorrhea was greater in rural areas than in urban areas for a given length of breast feeding. A nationwide budget sample survey, and weighing surveys in rural Khombole and M'Bourwaye yielded nutrition data. The data indicated that the urban diet was more abundant and contained a better balance of animal protein. A better diet was correlated with lower child mortality. No evidence was found to indicate an influence of nutritional status on fertility.

37. SENEGAL. Cantrelle, P. and Leridon, H. Breast-feeding, Mortality in Childhood and Fertility in a Rural Zone of Senegal. Popul Stud 25:505, 1971.

This study of 8,456 live births in Niakhar district of the Fatik Department of Senegal between 1962 and 1968 found that infant mortality among this group of Serer peasant farmers was 210/1000, 2nd year mortality 202/1000 and 1-5 year mortality 355/1000, leaving only 510 survivors at age 5. Mortality rates peaked during the harvest, from September to November. Couples resumed sexual relations about 2 months after birth. Weaning from the breast was most common near the second birthday and between March and May. The average birth interval was increased by 9 months by a 12-month increase in age of weaning, when weaning occurred between 12 and 36 months. An effect of weaning on mortality was clear only when the child was weaned during the subsequent pregnancy, which tripled the probability of death of the weanling. The study found no direct effects of fertility on mortality or of duration of breast feeding on mortality. Children who died between 2 and 4 years had been weaned at an average of 25.6 months, compared to 24.3 months for survivors. The authors suggest that mothers weaned children perceived to be sickly later than those that were healthy.

38. SIERRA LEONE. Kandeh, H. B. S. Infant and Child Mortality in the Bo District of Sierra Leone. Paper presented at the Annual Meeting of the Population Association of America, 1979. Pennsylvania, 3718 Locust Walk/CR, Philadelphia, PA 19104.

A study of currently married women (15-49), residing in Bo town (the second largest town in Sierra Leone), and four smaller towns representing Chiefdom Headquarters in the Bo District. Bo town had an infant mortality rate of 186 per 1000 births and a child death rate of 26 per 1000 children aged 1-4 years. The respective figures for the other towns were 246 and 36 deaths. First order births, births by very young and very old mothers, births after short birth intervals and births to mothers with very little or no education had very high infant and child mortality rates. Policy recommendations included (a) a greater emphasis on preventive health care programs by the Ministry of Health, (b) provision of more "well baby" clinics, (c) more health education programs to enlighten parents about the mortality risks faced by their children and the preventable nature of most of the infant and early childhood causes of death.

39. SIERRA LEONE. Snyder, D. W. Economic Determinants of Family Size in West Africa. Demography 11:613-27, 1974.

The economic theory of fertility postulates that income and prices, broadly defined, are important determinants of family size. This article reports an attempt to test this theory against the behavior of 717 predominantly urban households in Sierra Leone. Husband's education is used as a proxy for income; the "price" of a child is accounted for by wife's education and wife's wage rate. Other important variables are wife's age, a measure of child "quality," wife's age at first birth, and child mortality. The findings of the study tend to lend support to the economic theory of fertility but contain peculiarities which indicate a need for further research.

40. TOGO. Kumekpor, T. K. Rural Women and Attitudes to Family Planning, Contraceptive Practice and Abortion in Southern Togo: A Report of a Pilot Survey in the Maritime Region of Republic of Togo. Legon, Ghana: Department of Sociology, University of Ghana, 1970.

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A sampling technique was used to gather interviews from 293 women aged 15 or over in the three administrative districts of Anecho, Tsevie, and Tabligbo in Togo. Even though little or no family planning was practiced by these women, most of whom were under age 35, the majority were aware of the adverse effects of too many children at too short an interval. The ideal spacing was seen as three years.

The following table presents the survey findings which show that these rural women were not as conservative as usually pictured.

Recognized adverse effects of short birth interval on mother's health	87%
No adverse effects if mother in good health	9%
Too many children cause economic problems	11%
Too many children cause psychological problems for mother	11%
Short birth spacing damages health of first child, may lead to death or Kwashiorkor	72%
Short birth spacing makes it difficult for parents to provide adequately	19%
Would practice abstinence to avoid pregnancy	54%
Would do nothing to avoid pregnancy	31%
Would see a doctor	3%
Would use herbs or induce abortion	3%
Would keep unwanted pregnancy	77%
Believed abortion is bad, criminal or against religion	90%
Believed abortion is good but dangerous	9%
Circumstances surrounding pregnancy might compel woman to abort	37%
Abortion justified if essential to mother's health, if woman too young, or had too many children	18%
Believed abortion increasing in their area	52%
Believed abortion decreasing in their area	11%

41. UPPER VOLTA. Laurentin, A. R. and Benoit, D. Infant Mortality and Birth Intervals. Popul Stud 30(2):279-294, 1976.

In the course of a demographic inquiry which also offered medical advice to the respondent women, information was obtained on the reproductive life and child mortality of women in three regions of Upper Volta. Foetal mortality rates are inversely correlated with fertility rates, whereas the opposite holds true of the mortality of children aged up to four years. An explanation of this phenomenon is attempted, showing how large variations in mortality rates continue to exist in developing countries.

The second section of the paper deals with spontaneous abortions which happen much more frequently than is believed in Black Africa and with the effect of pathological sterility on birth intervals. Venereal disease is an important factor. Account is taken of the taboo on sexual relations after children have been born, a taboo which continues to be kept in the region studied and which has an important effect on inter-birth intervals.

42. UPPER VOLTA. Munson, M. L., Bumpass, L. L., and Pool, D. I. Determinants of Cumulative Fertility in Urban Upper Volta. Paper presented at Annual Meeting of Population Association of America, 1979.

This analysis of fertility differentials in a "traditional" urban population examines cumulative fertility of mothers by four exposure variables (age,

span of fertility, marital stability, and monogamous/polygynous union) and six socio-structural variables (nutrition, spouse's occupation and education, respondent's education, religion, and birthplace). Dummy variable multiple regression is used to estimate the separate and joint effects of each of the variables. The exposure variables account for 95% of the explained variance, with an R^2 of .466. The necessity of controling for age in studies of this kind is demonstrated by the fact that nearly every zero-order relationship in the analysis is either substantially modified or reversed after age controls are introduced. For example, polygynous wives have 36 more children per hundred than monogamous wives, but when differences in their age distribution are taken into account, the polygynous wives have 26 fewer children per hundred mothers.

43. ETHIOPIA. Huber, A. and Ulm, R. Probleme der Laktationsamenorrhoe (Problems of Lactation Amenorrhea: Investigations in Ethiopia). Gynaecologia 153(6):282-297, 1962.

A 1962 report on a project investigating lactation amenorrhea in Ethiopian women undergoing treatment at the Imperial Guard Hospital in Addis Ababa revealed that 81% of the women nursed their babies fully for at least 1 year. Lactation amenorrhea in these women averaged 13-14 months. Within 1 year 44.7% and within 2 years 95.5% of the women had menstruated. During the lactation amenorrhea 10% of the women became pregnant. Curettings taken during amenorrhea showed that in 73.5% there was an inactive endometrium, but in 26.5% there were signs of ovarian hormonal effects on the endometrium. Blood tests suggested that prolonged lactation could be temporarily harmful to undernourished mothers. Uterus measurements, however, revealed that prolonged lactation had only a mild and reversible effect on the size of the uterus.

44. ETHIOPIA. Knutsson, K. E. and Mellbin, T. Breast Feeding Habits and Cultural Context (A Study of Three Ethiopian Communities). J Trop Pediatr 15:40-49, 1969.

This study presents breast feeding habits in three rural Ethiopian villages in the provinces of Tigre, Sidamo, and Arussi. In Tigre, 92% of infants received breast milk for more than one year within a traditional group that depended on subsistence agriculture and had little outside contact. In a coffee cashcropping village in Sidamo, where Western clothing and Christian and Muslim religions were replacing local traditions, 61% were breast fed more than a year. The impoverished and displaced Arsi Gala herdsmen in Arussi, however, had cultural norms that specified 5 months as the weaning age for girls and 6 months for boys. The Arsi expressed the belief that early weaning was necessary to increase the number of children a woman could bear during her fertile years. The Arsi used a traditional gourd feeding bottle. Only 11% of infants were breast fed more than twelve months and boys were, in fact, fed longer than girls.

In the five field stations followed in Ethiopia, both the birth and child mortality rates from 1963 to 1965 were highest in the Arussi area, and resulted in about the same number of living children per family in Arussi as in other areas. The authors speculate, however, that in previous generations, when the Arsi transhumance cattle economy was still functioning and was situated in the cooler highlands, cows' milk was sufficiently abundant and risk of infection was low enough to make early weaning a rewarding strategy in terms of number of surviving children.

45. ETHIOPIA. Selinus, R. et al. Dietary Studies in Ethiopia: Dietary Pattern Among the Rift Valley Arusi Galla. Am J Clin Nutr 24:365-377, 1971.

Infants of the Rift Valley of Ethiopia were usually breast fed up to 6 months. Children aged 2 months to 1 year might be partly breast fed. Breast feeding usually continued normally for 6 months, occasionally for 1 year, but sometimes for only 3-4 months. This rather short period for an underdeveloped area was because the Arsi believed lactation prevented pregnancy and that a high birth rate was necessary to counteract high mortality. At about 1 year the child was introduced to adult food. Often the first solid food was toasted corn, but the infants relied mainly for nourishment on butter milk in quantities as available.

46. ETHIOPIA. Tayback, M. and Prince, J. S. Infant Mortality and Fertility in Five Towns of Ethiopia. Ethiop Med J., 11-17.

Infant mortality and fertility performance were estimated for a sample of 5 towns in Ethiopia in 1964-1965. The infant mortality rate was 152 deaths per 1000 liveborn and 59% of this loss took place within the first two months of life. The birth rate appeared to be 40 live births per 1000 population per year or 143 annual births per 1000 women aged 15-44 years of age. This latter rate was 43% higher than that found in European and North American nations.

47. KENYA. Blankhart, D. M. Four Villages Survey in the Coastal Area Kwale, Kenya. Mimeographed. Amsterdam: Koninkligk Instituut Voor De Tropen, 1-10, 1971.

In 1970 a survey was done in four population centers of Kwale, Kenya, to determine the nutritional status of the following communities: Kumbani, Gozi, Mbaleni, Borani. In Kumbani it was found that breast feeding was continued for at least 18 months and was rarely done after 24 months. Gozi follows the same pattern except that breast feeding was fully absent after 30 months. In Mbaleni there was frequent breast feeding up until 24 months. In Borani there was a slight decline of breast feeding after 18 months and only complete absence after 30 months. Weaning foods common to all areas are rice, sweet potatoes, cassava, beans, peas, bananas, mangos, meat and fish. (Editor's note: This article, which was not available to the compilers of this annotated bibliography, probably contains additional relevant information.)

48. KENYA. Ojiambo, J. A. Maternal and Infant Dietary Practices of the Abasamia of Busia District, Western Province, Kenya. A Preliminary Study 1966-67. East Afr Med J 44:518-523, 1967.

A study of infant feeding practices in a remote area of western Kenya showed that for infants, breast milk was the staple; of 32 mothers, 15 breast fed for 2 years. A watery porridge, pounded banana, yam, rice and occasionally liver was introduced at 6 months to 1 year.

49. RWANDA. Bonte, M., Akingeneye, E., Gashakamba, M., Mbarutso, E., and Nolens, M. Influence of the socio-economic level on the conception rate during lactation. Internatl. J. Fertil. 19:97-102, 1974.

Factors that influence the rate of conception during lactation were studied retrospectively among 655 relatively malnourished and traditional rural women and among 253 urban women claimed to be well nourished and to have occidentalized habits. The rural infants were carried on the back and breast fed on demand whereas the urban infants were less frequently on the back and were breast fed on schedule. In non-lactating women, menstruation and conception occurred at the same time interval postpartum in the rural and urban groups. Lactating and amenorrheic rural women experienced an average 21 month delay to next conception versus an average 4.5 month delay for the urban group. Menstruating lactating rural women experienced a 22-month delay, versus 9 months for the urban group.

50. RWANDA. Bonte, M. and van Balen, H. Prolonged Lactation and Family Spacing in Rwanda. J Biosoc Sci 1(2):97-100, 1969.

Data from 368 women who had just given birth in a government hospital were collected by means of medical records (Groups 1 and 2) and interviews (Group 3). Group 1 consisted of 50 women whose babies lived less than one week, Group 2 contained 102 lactating women, and Group 3 consisted of an additional 102 lactating women who were assessed by interview. Conceptions among both groups of lactating women were delayed an average of 15 months as compared to non-lactators. Conceptions during lactation amenorrhea were on the order of 5.4%.

51. RWANDA. Saxton, G. A. and Serwadda, D. M. Human Birth Interval in East Africa. J. Reprod Fert Suppl 6:83-88, 1969.

This article reports the following birth intervals for lactating and non-lactating Banyarwanda women, who traditionally breast fed for 2-3 years and did not practice postpartum abstinence. Birth intervals for lactating women averaged 27 months compared to 15 months for women whose infants were still-born or died within a week of delivery.

BIRTH INTERVAL AMONG RWANDA WOMEN

Interval (months)	Women breast-feeding No.	%	Women not breast-feeding No.	%
8 to 11	1	0·5	19	38
12 to 14	4	2	34	68
15 to 17	16	8	37	74
18 to 20	32	15	40	80
21 to 23	60	29	42	84
24 to 26	99	47	44	88
27 to 29	141	68	46	92
30 to 32	174	83	48	96
33 to 35	195	93	49	98
36 to 38	204	98	50	100
39 to 41	208	99		
42 to 44	209	100		

PROBABILITY OF CONCEPTION DURING LACTATION

Months since delivery	Proportion menstruating and lactating (%)	Proportion conceiving (%)	Probability of new conception
6	20	1	1/20=5%
12	50	10	10/50=20%
18	60	40	40/60=67%
24	75	75	75/75=100%

52. TANZANIA. Everett, V. J. The relation between maternal height and cephalopelvic disproportion in Dar Es Salaam. East Afr Med J 52(5):251-256, 1975.

The mean height of 622 Dar Es Salaam primigravidae was found to be 148.5 cm, whereas that of the 21 (3.4%) who required caesarian section for cephalopelvic disproprotion was only 141 cm. A definite relationship exists between disproportion and maternal height which is an indicator of early maternal nutrition in population groups where malnutrition is endemic. Disproportion entails a high risk of maternal and infant mortality.

SENSITIVITY AND SPECIFICITY OF MATERNAL HEIGHT AS A PREDICTOR OF CEPHALOPELVIC DISPROPORTION

'At risk' maternal height	Sensitivity %	Specificity %
up to 136 cm	23.8	99.2
138.5	33.3	96.2
141	66.7	90.8
143.5	80.9	83.7
146	90.5	69.5
148.5	95.2	54.4
151	95.2	41.8

53. TANZANIA. Findley, S. E. and Orr, A. C. A Suggested Framework for Analysis of Urban-Rural Fertility Differentials with an Illustration of the Tanzanian Case. Paper read at 1978 Meeting of the Population Association of America. Minnesota State Planning Agency, Rm. 101, Capitol Square Bldg., St. Paul, MN 55101.

The authors offer a framework for analyzing how individual and urban or rural "place" factors interact to influence fertility decisions. The framework builds on the Davis-Blake model and additionally shows how place or community variables influence exposure to intercourse, conception, and birth, either with or without a conscious decision-making process. The framework emphasizes the way person and place related factors combine to determine a woman's perception of her life options before bearing any children, as well as how changes in these factors may affect subsequent childbearing decisions. The framework is briefly illustrated by the Tanzanian case. The analysis highlights urban-based considerations, such as education-wage differentials, which may influence the rural couple's decisions. A comparison of two rural groups shows that specific community variables, such as cultural attitudes, accessibility, general education levels, and child mortality, mediate the influence of these urban-based phenomena.

54. TANZANIA. Jelliffe, D. B. et al. The Children of the Hadza Hunters. J Pediatr 60:907-913, 1962.

Permissive breast feeding was the pattern of infant feeding among the Hadzas of northern Tanganyika (now Tanzania). Soft fats, gruel-like mixtures of uncooked powder and honey were given to infants in the early months. When an infant had 2-4 teeth, prechewed meat was given by the mother. By the age of 18 months, the full adult range of foods were given. Bone marrow, both raw and cooked, was introduced in the early months.

55. TANZANIA. Kocher, J. E. Socioeconomic development and fertility change in rural Africa. Development Discussion Paper, No. 16. Cambridge, Massachusetts: Harvard Institute for International Development, 1976.

In rural areas of Africa, demand for children typically exceeds supply. The numbers of children born and surviving are thereby limited by supply rather than demand constraints. A model is presented which postulates that socioeconomic development that initially causes the average number of surviving children (supply) to rise, later brings about a decline in the average number of children desired (demand), and that these changes eventually cause parents in later years of child-bearing to find themselves in excess supply rather than excess demand situations. As this trend continues, parents are motivated to try to prevent further births. Multiple regression is used to test separate supply and demand models of the determinants of number of children born to a sample of about 800 women, ages 20-39, in rural areas of Tanzania. The R^2s for the supply models are large and the coefficients for the independent variables are relatively large and statistically significant. R^2s for the demand models are low and statistical relationships are weak. These results are consistent with the hypothesis that in rural areas of Africa, supply characteristics dominate while demand characteristics have little to do with fertility levels and variations.

56. TANZANIA. Maletnlema, T. N. and Bavu, J. L. Nutrition Studies in Pregnancy Part I: Energy, Protein and Iron Intake of Pregnant Women in Kisarawe, Tanzania. East Afr Med J 51(7):523-528, 1974.

Dietary intakes of 70 pregnant women in Kisarawe, Tanzania were measured by the weighing and by the recall methods. The mean intake of protein, energy and iron were not up to the FAO/WHO recommendations. Less than one-third of women consumed an amount of protein satisfying the FAO/WHO recommendation of 38g of reference protein. The women on higher intakes delivered larger infants than those on low intakes. Protein intake was more highly correlated to birth weight than calorie intake. Women, who according to the recall method said that they ate mainly cassava foods, showed a lower intake of protein, energy and iron than those who had mixed diets. According to the author, maternal malnutrition, which seemed to affect about a quarter of the women, could be eliminated by improving the communication in the district, by treating and preventing diseases, and by increasing the production and utilization of agricultural products.

57. TANZANIA. Mayer, G. Undernutrition, Prolonged Lactation and Female Infertility. J Trop Pediatr 12(3):58-59, 1966.

Undernutrition, prolonged lactation,and female infertility were studied among an unreported number of women in a mountain village in Tanzania. A tribal

method of birth control consists of sexual abstinence for 4-6 months after delivery and prolonged lactation which is continued until the next pregnancy is recognized (2-3 years). These women depend almost entirely on breast milk as the only food for their children during the first 2-3 years. Those of the higher socioeconomic group who feed their children by other methods get pregnant nearly every year. In the low socioeconomic group no woman menstruated during the first 6 months postdelivery, 17% did so before 12 months, 48% before 18 months, 83% before 24 months, and 17% were amenorrheic for more than 2 years. All those in the high socioeconomic group started menstruating within a year in spite of lactation. The women in the low socioeconomic group menstruate only 2-5 times before they are pregnant again. Medical examinations revealed reduced estrogen production (or complete absence) in lactating malnourished women.

58. UGANDA. Cook, R. The Ankole Pre-school Protection Programme, 1964-1967. Mbarara, Uganda: Ankole Pre-school Protection Programme, 1967.

This preschool health and nutrition program, with a total target population of about 650,000, collected data showing marginal improvement in mean weights of children from 1965 to 1967. The program did not advocate population control because the writer "feels it an impertinence to make any such attempts in a foreign country, and in any case, opinion is divided as to whether East Africa will need a larger population in future." The program did, however, assist in the provision of family planning services for birth spacing. To avoid potential political sensitivity, the family planning program was sponsored by a private organization, the Ankole Medical Association. The Preschool Protection Program, however, paid the staff conducting the family planning clinics and provided some equipment. Clinic was held after normal working hours and was not publicly announced. The Lippes loop was most frequently used, followed by the pill. Three-fourths of target women surveyed concerning child health favored family spacing. This article indicated a demand for family planning services in Uganda despite a pronatalist political environment.

59. UGANDA. Jelliffe, D. B. et al. The Children of Lugbara. Trop Geogr Med 14:33-50, 1962.

A field study of the Lugbara tribe in the West Nile District of Uganda in 1961 revealed that all children were breast fed, and that 41% of the children surveyed were still on the breast at 2 years of age. In the first six months of life only a minority of children had any food besides breast milk. From 7-12 months between a quarter and a third of the children were given peas, ground nuts and millet. By 2 years of age, the whole range of Lugbara foods were given.

60. UGANDA. Jelliffe, D. B. et al. The Health of Acholi Children. Trop Geogr Med 15:411-421, 1963.

Among the Acholi tribe in Uganda, breast feeding is prolonged into the second year of life or longer. Soft and semi-solid foods, including millet, beans, sesame are introduced from the second 6 months of life onwards. Among urban Acholi, breast feeding is carried on for an average of 16-18 months. Meat and dried fish is eaten more frequently than in other areas, but usually only the soup is given to small children.

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61. UGANDA. Jelliffe , D. B. et al. Ecology of Childhood Disease in the Karamojong of Uganda. Arch Environ Health 9:25-36, 1964.

Karamojong babies are universally breast fed. If the mother has insufficient milk, the child may receive supplements of undiluted sheep's milk. Breast feeding is prolonged and continued through pregnancy until the next child is born. Fresh and sour milk and butter may be added to a child's diet from 1 month of age. Sorghum porridge, soft meat and beer are given regularly at about 6 months. By 2 years, a child is eating all adult foods.

62. UGANDA. Namboze, J. M. Weaning Practices in Baganda. Trop Geogr Med 19:154-160, 1967.

Of 73 mothers from under 19 to over 30 years old in Baganda who were interviewed, 26 stopped breast feeding at 12-14 months, for the others the age varied from 3 months to 2 years. The main reason given for weaning was that the child was big enough. Another reason was insufficient milk from the mother. Solid foods were introduced gradually by 28 mothers, but 18 weaned their babies abruptly without previous introduction of solid foods. In 33 cases a child was sent to a relative after weaning.

63. UGANDA. Welbourne, H. C. Weaning Among the Baganda. J Trop Pediatr 9: 14-24, 1963.

A study of Baganda children attending child welfare clinics during the weaning period found that the duration of breast feeding was usually from 12-16 months. Additional foods, matoke and tea, were given from the age of 6 months or earlier. The final cessation of breast feeding was abrupt and often pre-planned for a particular day, although the mother stopped breast feeds in the day time a few weeks before she stopped the night feeds.

Weaning marked a frequently traumatic emotional separation from the mother during which period children frequently became malnourished. About 45% of children were sent away from home to live with other relatives either at weaning or during the following 2 years. The author suggested that children with strong primary attachments survived the weaning trauma with better personality adjustment than the increasing number who experienced bottle feeding and early family instability associated with modernization.

64. ZAMBIA. Wenlock, R. W. Birth Spacing and Prolonged Lactation in Rural Zambia. J Biosoc Sci 9:481-485, 1977.

Data were collected from 1044 mothers resident in the rural areas of Zambia during a National Nutrition Status Survey, to determine the effect of lactation on the interval between conceptions. Lactation is very prolonged with a small proportion of mothers continuing up to 33 months. A main reason for cessation of breast feeding appears to be a new pregnancy, only 1.5% of mothers being neither pregnant nor lactating up to 12 months. During lactation, conception is delayed for at least 12 months. The peak in new conceptions occurs between 25 and 27 months. The normal interval between births is 3 years for rural Zambian mothers.

65. CENTRAL AFRICAN EMPIRE. Vis, H. L. et al. The Health of Mother and Child in Rural Central Africa. Stud Fam Plann 6(12): 437-441, 1975.

Studies on food consumption and the relation of fertility to malnutrition in the great lakes region of Central Africa conducted by the Medical Mission of the Medical and Scientific Center of the Universite Libre of Brussels in Central Africa and The Institute for Scientific Research in Central Africa are summarized, and longitudinal studies on maternal and child health reported. The annual population growth rate in this area was [illegible].6% and death rate was 23/1000. The average woman had 6-7 live children during her fertile years. Perinatal mortality was 50-55/1000 births. Infant mortality 70-100/1000 live births. There was a low incidence of gastroenteritis and pneumopathy due to prolonged breast feeding. There are 2 nutritional subgroups in this area: 1) those who use milk as a weaning food and 2) those who are unable to ensure a good protein supply after weaning. Endemic malnutrition delayed puberty in the female to age 15-16 and caused a low level of milk production and prolonged postpartum amenorrhea. This ensured spacing of children between 33-39 months. Studies of growth indicate psychomotor development was normal and only somatic growth delayed. About 20% of children were malnourished.

66. ZAIRE. Anderson, B. A. and McCabe, J. L. Nutrition and the Fertility of Younger Women in Kinshasa, Zaire. Journal of Development Economics 4:343-363, 1977.

A significant positive association was established between fertility and purchased calories per adult equivalent using individual household data for Kinshasa, Zaire. The analysis was based on a sample of women aged 20-24, none of whose children had died. Characteristics likely to influence fertility both behaviorally and biologically, such as education, were included as separate independent variables. Both the first and second closed birth intervals and conditional second birth probabilities were analyzed, with the latter providing more significant results. Evidence is also presented showing that above low levels of calorie consumption infant and child survival is positively related to protein consumption.

67. ZAIRE. Carael, M. Relations Between Birth Intervals and Nutrition in Three Central African Populations (Zaire). In Nutrition and Human Reproduction, ed. W. H. Mosely. New York: Plenum Press, 1978.

The influence of various factors on postpartum amenorrhea and, therefore, on birth intervals is considered. A retrospective and cross-sectional study was conducted among 3 tribes living in 2 different ecological areas in Zaire. The ecology, dietary pattern, and health situation for the different study groups are described. Lactation was found to prolong postpartum amenorrhea in both areas studied. The 2 populations from the equatorial forest, despite differing customs, were found to have rather equal periods of amenorrhea, due probably to a similarity in nutritional patterns. The author claims that protein and lipid deficiencies caused the highland population to experience longer durations of amenorrhea. When these women moved to a relatively urban area, adoption of a balanced diet caused the period of amenorrhea to drop. Age and parity had no significant effect on the duration of amenorrhea. Partial weaning resulted in a 2-3 month shortening of the amenorrheic period.

68. ZAIRE. Delvoye, P., Delogne-Desnoeck, J. and Robyn, C. Serum prolactin in long-tasting lactation amenorrhea. Tancit ii:288-289, 1976.

Summary: Basal serum-prolactin concentrations were high until 15 months postportum in nursing mothers of Central Africa (Lwiro). They were significantly lower in menstruating than in amenorrheic nursing mothers. These results support hypothesis that prolactin is involved in the long-lasting amenorrhea which occurs in regions where breast feeding is prolonged for up to 2 years after delivery.

Bloods were collected just before and 30 minute after suckling started from 39 lactating women between 1-24 months after delivery. Controls were 20 adult men. Mean basal serum prolactin was significantly higher in amenorrheic nursing women then in menstruating nursing women. Mean basal serum prolactin was significantly three times higher in menstruating nursing mothers than adult men. There was a significant decrease in basal serum prolactin with time between 3 to 24 months postpartum -- little difference between 3-9 vs 9-15 months but these were significantly higher than 15-24 month levels. After suckling, mean basal serum prolactin increased in both amenorrheic and menstruation mothers but not significantly. Mean basal serum prolactin in menstruating mothers 30 minutes after suckling began still significantly lower than mean basal level in amenorrheic women before suckling.

Mean serum L.H. concentration was higher in menstruating than in amenorrheic mothers but the difference was not significant. Mean serum FSH concentration was almost same in amenorrheic and menstruating mothers.

This data confirms Tyson's work that after 3 months postportum the increase in serum prolactin following suckling is negligible.

69. ZAIRE. Delvoye, P., Demaegd, M., Delogne-Desnoeck, J. and Robyn, C. The influence of the frequency of nursing and of previous lactation experience on serum prolactin in lactating mothers. J. Biosoc. Science 9:447-451, 1977.

Summary: Serum prolactin was measured in single blood samples collected within the first 22 postpartum months from 97 nursing mothers from an urban area (Bukavu) of Zaire. Nursing mothers were hyperprolactinemic, higher serum prolactin levels being associated with more frequent suckling episodes per day. Furthermore, serum prolactin declines rapidly in mothers who were giving the breast less than 4 to 6 times per day: the levels were within the normal range found in non-lactating women after the 6th postpartum month. Among mothers giving the breast more than six times per day, serum prolactin did not decline significantly during the 1st postpartum year, but returned to the normal range between 18 and 21 months postpartum.

Previous lactation experiences did not facilitate the effect of nursing on prolactin secretion during subsequent lactations.

Sixteen percent of lactating women menstruated by the end of the first year postpartum and 75% by the end of the second year.

70. BOTSWANA. Kolata, G. B. "!Kung Hunter-Gatherers: Feminism, Diet, and Birth Control." Science 185:932-934, 1974.

Until the 1960s, the !Kung lived as hunters and gatherers, a way of life they observed for 11,000 years. Now, less than 5% of the !Kung live as nomads. This rapid transition from nomadic to agricultural life style has among other things also resulted in dramatic changes in population growth.

The average age of menarche is later among nomadic !Kung females (15.5 years old) than it is among agrarian !Kung females. Nomadic !Kung women typically marry at puberty and have their 1st child at age 19.5. Nursing lasts 3-4 years and the average birth interval is 4 years. Nomadic !Kung population size is stable because so few children are born. Long term growth rate is 0.5% per year.

The rapid population growth among the sedentary !Kung is attributed to decreases in both the age of menarche, and to a shortening of birth intervals by 30%. Babies receive supplementary foods earlier due to the availability of grain and cow's milk. Sedentary !Kung also are taller, heavier, and fatter than nomadic !Kung.

71. BOTSWANA. Konner, M. Worthman, C. Nursing Frequency, Gonadal Function, and Birth Spacing among !Kung Hunter-Gatherers. Science 207 February 15:788:791, 1980.

!Kung mothers nurse their infants a few minutes at a time, several times an hour, throughout the daylight hours and reportedly also during the night. Mean interbirth interval in traditional !Kung hunter-gatherer bands is 44.1 months. Dawn to dusk observations of 45 infants found that percentage of 15 minute periods when mother-infant pairs did not nurse was less than 25%. Six hour observations of 17 mother-infant pairs, with infants ranging in age from 12 to 149 weeks (mean 63.9±9.9) yielded the following overall mean values for nursing variables: 4.06±0.41 bouts per hour; 7.83±1.27 minutes per hour; 1.92±0.18 minute per bout; with 55.16±3.79 minutes (mean ± standard error) being the maximum interval. The age of the infant was unrelated to the bout length or nursing time, but was strongly related to the interval between bouts (r=.71). Serum levels of 17B-estradiol (E_2) and progesterone (P) in 12 non-cycling nursing women were in the low range comparable to those found in hyperprolactinimic amenorrheic Western women. E2 and P levels were significantly related to infant's age and to mean interbout interval, but not to bout length, parity, or sex of infant. The authors conclude that interbout interval may be a key variable in lactation infertility. They hypothesize that the key change, as the infant grows, is the lengthening of the interval between bouts, to a mean interval at 2 years that is approximately equal to the 10 to 30 minute half-life of prolactin in human plasma. This could allow prolactin levels to remain low enough, long enough, to impair antigonadal or antigonadotrophic effects, permitting cycling to be reinstated.

72. BOTSWANA. Wilmsen, E. N. Seasonal effects of dietary intake on Kalahari San. Fed Proc 37(1):65-72, 1978.

San bushmen living in the northwestern Kalahari Desert may be grouped according to different kinds and proportions of dietary habits. At one end of a continuous scale are those whose food is obtained almost entirely from wild bush sources; at the other extreme are those who obtain large amounts of food from domestic sources, principally milk and maize meal. The majority fall

between these poles. The region is also home to a substantial number of pastoralists and horticulturalists. Data were collected on the productivity of both the natural and domesticated environments, on resource procurement strategies, and on food consumption during a period of more than 1 year. Seasonal weight fluctuations associated with food production cycles among the San were found to be 6% of average weight. Among those San who consumed substantial amounts of domestic foods, mean weight was 4 kg higher and mean serum lipid values were higher than among bush food eaters. Thirty-two percent of all infants of bush food dependent mothers were conceived in June to August when calorie and protein intake were highest and individual weights were at their peak, while births of women consuming domestic foods were more evenly distributed.

73. NAMIBIA. Konner, M. and Worthman, C. Nursing Frequency, Gonadal Function, and Birth Spacing among !Kung Hunter-Gatherers. Science 207 February 15:788-791, 1980. (See BOTSWANA)

74. SOUTH AFRICA. Frere, G. Mean age at Menopause and Menarche in South Africa. South African Journal of Medical Sciences 36:21-24, 1971.

Mean age of menopause of 744 whites and 1319 Bantu with differing rates of cancer of the uterus were compared in a survey of the Johannesburg Hospital patients. For the former group the mean age was 51.44 while for the latter it was 50.70. The difference was significant at the 5% level. Another survey of 4838 Bantu urban school girls was made to establish whether nutrition affects the mean age at menarche. The two groups of "poor" versus "average" nutritional status did not significantly differ in terms of the mean age of menarche.

75. SOUTH AFRICA. Gross, R. L., Newberne, P. M. and Reid, J. V. O. Adverse Effects on Infant Development Associated with Maternal Folic Aci Deficiency. Nutr Reports International 10(5): 241-248, 1974.

Fourteen South African children aged six weeks to four years whose mothers had been severely folic acid deficient during pregnancy were assessed developmentally with the Denver Developmental Screening Test (DDST). Eight of the fourteen children showed abnormal or delayed development in one or more of the four general areas measured by the test. Eighteen control children, who were products of normal pregnancies or pregnancies associated with iron-deficiency anemia, were also studied. Only two of these control children showed a delay in development as measured by DDST. The role of adequate folic acid status during pregnancy on subsequent infant development requires further study.

76. SOUTH AFRICA. Moodie, A. D. Low-Weight Cape Coloured Mothers and their Infants. South Afr Med J (Supplement-South African Journal of Nutrition) pp 1400-1408, Dec. 19, 1970.

A controlled study of 55 pregnant Cape Coloured mothers was undertaken to discover whether the reproductive efficiency of underprivileged women in the community was impaired by malnutrition and whether their infants were

malnourished. The nutritional parameters used were the weight/height ratio of the mothers and their weight gain in pregnancy.

The overt reproductive efficiency of the mothers was not impaired by the degree of malnutrition that existed in the lowest economic groups. However, the women with low weight/height ratios and low pregnancy weight gains came from the poorest socioeconomic circumstances and tended to produce small infants of high morbidity and mortality.

When the mother's non-pregnant weight/height fell below 100%, both non-pregnant weight/height and pregnancy weight gain of more or less than an average of 270g per week appeared to affect birth weights and weight-for-age at 6 months. In women falling above 100% of weight/height, pregnancy weight gain appeared to make less difference than weight/height, although the sample was small. Gestational age of 38 weeks or less was found in 32% of infants of mothers with weight/height below 100%, versus 6% in those above 100%.

77. SOUTH AFRICA. Slome, C. Culture and the Problem of Human Weaning. J Trop Pediatr 6:23-24, 1966.

The author defines weaning as the complete and permanent cessation of suckling. The paper involved a study of the wide variations found in different societies in time and method of weaning, reasons for cessation of breast feeding and rituals and beliefs associated with the process. For example, among the Basuto and Zulu, the onset of pregnancy leads to immediate weaning, based on the belief that breast milk would prove injurious to the suckling baby. The Chaga, believing the mother's milk is inadequate, spit food into the baby's mouth from the second day of life and with the gradual introduction of foods, the breast serves primarily as a comforter.

Among the Zulu, foods are introduced before breast feeding because of the belief that colostrum is injurious to the infant. The breast is withheld for the first 24-28 hours or longer. A finely sieved, pulped maize-and-water gruel is given as a substitute.

78. ZIMBABWE. (formerly Rhodesia) Davies, J. C. A. Measles and the Birth Rate. Centr Afr J Med 22(8):152-154, 1976.

This paper suggests an association between the decision to eradicate measles and an increase of family planning practice in Salisbury. Measles previously had been judged the commonest cause of death in the isolation hospital in Salisbury. By 1975, however, 40,000 of the city's 50,000 "under fives" population had been vaccinated by means of a campaign that immunized every child sick or well -- attending health services. Team members, assisted by the Health Education Unit, swept through the city with loudspeaker vans to vaccinate all resident children. Reduction in measles was estimated in 1975 to save a total of $20,000 in hospital costs. A policy of promoting preventive, well-baby care also succeeded in increasing clinic attendance from 60,000 in 1973 to 150,000 in 1975, and resulted in a decline in the prevalence of whooping cough. Poliomyelitis, diplitheria and neonatal tetanus also had been virtually eliminated within the city.

Simultaneously, without intentional promotion, attendance at family planning clinics increased and contraceptive practice increased by 60% from 1973 to 1975. In particular, Depo Provera injections given in the maternity units immediately after birth became increasingly acceptable. The proportion of women receiving such injections increased from about one-quarter in 1974 to approximately half of those delivered in the City Health Department's units in 1975. (Editor's note: Depo Provera has been found to inhibit lactation.)

79. ZIMBABWE. (formerly Rhodesia) Pugh, A. O. Aspects of Rural Health V: Better Maternity Services. Centr Afr J Med 24(6):123-124, 1978.

Some maternity units in Zimbabwe have provided accommodations where pregnant women, particularly those with high risk of complications -- can come and wait for delivery, in order to reduce the risk of delivery along the way in areas where transportation is difficult. The local communities should provide traditional buildings in which the mothers cook and look after themselves as usual. A water standpipe, sanitation, and a washing hut would be provided by the maternity unit. The presence of women at the end of pregnancy has been found to provide an excellent opportunity for family planning, nutrition, child care, and health education.

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80. JORDAN. Kimmance, K. J. Failure to Thrive and Lactation Failure in Jordanian Villages in 1970. Environ Child Health 18:313-316, 1972.

Sequential weighings between birth and 3 months of 313 southern Jordanian village infants attending Save the Children Fund child health clinics were examined for evidence of lactation failure and its causes. The children were exclusively breast fed. Failure to thrive implying lactation failure was defined as rate of weight gain less than or equal to 2 standard deviations below the standards for North American children published in Fomon's Infant Nutrition. Lactation failure affected 35.8% of the mother-child pairs. None of a series of socioeconomic and biological variables were strongly associated with lactation failure. Weak but statistically significant associations included high parity, and obesity of the mother. A marginal association with maternal shortness may have existed although mothers did not permit accurate height recordings.

By six months of age 31% of the children failed to thrive, although breast feeding alone was not implicated because semi-solids were introduced at about 3 months. Of the original failure to thrive group, 69% had achieved normal rates of weight gain by 6 months, whereas 21% of the previously normal group had fallen below normal. Although there had been no sex difference at 3 months, 62.3% of infants failing to thrive at 6 months were female.

81. KUWAIT. Nagi, M. H. Excessive Fertility in Kuwait: Patterns and Implications. Paper presented at The Annual Meeting of the Population Association of America, 1980.

Kuwait is among those Middle East countries that today have the highest birth and population growth rates in the world. This paper presents data on recent fertility trends and differentials in Kuwait. Data analysis included birth rates, age specific fertility rates, natural increase rates, age specific rates of female birth, and gross and net reproduction rates as well as fertility rates by: a) level of education and b) occupational groupings, computed separately for native and immigrant population.

The consistently higher level of native fertility was explained by a number of socioeconomic factors,including age of marriage, age of first pregnancy, differences in sex ratio, differences in education and occupational groupings and socioeconomic status.

The analysis has some relevance to other oil rich countries in the region. Their pattern of excessive fertility raise fundamental questions concerning the impact of their tremendous wealth on the fertility level. From the evidence it becomes necessary to reassess the value of transition theory for this region of the world at this stage of development.

82. LEBANON. Chamie, J. Religious Differentials in Fertility: Lebanon 1971. Popul Stud 31(2):365-382, 1977.

Attempts to research population dynamics in Lebanon prior to 1970 were hampered not only by political obstructions, but by the scarcity of reliable census data. The 1970 Lebanese survey of about 1/15th of all households was the first national survey conducted since 1932. The 1971 National Fertility and Family Planning (NFFP) Survey investigated a 10% subsample of this survey population.

The NFFP examined the extent of fertility differentials within Muslim and Christian groups. Chamie concluded that sect or denomination must be considered in studies of Lebanese fertility differentials. Differentials must be examined in terms of 5 religious subgroups, rather than 2 major religions. Significant fertility differences exist within both Muslim and Christian groups. Compared to the National average fertility rate, Shi'as range 20-40% above the national average, Sunnis 6-26% above. Druze, Catholics, and non-Catholics were consistently below the national average: Druze (5-10%), Catholics (10-20%), and non-Catholic (18-20%). However, religious differentials were significant only at low SES levels as measured by low educational level of the wife. Moslem and Christian women with secondary education or higher had the same low levels of fertility.

83. LEBANON. Chamie, M. and Harfouche, J. K. Indigenous midwives in Lebanon. In The Organization of Family Planning Programs: India, China, Costa Rica, Venezuela, Lebanon. Smithsonian Institution, Interdisciplinary Communications Program, Occasional Monograph Series No. 8: Washington, D. C.; 1976. pp. 183-223.

In 1970 over one-third of the infants ever born in Lebanon had been delivered by indigenous midwives (dayas). This study interviewed a representative sample of about 60 dayas. Dayas recommend breast feeding as a birth control method. About half of those of childbearing age personally used birth control, mainly withdrawal. The majority of younger dayas with some schooling recommended Western birth control methods to their clients. Urban dayas tended to feel the number of children in their neighborhood was too high. Twice as many urban as rural dayas viewed family planning as the solution. Urban dayas believed in older age at marriage and smaller ideal family size than rural dayas (5 versus 7 children, with 3 boys to 2 girls). Most dayas believed there should be a two-year interval between marriage and the first birth and between births. Dayas generally were open to further training and to incorporation into the formal health care system.

84. LEBANON. Harfouche, Jamal K. Feeding Practices and Weaning Patterns of Lebanese Infants. Khoyats, Beirut, Lebanon, pp. 1-116, 1965.

A prospective study was done on the feeding practices and weaning pattern of 379 Lebanese mothers in the low-income group in 1960. Out of 379 mothers, 370 (97.6%) had planned to breast feed their infants during the prenatal period. At the age of 1 month, 96.8% of their infants were breast fed, either completely (78.7%) or partially (18.1%) and 9.5% continued to breast feed partially through the 18th month of life. The peak incidence of partial breast feeding (58.0%) was attained by the age of 6 months and only 9.9% of infants in the three groups were still completely breast fed at this time. 99.2% of the mothers fed their infants on demand. 91.8% of the infants were weaned gradually and 8.25% were weaned abruptly. None of the infants were abruptly weaned after the age of one year. The commonest causes of weaning were milk inadequacy or pregnancy. By the end of the 7th month, all infants but one were given water, fruit juices; beverages and soft drinks were usually given between 4-6 months. The highest frequency for starting cereals was between 4-6 months.

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85. LEBANON. Yaukey, D. Fertility Differences in a Modernizing Country: A Survey of Lebanese Couples. Princeton: Princeton University Press, 1961. pp. 55-59.

This study found the following rate of fertility and lactation by education and social background in Lebanon, see table below.

MONTHS NURSING PER CHILD BY SOCIAL BACKGROUND TYPE

Social Background Type	Number of Women	Total Fertility Rate	Months nursing per living child, with nursing unlimited by next pregnancy
Village, uneducated			
1. Moslem	184	7.43	18.9
2. Christian	76	8.16	15.5
City, uneducated			
3. Moslem	136	7.35	12.0
4. Christian	96	4.14	11.5
City, educated			
5. Moslem	49	5.56	10.6
6. Christian	107	3.44	7.0
TOTAL	648		

Mothers believed that prolonged lactation delayed pregnancy. However, the major involuntary cause of observed fertility differences was the age of marriage, which apparently overrode the effects of prolonged lactation. The study did not investigate contraceptive use.

86. SOUTHWEST ASIA. Cook, R. Nutrition and mortality of females under 5 years of age compared with males in the "Greater Syria" region. J. Trop. Ped. 10(3) Dec. 1964, 76-81.

The author presents evidence from Jordan, Lebanon, Syria and Palestinian Arab populations showing consistently poorer nutrition and higher mortality rates among girls than among boys in the 0 to 5 year age group. Under conditions of equal treatment mortality rates for males are known to be higher than for females. The author suggests that the marked cultural preference for male infants leads to uneven distribution of limited resources.

87. YEMEN. Allman, J. and Hill, A. G. Fertility, Mortality, Migration and Family Planning in the Yemen Arab Republic. Popul Stud 32(1): 159-172, 1978.

The paper presents an analysis of the current demographic situation in the Yemen Arab Republic using data from a 1972 survey of Sana'a City, the preliminary

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census results of February 1975 and a small survey of breast feeding and birth intervals conducted in April and May 1976. The data imply a very low expectancy of life at birth (less than 40 years) and a very high level of infant mortality, probably in excess of 200 per thousand. Fertility appears to be moderate by Middle Eastern standards; the crude birth rate is probably close to 45 per thousand and the total fertility rate is estimated at 6·8 for all women. Average duration of lactation ranged from 9 to 13 months depending on age of the mother and average length of amenorrhea was 5 to 8 months for the above lactation periods. Rural women and older women lactated longer than urban and younger women. An exception were the oldest group aged 35-39 years who breast fed an average of only 10 months. Partly responsible for the low level of fertility are the large numbers of males in the prime ages working outside Yemen. These temporary migrants are estimated to number 400,000. The natural increase rate of the Yemeni population is at present below two percent per annum but the rate is certain to rise as mortality is reduced, largely because of external assistance being used to improve public health. Surprisingly large proportions of clinic-attenders knew of and used one or more contraceptive methods (16% with marriage durations of 0-4 years were contracepting) and it is suggested that further extension of family planning services in Yemen may help to alleviate some of the problems which will arise as population growth accelerates.

88. BANGLADESH. Anonymous. Decline in Breast Feeding Endangers Infant Health, Leads to More Births Unless Contraception is Used. Int Fam Plann Perspect D:f 4(3):95-96, 1978. (See MALAYSIA)

89. BANGLADESH. Barhat-e-Khuda. Value of Children in a Bangladesh Village. In The Persistence of High Fertility: Population Prospects in the Third World, Vol. 2, ed. J. C. Caldwell. Family and Fertility Change, Changing African Family Project Companion Series, No. 1. Canberra: Australian National University, Department of Demography; and Ibadan: University of Ibadan, Sociology Department, 1977.

Despite severe malnutrition and overpopulation in rural Bangladesh, the author found that parents believed that large family size was beneficial to them particularly for providing old age support and that costs of children were not excessive. Almost half believed that boys and one-third believed that girls who did not attend school earned more than they cost by 11-14 years. This article, reporting a study in village Barkait in Comilla District, discusses the findings of an extensive survey of attitudes and children's work activities.

90. BANGLADESH. Cain, M. T. Economic Class, Economic Mobility, and the Developmental Cycle of Households: A Case Study in Rural Bangladesh. Paper presented at The Annual Meeting of the Population Association of America, 1978.

The author considers the relationship between the developmental cycle of households and their economic mobility in rural Bangladesh and proceeds to state two major assertions. First, in the current socioeconomic and demographic context of rural Bangladesh, a parental strategy of fertility maximization will tend to increase the chances of upward intra-generational mobility. Second, there are systematic economic class differences in family life cycle processes which contribute to widening the gap between rich and poor in rural Bangladesh.

The ways in whcih variations in the course of the household life cycle influence economic mobility are discussed. These include effects through child labor utilization, effects on the probability of property loss during economic crises, and effects on the probability of property loss at the time of household dissolution.

Data are presented which show economic class differentials in demographic factors affecting the course of the household life cycle. These include child and adult mortality and children's age at leaving the household. The implications of the analysis for population policy are discussed.

91. BANGLADESH. Chen, L. C. et al. A Prospective Study of Birth Interval Dynamics in Rural Bangladesh. Popul Stud 28(2):277-297, 1974.

A group of 209 married, fecund women in rural Bangladesh were studied prospectively for 24 months from 1969 to 1971 to define some of the biological and sociological factors relating to fertility performance. These women

were selected from a larger study population of 112,000 that had been followed with a daily house-to-house vital registration programme since 1966. The selected women were interviewed bi-weekly and were asked questions about menstruation, pregnancy, lactation, husband's occupational absences, and monthly urine tests for pregnancy were taken. The results for 193 non-contracepting women revealed that the seasonal pattern of births previously observed in this population could be associated with a corresponding seasonal pattern of conceptions and that this was due to a seasonal trend in fecundability. The highest conception rates were from January to June, which period includes the coolest months of the year. At this time food supplies were also relatively more adequate. Postpartum lactational amenorrhea was very prolonged, averaging 17 months for women with a surviving child. The appearance of the first postpartum menstrual flow (onset of ovulation) also had a seasonal trend which could not be adequately explained, although nutrition may have played a role because the seasonal period when menses most commonly returned started in November following the major rice harvest. The median waiting time to conception, once menstruation had resumed, was 8 months. This interval was influenced by seasonal fluctuations, as well as by the age of women and by husbands' absences. The foetal wastage rate was 15.0 per 100 conceptions, with 62% of the foetal losses occurring during the second month of gestation. Overall, the average birth interval was 33 months, with lactational amenorrhea accounting for almost 45% of this interval.

92. BANGLADESH. Chowdhury, A. K. M. A. Effect of Maternal Nutrition on Fertility in Rural Bangladesh. In Nutrition and Human Reproduction, ed. W. H. Mosley. New York: Plenum Press, 1978.

Prospective data was obtained on 643 Bengali women who had delivered and begun to menstruate (postpartum amenorrhea segment) and 483 of whom had conceived following reappearance of menstruation (waiting time to conception). The median duration of postpartum amenorrhea was found to be 17.9 months. The median duration of the menstruating interval between the end of amenorrhea and conception was 10.9 months. A multiple regression on the duration of postpartum amenorrhea yielded a positive correlation with age and hematocrit count, and a negative correlation with parity. A multiple regression on the duration of the menstruating interval yielded a positive correlation with age and husband's absence, and a negative correlation with parity.

No significant relationship was found between the nutritional indicators of height, weight and arm circumference and length of postpartum amenorrhea or the waiting time to conception. This study included only data on closed intervals which could have biased the measurement of fecundability by failing to delineate those women who could not conceive. The author has preliminary data to suggest that a higher percentage (17.6%) of women in lowest weight group (less than 38.5 kg) had not conceived in five years compared to higher weight groups (6.7 and 8.4%). However, analysis of these data had not yet been adjusted for age differences.

93. BANGLADESH. Chowdhury, A. K. M. A. et al. The Effect of Child Mortality Experience on Subsequent Fertility: Pakistan and Bangladesh. Popul Stud 30(2):249-261, 1976. (See PAKISTAN)

94. BANGLADESH. Chowdhury, A. K. M. A., Huffman, S. L., and Curlin, G. T. Malnutrition, Menarche, and Marriage in Rural Bangladesh. Soc Biol 24(4):316-325, Winter, 1977.

A survey of 1,555 girls aged 10 through 20 was conducted in a rural area of Bangladesh in March, 1976, to assess the impact of nutritional status on the onset of menarche and the association between age at menarche and age at marriage. In recent years there has been an increased age at onset of menarche which appears to have been associated with malnutrition caused by war, postwar inflation, floods, and famine in the period 1971-76. Body weight was highly correlated with the age of onset of menarche. A seasonal trend in onset of menarche was noted with the peak occurring in the winter months corresponding to the largest annual rice harvest. An increased age of marriage was also noted, which may be correlated with the increased age of menarche.

95. BANGLADESH. Chowdhury, Z. The Paramedics of Savar: An Experiment in Community Health in Bangladesh. Development Dialogue 1: 41-50, 1978.

The People's Health Centre is situated in rural Savar, some 30 miles from Dacca. It was set up in 1972, following the war of liberation, by a group of Bengali doctors. The Centre has gained an international reputation as an example of integrated development: none of the familiar problems (health, family planning, food, even poverty) are dealt with in isolation. Health, however, dominates the activities of the Centre. Better health means lower birth rates in one of the world's most heavily populated countries. Better health demands better nutrition, higher incomes, greater emancipation of women. Most of the Centre's 44 paramedics are women. Few have received extensive medical training and half at least come from the actual area. Their job is to promote as much as to heal. However, the scheme has not been without its setbacks. In 1976, a key paramedic was murdered in one of the local villages -- illustrating the kind of opposition to pioneering health that exists among the wealthy elite, and not least among the quack doctors, in the villages.

96. BANGLADESH. Huffman, S. L., Chowdhury, A. K. M. A., Chakraborty, J., and Mosley, W. H. Nutrition and Post-Partum Amenorrhea in Rural Bangladesh. Popul Stud 32(2):251-250, 1978.

A study was conducted among 2048 lactating, noncontracepting, and nonpregnant women from 86 rural villages in Bangladesh. The study confirmed the very long period of lactational amenorrhea in rural Bangladesh. The median length of postpartum amenorrhea among lactating women was 18-20 months. Maternal age was positively correlated with amenorrhea duration, older women remaining amenorrheic longer than younger women. Maternal nutritional status did not significantly affect the length of postpartum amenorrhea: the mean postpartum interval was 17.4 months for the "low nutritional status group" (average weight was 37.14 kg); 17.1 months for the "median nutritional status group" (average weight was 40.83 kg); and 17.3 months for the "high nutritional status group" (average weight was 44.84 kg). Average height was identical (147.8 cm) for each group. Breast feeding practices were, in fact, found to be the main determinant of postpartum amenorrhea. For this reason, socioeconomic status was found to be related to postpartum amenorrhea because it affects breast feeding practices. Improved supplemental infant foods led to decreased frequencies of durations of breast feeding and, subsequently, shortened birth intervals.

97. BANGLADESH. Huffman, S. L., Chowdhury, A. K. M. A., and Sykes, Z. M. Lactation and Fertility in Rural Bangladesh. (Popul Stud December 1978.) Presented at Annual Meeting of Population Association of America, April 1978, Atlanta, Georgia.

Analysis of data from three phases of a study on postpartum amenorrhea in rural Bangladesh (Matlab Thana) illustrated good aggregate consistency of response on menstrual status, but less individual consistency on duration of postpartum amenorrhea. Using life table techniques, the median duration of amenorrhea was calculated as 19.9 months for women with births from February to September 1974. The seasonal trend in return to menses had a substantial influence on duration, with the median duration decreasing from 21.5 months for women with February births to 16.9 months for those with September births. Seasonal pattern is similar for all weight groups. By contrast, the median duration of postpartum amenorrhea for women weighing less than 38 kg (approximately the lowest quartile of the distribution by weight of the sample) was 21.1 months compared to 19.3 months for women weighing 44 kg or more (approximately the highest quartile). Nutritional status affects duration of postpartum amenorrhea to a lesser degree than does seasonal pattern. The cause of seasonality in resumption of menses is not determined, but the authors speculate that factors associated with the harvest contribute to the pattern.

98. BANGLADESH. McCord, C. Integration of Health, Nutrition, and Family Planning: The Companiganj Project in Bangladesh. Food Research Institute Studies 16(2):91-105, 1977.

The Companiganj Project was conducted by the Bangladesh government with outside aid to demonstrate how nutrition, health and family planning programmes in rural areas might be integrated. The training programme for project personnel began in 1973 and the full programme has been in operation since 1975. However, the obstacles to change are strong and by the end of 1977 there was little evidence of improvement at the village level: there has been little general acceptance of the concept of integration and most of the government civil service system is run by university-educated urban-oriented officers, which makes community participation difficult. The main success of the project lay in identifying and training people to carry out health work in rural areas: local women proved to be keen recruits, and illiterate women were in many cases the most efficient workers.

99. BANGLADESH. Schultz, T. P. Retrospective Evidence of a Decline of Fertility and Child Mortality in Bangladesh. Demography 9:415-430, 1972.

A detailed analysis of survey data collected in 1961-1962 for a sample of 4200 families in central East Pakistan produced consistent and reasonable estimates of birth and death rates for the preceding decade. Extremely high levels of infant and child mortality declined noticeably in the period 1952-1961. Age-specific birth rates to married women also decreased in the decade for women over the age of 19, while a small increase was recorded for married women aged 15 to 19. During the 1950's total marital fertility declined about one-fifth. Birth rates remained high in 1960 according to these estimates, but there is reason to anticipate further reductions in birth rates, particularly among older women. To improve understanding of the determinants of fertility and to aid in the formulation of policy to cope with population trends, statistical analysis must increasingly consider information on families over time. Retrospective household survey data may provide the empirical base for this line of inquiry. In rural areas where 95% of the East Pakistani live, the retrospective estimate of the infant death rate fell from about 170/1000 in 1952 to 150/1000 live births in 1961. The average total number of children born to all cohorts of women over the age of 34 was about six; yet because of the exceptionally high death rates, the median number of children still alive to these women in 1960 was about three. (By 1962, 3/4 of the women aged 30-34

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and older already had three living offspring. Continued high fertility among these older women will lead them to have more living children than the previous generation had.)

100. BANGLADESH. Stoeckel, J. and Chowdhury, A. K. M. A. Pregnancy Termination Intervals in a Rural Area of Bangladesh. Demography 11(2):207-214, 1974.

Pregnancy termination intervals, i.e., live birth to live birth (LB-LB), live birth to fetal loss (LB-FL), and fetal loss to live birth (FL-LB), are analyzed prospectively between 1966 and 1970 in a rural population (117,000) of Bangladesh. Results indicate that the mean LB-LB interval was almost 30 months, the LB-FL interval 27 months, and the FL-LB interval 18 months. In addition, postpartum amenorrhea was estimated to be about 13-14 months, and the time added by a fetal loss to a LB-LB interval about 15 months.

No relationship was found between LB-LB intervals and the number of living or dead children.

101. BANGLADESH. Swenson, I. Early Childhood Survivorship Related to Subsequent Pregnancy Spacing. J Trop Ped 24(6):103-106, 1978.

The analysis uses data from a population in Matlab Thana in rural Bangladesh where lactation is prolonged, nutrition limited, medical care is essentially absent, and both fertility and mortality rates are high (unspecified). The sample consists of 17,066 live births that occurred between 1966 and 1970 who: 1) were alive at the end of the first year of life; 2) could have reached age 3 by the end of the follow-up; 3) had a life span longer than the subsequent birth interval; and 4) were the first pregnancies of a closed interval. Childhood mortality is significantly higher among children whose birth is followed by another pregnancy in less than 12 months compared to those whose birth is followed by another pregnancy in more than 12 months. This relationship is apparent when the second pregnancy of the interval results in a live or a non-live birth. These results suggest that a second closely spaced pregnancy adversely affects the older child even when the second pregnancy does not terminate as live birth which competes for breast milk and other maternal attention. The period of competition from the second closely spaced pregnancy does not appear to have a significant effect on the survivorship of the older child. However, children followed by a short interval and a live birth have a higher mortality than children followed by a short interval and a non-live birth. After adjustment for previous child losses, there were no significant associations between pregnancy order, age of mother and infant and childhood mortality, or between fetal death, pregnancy order and age of mother.

102. INDIA. Anand, D. and Rao, A. R. Feeding Practices of Infants and Toddlers in Najafgarh Area. Indian Journal of Child Health 11:172-181, 1962.

The study was made at the township of Najafgarh and at the village of Mitraon. Nearly all the mothers, 84% in town and 90% in the village, gave their infants their first feed "ghutti," which was usually sugar and water; few gave reasons why except that it was customary. Only 24% of the mothers gave the first breast feed at 6 to 12 hours after birth, 38% did so on the third day, and 3% on the fourth day. Feeding was usually irregular and on demand thereafter.

Supplementary feeding with diluted buffalo's, cow's or goat's milk or a combination was used by 66% of mothers in the town and 63% in the village. More than half the mothers in both places gave no solid food in the first year, but 42% started in the second 6 months. In the village, 75% of the mothers said that they preferred to start the child directly on adult foods rather than cook special dishes for them; of the others, most made special dishes only if the child was unwell. Fruit in season was given by 75% of mothers in Najafgarh and 71% in Mitraon.

103. INDIA. Anker, R. The Effect of Group Level Variables on Fertility in a Rural Indian Sample. J Devel Studies, 14:63-76, 1977.

This paper studies reproductive behaviors (ideal family size, completed family size and family planning acceptance) in a rural Indian area which was rapidly industrializing. Two castes and eleven villages were sampled. It was found that family planning was quite common and that fertility differentials among couples were related to the couples' unique socioeconomic characteristics as well as to two group level variables (caste and village). The latter result was shown to be statistically significant for all three measures of reproductive behavior, even after many unique socioeconomic characteristics and attitudes of each couple were accounted for statistically.

104. INDIA. Bai, K. and Vijayalakshmi, B. Age of Menarche in South Indian School Girls, Tirupati (A.P.). J Trop Ped 24(4):171-175, 1978.

The distribution of the age of menarche was studied among 1,698 school girls in Tirupati, Andrah Pradesh, South India. The girls, aged 10-18 years (specifically: 120-215 months since birth) were from poor (Rs 300/month or less) and not-poor (Rs 300/month or more) households. The survey took place in May, 1973. The probit curve appears to fit the data better than either the gamma or logistic curve. (The logistic curve was a good fit in a study of South African Bantu school girls by Burell and coworkers -- Hum Biol 33:250-261, 1961.)

In the present study, the mean age of menarche was 13.5±0.037 for the non-poor group and 13.94±0.092 for the poor group. Season had an effect on maturation with the majority of girls attaining menarche during the hot months -- from May to August.

105. INDIA. Baxi, P. G. A Natural History of Childbearing in the Hospital Class of Women in Bombay. Journal of Obstetrics and Gynecology of India 8:26-51, 1957.

The reproductive histories of 529 women are analyzed using interview recall data. The interrelation between the period of postpartum amenorrhea, resumption of menses following childbirth, and the duration of lactation is discussed. Baxi found that mothers who nursed their babies experienced an amenorrhea which was 6.7 months longer than mothers who did not nurse. Among the former, lactation inhibited the resumption of menses an average of 12-51 months.

106. INDIA. Belavady, B. Nutrition in Pregnancy and Lactation. Indian J Med Res 57:63-74, Aug. Supplement, 1969.

A survey was done covering different parts of South India, tracing the patterns of breast feeding and weaning. It was found that breast feeding was usually started within 2 or 3 days after delivery and was continued into the second or third year after birth. Among poorer communities, it was found that 92% of the infants were breast fed at the age of six months and one child in every five was at the breast beyond 2 years of age. In a study of the hill tribes of South India, it was found that the majority of mothers continued breast feeding until at least the end of the second year. A study of some rural communities found that more than 50% of the children were at the breast at the age of 3 years.

107. INDIA. Biswas, S. A Study of Amenorrhea after Childbirth and its Relationship to Lactation Period. Indian J Public Health 7(1):9-14, 1963.

A sample of 500 mothers, residents of Calcutta City, who had been in the hospital for childbirth or miscarriage were monitored by nurse investigators for 1 year following their discharge. It was concluded that during amenorrhea the chance of conception was almost negligible in comparison to the postamenorrhea period. By the 12th month 40% of nursing mothers were still amenorrheic compared to 4.75% of the mothers who miscarried.

108. INDIA. Ghosh, B. N. Feeding Habits of Infants and Children in South India (On 600 Families). Ind J Med Res, 54:889-897, 1966.

In South India, 600 mothers with children under three years were interviewed to determine their beliefs on ideal infant feeding and their actual practice and customs. Most mothers start breast feeding on the third day after delivery and continue until the infant is two years old. Supplementation with other liquid foods is started about 6 months -- 33% using fresh cow's or buffalo's milk. Solid food is introduced between 1-1.5 years; 43% use rice, 22% use rice and another cereal, 3% use meat, fish or eggs.

109. INDIA. Gopalan, C. Malnutrition Among Infants and Young Children in India. J Trop Pediatr 3:3-12, 1957.

A study of malnutrition among pregnant women in South India revealed that the mothers were able to produce breast milk, at least for the first few months after delivery. Some mothers had considerable milk in the 18th and 24th months of lactation. Supplementary feeding of infants is often started in the 6th month. These supplements are mostly unmodified versions of the adult diet and consist almost entirely of cereal gruel and occasional vegetables. Milk, meat, eggs do not figure to any appreciable extent in these supplementary foods.

110. INDIA. Gopalan, C. Studies on Lactation in Poor Indian Communities. J Trop Pediatr 4:87-97, 1958.

A group of fourteen lactating Indian women were studied to obtain information about 1) the extent to which breast milk contributes to the infant's nutrition, 2) whether improvement in quality and quantity of breast milk was possible, and 3) the effects of prolonged breast feeding on the mother's nutrition. Women breast feed their children for nearly two years and feeding is almost always on demand. Infant growth was adequate during the first 6 months of total breast milk diet, but when rice gruel was supplemented after the sixth month, growth became progressively inadequate. Breast milk gave 60% of the infant's protein intake between 6 and 12 months and 35% from 12 to 18 months. An increase in the mother's dietary protein by 30g daily increased milk output; however, protein content of the milk decreased. Nitrogen retention increased as protein intake increased, and nitrogen balance studies showed that the women needed 0.15g nitrogen/kg body weight/day, requiring 1.5g protein/kg body weight/day. The problem of infant feeding in poor communities is to ensure adequate improvement of the maternal diet to maintain lactation at the current level but without maternal protein depletion.

111. INDIA. Greaves, J. P. and Donoso, G. Relevant Health and Nutrition Education. Food & Nutrition, 2(3):14-18, 1976.

Health and nutrition information relevant to the poorer sections of the community in India is discussed. An important point to convey is that the first two years of life are a most vulnerable period. The child is totally dependent on others for his nutrition. An increase in the family income will make little difference unless the mother's understanding of her child's needs is improved. The following six points have universal validity: 1) Breast feed as long as possible with extra food from age 4 months on; 2) feed only clean food and water from clean utensils; 3) seek immediate help from available resources if the child falls ill and give child sugared water or weak tea; 4) get the child immunized; 5) a pregnant or nursing mother should eat four times a day including dark green or yellow vegetables; and 6) two or three healthy children are enough. The fact that breast feeding reduces the chances of conception is an important reason for prolonging it. Spacing children will allow the mother better nutrition which will carry on to her children.

112. INDIA. Jusadeson, V. and Ambujadevi, K. R. Relationship Between Socio-Economic Factors, Demographic Characteristics and Nutritional Status of Pregnant, Lactating and Weaning Mothers. J Fam Welfare, 25(1):3-19, Sept. 1978.

Twenty-two villages in 3 contiguous blocks of Mahabubnagar District of Andrha Pradesh, India, were randomly selected for study in order to examine the various factors that determine nutritional status of 501 pregnant, lactating and weaning rural mothers. The women were married, and their mean current age was 26. A causal model was proposed that postulated that socioeconomic status, demographic factors, and family structure determine fertility behavior and nutritional status.

After other variables were controlled, women in nuclear families had more pregnancies than women in joint families. Independent of the effect of number of pregnancies, older women displayed more severe nutritional deficiencies than younger women. However, in each of the age categories, the higher the parity the worse was the nutritional deficiency. Only 11% of the women did not exhibit some sign of malnutrition. When other factors were held constant, women from lower socioeconomic status were more malnourished than women from higher levels of socioeconomic status. The number of food taboos contributed significantly to iron deficiency. Vitamin A deficiency was not correlated with fertility

behavior, but Vitamin B deficiency increased with number of pregnancies. The study concludes that although cultural norms regarding food and pregnancies may have an impact on nutritional status, nutritional status will fail to improve unless the standard of living is increased.

113. INDIA. Jyothi, K. K. et al. A Study of the Socio-Economic Diet and Nutritional Status of a Rural Community Near Hyderabad. Trop Geogr Med 15:403-410, 1963.

Infants of families living 20 miles from Hyderabad were breast fed after the third day postpartum. The first supplement was usually introduced between 1 and 2 years and breast feeding stopped between the 2nd and 4th year. In the well-to-do families, the first supplement given to infants was cooked rice with salt, milk and ghee. Among the poorest sections, the same supplement was given without milk and ghee -- which was replaced by ground nut oil. Not uncommonly, babies were straightaway placed on the adult spicy food when weaned.

114. INDIA. Kamat, M. Diet and Fecudnity in India. In: International Planned Parenthood Federation (IPPF), the Sixth Internatl. Conf. on Planned Parenthood. Theme: Family Planning: Motivation and Methods, New Delhi, India, Feb. 14-21, 1959. London, IPPF. pp. 114-121. 1959.

Data collected from a survey in Bombay by the contraceptive testing unit have suggested an explanation of the following 3 points regarding fertility: 1) that fertility was higher among affluent groups than among the lower classes as judged by live births to ever married women at least 45 years of age; 2) that the average interval between births in India was longer than that in European countries prior to the popularity of birth control practices; and 3) that fertility rates for Indian women over 35 years of age were lower than those for European women of the same age category 100 years ago. Chronic semi-starvation prevelent in India was found associated with decrease in libido, slightly shorter fertility periods in women and longer periods of infertility following delivery, attributed by this study to protein starvation. This study does not consider lactation effects.

115. INDIA. Karkal, M. Infant and Child Mortality in Maharashtra - India. International Institute for Population Studies, Deonar, Bombay. Paper presented at The Annual Meeting of the Population Association of America, 1980.

In India registration of vital events is not satisfactory. Compared to the data in many other states, those in Maharashtra are better. With the help of data on age-sex distribution, from censuses and those from vital registration, estimates were made for infant and child mortality in Maharashtra and its rural and urban areas. With over 95% of registration of vital events in Greater Bombay more detailed analysis of these data has been possible.

In ages 1 to 4 and 5 to 14 mortality was higher in rural areas compared to urban areas. Deaths for female children were much higher than those for males indicating their neglect.

Data on causes of deaths were available from urban areas. Large numbers of infants died of congenital malformation, birth injury, etc. Di rrhea, dysentry and infective diseases were next in importance. There was a rise in deaths due

to respiratory diseases. Nearly 17% of child deaths (5-14) were from accidents, violence and poisoning.

116. INDIA. Kaur, P. et al. Correlation of Amenorrhea with Age, Parity and Lactation. J Fam Welfare, 23(2):40-44, Dec. 1976.

The present study was conducted with 535 currently married women in the reproductive age group in a slum area of Varanasi to study the relationship of amenorrhea with age, parity and lactation. Amenorrhea and age were found to be significantly related as shown by the simple correlation coefficient of 0.068 ($P<0.01$). No relationship between amenorrhea and parity was found while amenorrhea and lactational period were strongly related as indicated by statistical tests, when age was taken as a constant.

117. INDIA. Kishore, N. et al. Post Partum Vaginal Smear in Lactating and Non-Lactating Women. J Obstetr & Gyn of India 26(5):747-751, Oct. 1976.

A study was conducted in India to study vaginal smears of lactating and non-lactating women to determine the return of ovulation. One hundred twenty-five cases of postpartum amenorrhea were studied, 100 lactating and 25 non-lactating. Maturation index, maturation value, and karyopyknotic index were used to evaluate the smears; and the estrogenic effect of vaginal epithelium was studied according to colpocytological count obtained from smears. An atrophic type of smear was obtained in the immediate postpartum period: the malignant-like changes returned to normal in time. The cornification index increased for one year, but if lactation was prolonged it fell slightly. The ovaries started functioning much earlier in the non-lactating women than in the lactating women. The return of ovarian activity was later in multiparous than in primiparous women. The low nutritional status group experienced a later return of ovarian activity compared to the fair or good nutritional group. In lactating women ovulation occurred in 10% of the cases during amenorrhea and in non-lactating women it occurred in 16% of the cases.

118. INDIA. Kora, S. J. Effect of Oral Contraceptives on Lactation. Fertility & Sterility, 20(3):419-423, 1969.

The effect of the oral contraceptive (OC) Ovulen during lactation was studied in Bombay in 62 women who had participated in a pre-OC study for three weeks and then took OCs for a subsequent five weeks. The average amount of test feed during the first three months was significantly higher in the pre-OC group than in controls (P less than .01), while the average infant weight gain was almost the same. During the subsequent five week study, both the average amount of test feed and the average infant weight increase were significantly lower in the OC group than in controls (P less than .01). It is concluded that the use of Ovulen in this series resulted in a reduction in milk production and infant weight gain.

119. INDIA. Lala, V. R. and Desai, A. B. Feeding of Newborns and Infants (Cultural Aspects). Pediatric Clinics of India 5:191-197, 1970.

Women in a postnatal ward in Ahmedabad were interviewed with a questionnaire; 410 completed the study. Most put the infant to the breast within 12 hours after birth. The average duration of breast feeding was over 3 years. Most gave the first supplements of solid food or milk between ages 1 and 1.5 years.

120. INDIA. Loebner, H. and Driver, E. D. Differential Fertility in Central India: A Path Analysis. Demography, (1):329-350, 1973.

This study is one of the few multivariate path analyses of the relations of several demographic and socioeconomic variables to fertility and the use of contraception. For fertility, 56 of the 92 hypothesized paths are found to be significant at the .05 level or better. The five variables having a significant and direct effect on fertility, as shown by their path coefficients (p) are: duration of marriage (p=.721), spouse's cohort (p=-.093), spouse's age at marriage (p=0.52), caste (p=-.071), and number of siblings of husband (p=.050). The use of contraception is affected by, in order of importance, the spouse's education (p=.267), the husband's education (p=.099), the husband's income (p=.089), and surplus children, i.e., number of living children exceeding ideal number of children (p=.059). Child mortality, which is linked to number of living children and thus indirectly to surplus children, is affected by, in order of importance, the number of children ever born (p=.723), the husband's education (p=-.166), the spouse's absence by death or separation (p=.084), and family structure (p=-.035). The advantages and disadvantages of path analysis for this type of research are briefly mentioned.

121. INDIA. Malkani, P. K. and Mirchandani, J. J. Menstruation During Lactation. Journal of Obstetrics and Gynaecology of India 11:11, 1960.

The relation between duration of lactation, amenorrhea, and the use of supplemental milk is reported for 282 women. It was demonstrated that the earlier supplemental milk was given, the sooner menstruation resumed.

122. INDIA. Mudkhedkar, S. M. and Shah, P. M. The Impact of Family Size on Child Nutrition and Health. Indian Pediatr 12(11):1073-1077, 1975.

A random sample of 163 rural and urban families was chosen from a rural community around Palghar, 87 km north of Bombay, and in the metropolis of Bombay. Sixty-seven percent of the Palghar families were rural while 32.8% were urban, close to the actual rural-urban distribution in Maharashtra State. In the city, the sample was selected among the chawl population, as these represent 74% of the population in Bombay. Only families having at least one living child under five years of age and where both parents were alive were chosen for the investigation. Obstetric and dietary histories as well as 24-hour dietary recall were obtained. The "typical" rural family averaged 6.3 members including 3 adults and 3.3 children (of whom 1.6 were aged under five). The "typical" urban family averaged 7.1 members including 4 adults and 3.1 children (of whom 1.5 were aged under five). Nutritional status of the under-fives was studied in relation to family size. 64.2% of children in "small" families (3-5 children) and 62.5% of children in "large" families (more than 6 children) in the rural community showed malnutrition and weighed less than 70% of the

Harvard standard. The difference in weights among the two groups was significant ($p<0.001$). 12.5% of the children in small urban families weighed 70% or less against 25.0% of children in large urban families. In the rural group, 54.2% of children from one-child families and 60.8% of children from families with three children were moderately (weighed about 61-70% of standard) or severely malnourished (60% less of standard). Among the urban community the trend was similar, with 23.1% of children from one-child families and 45.4% of those from families with three children being moderately or severely malnourished. On the whole, 29.1% of children in one-child families were anemic versus 39.1% in families of three children. In rural areas this trend was more pronounced: the figures being 23.3% and 54.5% respectively. When rural and urban groups were combined, there was no significant difference in total caloric intake among children of small (<3 children) and large (>3) families. 15.6% of children in small families ate less than 80% of the protein requirement against 50% in large families. This was significant ($p<.01$). The mortality rate for children under five of small families was 0.3% against 10.2% for those of large families. The proportion of neonatal and/or infant mortality did not differ significantly in small vs large or urban vs rural families; infant mortality, however, was significantly lower in the urban sample than in the rural sample, irrespective of family size ($p<.01$).

123. INDIA. Mudkhedkar, S. M. and Shah, P. M. The Effect of Spacing of Children on the Nutrition and Mortality of Under-Fives. Indian J Med Res 64(7):953-958, 1976.

The relationship between the birth intervals of under-fives in 164 families and their nutritional status and mortality rate was studied in Bombay and nearby rural communities. When the birth interval of under-fives was one year or less, there was a high prevalence of moderate or severe malnutrition and much higher infant and neonatal mortalities in comparison with under-fives whose birth intervals were from three to four years. When the interval was more than 24 months the number of older siblings weighing above 70% weight for age was 1.9 times the number when the interval was less. Neonatal and infant mortalities were both lowest for birth intervals from 36 to 48 months. When the prevalence of malnutrition and the mortality rate of young children are both high, emphasis should be placed on the spacing of children so that birth occurs at intervals of three years.

124. INDIA. Parker, R. L. et al. The Narangwal Experiment on Interactions of Nutrition and Infections: III. Measurement of Services and Costs and Their Relation to Outcomes. India J Med Res 68 Suppl: 42-54, Dec. 1978.

This paper reports on 5 years of field research undertaken in 26 villages in Punjab, India with a population of about 25,000 people. Funded by numerous Indian and international agencies, and using a staff of 200, the Narangwal experiment was an important investigation on the cost-effectiveness of low cost health nutrition and family planning service delivery in rural areas. Sample findings reported in this paper (one of many papers reporting the project results) include comparisons of the cost of different programs relative to each death averted. The researchers found that prenatal child care (averting stillbirths) was the most economical intervention ranging in cost from Rs. 570 to Rs. 1010 for each perinatal death averted. Stillbirths were less expensive to prevent than infant deaths while the latter were one-seventh as expensive to prevent as child deaths. The cost of providing nutrition and health services to children under three in the Narangwal nutrition project were about Rs. 150 per child or Rs. 14 per capita per year. This cost was close to what

the Government of India was currently spending in primary health centers, making the Narangwal experiment relevant to widespread use in India.

125. INDIA. Potter, R. G. et al. Lactation and its Effects upon Birth Intervals in Eleven Punjab Villages, Inda. J. Chron Dis. 18:1125-1140, 1965.

In the Punjab villages of the Khanna study, lactation substantially prolonged postpartum amenorrhea. When an infant survived one month or more, lactation usually lasted well over a year, and the median length of postpartum amenorrhea was 11 months. Whereas if the child was stillborn or died in the first month of life the mother did not lactate and the median length of postpartum amenorrhea was in the vicinity of 2 months. From an unfinished analysis of data from the Khanna study involving 'partly retrospective' as well as 'entirely prospective' and 'truncated prospective' data from 1500 couples, it was estimated that the mean length of postpartum amenorrhea following a live birth was 11 months while that for menstruating intervals was 10 months. It was further estimated that without contraception the mean menstruating interval would be one or two months shorter. The average prolongation of birth intervals by pregnancy wastage was gauged at 2 months. These 11 months of postpartum amenorrhea, 9 months of gestation, 8 months of menstruating interval (in the absence of contraception), plus 2 months added by pregnancy wastage sum to 30 months.

If allowance was made for anovulatory cycles and for the limited contraception practised by the Khanna study couples, then their mean ovulatory exposure may be estimated as 6 or 7 months. Roughly half of the average prolongation of birth intervals by pregnancy wastage was composed of ovulatory exposure. Given all the above assumptions, the ratio of ovulatory exposure to average birth interval without contraception becomes 7:30. This result means that even if contraception was 50% effective and was doubling ovulatory exposure, it would be augmenting the total birth interval by a factor of only 7/30, or less than 25%. As mothers passed from their early twenties to their late thirties and early forties fetal wastage doubled and menstruating intervals and length of postpartum amenorrhea lengthened substantially.

126. INDIA. Potter, R. G., Jr., New, M. L., Wyon, J. B., and Gordon, J. E. A Fertility Differential in Eleven Punjab Villages. The Milbank Memorial Fund Quarterly, Vol. XLIII, No. 2. Milbank Memorial Fund, 40 Wall Street, New York, NY 10005, April, 1965.

In a rural population of about 12,000 in the Punjab, India, a moderate fertility differential was found between the two numerically dominant caste groups, namely, the Jat farmers who compose about half of the population and the Chamar leather workers who compose another quarter. Data come from the India-Harvard-Ludhiana Population Study, also known as the Khanna Study.

Jat wives aged 45 years or older averaged about one child less than corresponding Chamar women. Among wives of childbearing age, Jats had lower fertility than the Chamars at all ages. This last differential appears to have depended partly on the Jats' higher rates of fetal wastage and partly on their earlier stopping of pregnancies. The two caste groups reported essentially the same amount of practice of contraception, and their similar distributions of intervals from end of postpartum amenorrhea to next conception also rule against the idea of appreciably differing contraceptive practice. A practice of induced abortion is tentatively inferred from the Jats' consistently higher

rates of fetal wastage. The basis of their earlier infertility remains uncertain. Several factors may be involved, including contraception and the sterilizing effects of crude abortions.

127. INDIA. Potter R. G., Wyon. J. B. New, M., and Gordon, J. E. Fetal Wastage in Eleven Punjab Villages. Hum Biol 37(3):263-273, 1965.

The India-Harvard-Ludhiana Population Study (Khanna Study) collected detailed pregnancy and menstrual histories during monthly home visits, over a period varying from 3 to 5 years, from a village population of roughly 12,000 in the Punjab, India.

An overall rate of 100 abortions and 30 stillbirths per 1000 pregnancies was obtained, based on a total of 1765 pregnancies. The abortion rate, while more than five times higher than that reported by the respondents retrospectively, is still believed to be an underestimate of the true incidence of spontaneous abortion among the Khanna Study villagers. The chief limiting factor appears to have been the unwillingness and incapacity of the respondents to report early symptoms of pregnancy. The observed increase in rate of fetal losses with advancing age of mother was the same order of magnitude as found in a recent United States study.

128. INDIA. Ram, E. R. Des services de santé integrés. Le Projet Miraj en Inde. (Integrated health services. The Miraj project in India). Carnets de l'Enfance, Assignment Children 39:15-32, 1977. Abridged version of a paper presented at the UNICEF Special Meeting on the Situation of Children in Asia, Manila, May 17-19, 1977.

The Miraj project was undertaken in a rural district of Maharashtra State with the objective of providing primary health care services to all sections of the community by evolving an effective infrastructure out of existing facilities. The first phase of the project was the training of the local health personnel. Following a one-week course for the trainers, including the medical officers of the three primary health centres, all the uni-purpose workers (vaccinators, sanitary inspectors, nurses, midwives, etc.) underwent a six-week course to enable them to serve instead as integrated health workers in charge of: nutrition education; immunization programmes; examination of all children under five years of age, and regular follow-up of those suffering from malnutrition; provision of simple medical care, referring more difficult cases to the primary health centres; family planning; and yearly examinations of all school children. The evaluation survey conducted in January and February of 1976 revealed that this combination of preventive and curative medicine led to a significant of preventive and curative medicine led to a significant reduction of the infant and neonatal mortality rates, and a decline of over 60% in the incidence of scabies, diarrhea, and ascariasis.

129. INDIA. Rao, K. V. and Gopalan, C. Nutrition and Family Size. J Nutr & Dietet, 6:258-266, 1969.

A 1969 study in India was made to assess the effects of family planning on the nutritional status of the women and children. Methods used were seven day diet surveys, nutrition surveys, anthropometric data, hematological surveys, and hospital statistics. Results of the diet survey showed that 2-adult families with three or fewer children had significantly greater ($P<.01$) dietary

amounts of both protein and calories than those with four or more children. Hemoglobin levels in the last trimester were significantly higher ($P<.02$) among pregnant women who had had three or fewer pregnancies than those with four or more. Nutritional deficiency signs were higher for the latter group ($P<.01$). Signs of nutritional deficiency were found in significantly more ($P<.0001$) children in the fourth birth order or higher than in those of earlier birth orders. Anthropometric measurement in preschool children of lower birth orders were higher ($P<.001$) than for children of later birth order. Child care and duration of lactation were also better for children of lower birth order.

130. INDIA: Roberts, D. F. et al. A Study of Menarcheal Age in India. Ann Hum Biol, 4(4):171-177, 1977.

The question of whether climate has an influence on the age of menarche is frequently asked. However, since there is a lack of adequate birth registration in tropical countries, the adolescents' exact ages cannot be determined. In some regions of Southern Asia, however, careful entries are made regarding the date and even the hour of the birth of girls, as well as date and hour of their first menses, in order to establish their horoscope. This type of record was used in Warangal, located at 18° northern latitude, where several populations were studied according to their diet and different social classes; elaborate statistical analysis (logit) was performed. The age of menarche varies from 12.9 to 13.7 years, depending on the social class. These ages are a little different from those of adolescents of Colombo studied in 1950, but are significantly lower than of girls in rural Ceylon (12.8 and 14.4 years, respectively).

131. INDIA. Rosenzweig, M. R. Educational Subsidy, Agricultural Development and Fertility Change. Paper presented at The Annual Meeting of the Population Association of America, 1979.

The major focus of this paper is on testing the hypothesis that the introduction of "refueling" agricultural technical change in the rural LDC context alters household decisions regarding the allocation of resources between increments to family size and to schooling. A household survey from rural India, which distinguishes households by their exposure to agricultural development programs promoting the technologies associated with "green revolution," is used as the principal data base. Maximum likelihood tobit procedures are employed to estimate the development program effects on a measure of birth flows standardized for age-patterns of fecundity and age-standardized school enrollment rates for farm and landless households. The empirical results suggest that farm households exposed to the new technologies reduced their fertility and increased the allocation of resources to schooling despite the concomitant rise in the demand for unskilled labor. No such response is observed, however, among landless households in the same locations when income effects of the technologies are controlled for.

132. INDIA. Saxena, P. C. Breast Feeding: Its Effects on Post-Partum Amenorrhea. Social Biology, 24:45-51, 1977.

Data is presented on lactation and postpartum amenorrhea for 323 women in Banaras, India, ages 15-35, who had one live birth and for 250 women with two live births. Data on prolonged breast-feeding habits and amenorrhea show that the mean duration of lactation is 15.5 months and postpartum amenorrhea is 6.01

months after the first birth. It appears that an increase in the duration of breast feeding is accompanied by an increase in the length of postpartum amenorrhea. The average period of amenorrhea was shorter in cases where lactation ceased because of infant mortality under age three months. Lactation and postpartum amenorrhea had coefficients of correlation of 0.275 and 0.257 in the case of first and second births respectively.

133. INDIA. Schultz, T. P. Indirect Measurement and Analysis of Sex Specific Child Mortality: Interpretation of District and Household Data for Rural India in 1961 and 1970. Paper presented at The Annual Meeting of the Population Association of America, 1980.

Differentials in sex specific child survival vary substantially across societies, but because measurement presents difficulties, hypothesis testing as to the cause for this variation has not made much progress. This study proposes an indirect measure of sex specific mortality in childhood as an indicator of intrafamily allocation of resources between the sexes, and seeks to explain it in terms of (1) household wealth that contributes equally to the survival of both boys and girls, and (2) expected employment and earnings opportunities of the adult men and women in the locality. Implications of the framework are tested against parallel Indian data at two levels of aggregation -- 311 districts from the 1961 census and 1300 households from a 1970 survey. Expected earnings and employment of women are associated with relatively improved survival prospects for girls; increased wealth levels have similar effects. Religion (Muslim) affects women's roles in the labor market and only thereby affects sex specific mortality differentials among children.

134. INDIA. Sehgal, B. S. and Singh, S. R. Breast Feeding, Amenorrhea, and Rates of Conception in Women. Mimeographed. Lucknow, India: Planning Research and Action Institute, 1966.

Data were gathered from 886 rural Indian women. The normal duration of lactation was 22.6 months and the average period of amenorrhea was 12.5 months. Contraceptive value of breast feeding is compared with that of artificial methods and the author concludes that breast feeding has an important role to play in family planning programs.

135. INDIA. Seth, V. and Ghai, O. P. Feeding Habits of Infants and Preschool Children in the Urban, Semi-urban and Rural Community. Indian Pediatr 8:452-455, 1971.

In the three places studied around Delhi, almost all infants were breast fed. By the age of 1 year, 36.8% of the urban, 4.5% of the semi-urban and 2.1% of the rural children were completely weaned. By the age of 9 months artificial feeding supplemented breast feeding in 75% of the urban and 57.1% of the rural children. Solid foods were introduced before 9 months in 24.5% of the urban, 13.6% of the rural children.

136. INDIA. Singh, K. P. Child Mortality, Social Status and Fertility in India. Social Biology, 21:385-388, 1974.

The relationship between social status (measured by educational attainment) and child mortality and fertility experience is examined using a sample of 311 Chandigarh women. High status women were less fertile and experienced less child mortality than low status women. Lowered mortality was associated with lowered fertility.

137. INDIA. Sundararaj, R. and Pereira, S. M. Diets of Pregnant Women in a South Indian Community. Trop Geogr Med 25:381-386, 1973.

The diets of 53 pregnant women were surveyed during the last trimester of pregnancy and the nutrients were calculated on the basis of food tables. The sample was drawn from the Harijan community, living on the outskirts of Sathuvachari Village, 3 km east of Vellore, South India. The women were of low socioeconomic status. Food taboos against eating the Jambu fruit, the fruit and root of palmyra, gingelly seeds and papaya were observed by most of the women. The women weighed between 35 and 50 kg. Daily intakes were found to be deficient in calories (51.9% of the women ingested 2000 Kcals or less); protein (range: 10.4g - 68.7g); retinol (range: 5 microg - 733 microg); riboflavine (range: 0.25 mg - 1.59 mg); ascorbic acid (range: 0 mg - 97 mg); iron (range: 8.8 mg - 44.0 mg); and calcium (range: 63 mg - 1345 mg). The requirements for niacin (range: 5.1 mg - 30.1 mg) and thiamine (range: 0.35 mg - 2.15 mg) were met according to the WHO 1965 Standards. One woman did not carry to term. Thirty-four babies born at term were weighed, and 7 were small-for-dates (less than 2500g), a parameter which is known to correlate with maternal nutritional status pre- and during pregnancy. (The authors have also shown on a subsample of 25 women that during pregnancy the women ate, on an average, 200 Kcals per day more than when they were not pregnant. It was primarily an increase in cereal consumption with a concomitant 5g rise in protein intake as well.)

138. INDIA. Sundararaj, R. and Pereira, S. M. Dietary Intakes and Food Taboos of Lactating Women in a South Indian Community. Trop Geogr Med 27:189-193, 1975.

The diets of 39 women from the Harijan community, (cf. Sundararaj and Pereira Trop Geogr Med 25:381-386, 1973), 3 km east of Vellore, were studied at regular intervals in the first year of lactation. It was shown that food taboos adversely affected the daily intake of energy (1700-2090 Kcals), protein (35 - 42g), and other nutrients in the first month. The weights of the women ranged from 35.9 to 64.2 kg (average: 43.6 kg). For at least the first month of lactation, dietary restrictions are severe. All the women breast fed their babies successfully. Thirty-eight of the women breast fed their babies for at least one year. Eight women terminated breast feeding by 18 months, and 8 more by 24 months. Fifteen mothers terminated breast feeding due to another pregnancy, 12 mothers continued to breast feed their child in the second trimester and 3 did so until the seventh month of subsequent pregnancy. Anthropometric measurements of the babies at less than 24 hours, 4 and 16 weeks showed that the infants were lighter at birth but that the rate of growth was comparable to North American standards. The period of food restriction in the first month of lactation appeared to have no adverse effect on the weight gain of the infants. The adverse effect of dietary restrictions and prolonged lactation on the women during repeated pregnancies has yet to be assessed.

139. INDIA. Thaman, O. P., Anand, H. L. and Manhas, R. S. A Review of Feeding Habits of Infants and Children in Kashmir. Indian Pediatr 1:428-435, 1964.

Three hundred and twelve children attending an out-patient clinic were selected at random from ages 6 months to 12 years. The time period covered was 28 months. Breast feeding was done in 96.2%, in 85% for over 6 months, 71% for over 12 months and 31% for over 2 years. The first food offered was breast milk in 35%; coffee or tea with milk and honey in 47%.

Weaning foods were introduced to 32% of the infants in the first 6 months, 37.5% between 6-12 months, 37.5% between 1-2 years, and 14% after age 2 years. Milk supplements were cow's, buffalo's, goat's or canned milk. Other foods offered were rice or bread, biscuits, tea or coffee.

140. INDIA. Thaman, O. P. and Manchanda, S. S. Child Rearing Practices in Punjab. Indian J Pediatr 35:334-341, 1968.

Feeding practices and related socioeconomic factors were studied in 500 children between 1 month and 14 years old admitted to the hospital in Amritsar. About 99% of the Punjabi women breast feed, 89% of them for more than 6 months, and 82% and 40% for more than 1 year and 2 years. In comparison, 84% of children in Kashmir were breast fed for 6-12 months, 70% for 12-24 months and 31% for over 2 years. Of Punjabi mothers, 62.5% and of Kashmiri women, 37.5% introduced supplementary foods to their infants between 6-12 months. Bread, rice and biscuits were the usual initial foods.

141. IRAN. Aghajanian, A. and Tashakkori, A. The Value of Children in Iran: A Pilot Study Among Urban Youth. Paper presented at the Annual Meeting of the Population Association of America, 1979.

An important factor influencing fertility levels and desires and planned changes in them, is the value of children to parents. Recently there has been growing interest in the study of the value of children across societies not only for the policy aims, but also to develop a theoretical model in order to explain fertility behavior. The present paper reports on a pilot study of the value of children in Iran. After describing the Iranian socio-cultural system, we presented an expected model of the utility of children with the Hoffman & Hoffman's theoretical framework. Then, data from a sample of high school students in the city of Shiraz, a large urban center in southern Iran, are used to test the expected model. The results provide evidence on the utilities of children within the Iranian socio-cultural system. The most frequently mentioned value of children to parents is the pleasure and stimulation they provide. We find substantial evidence on the value of children as a source of prestige and power and as a way of self-expansion. Furthermore, even in this large urban center we find that almost one-third of our sample note the economic utility of children, basically as a potential source of old age security. There are, however, significant sex differences in the perceived utilities of children which are explained in terms of the differences in sex-role socialization within Iranian society.

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142. IRAN. Froozani, M. D. et al. Maternal and Newborn Iron Status in a Public and A Private Maternity Hospital at Delivery in Teh J Trop Pediatr:182-185, Aug. 1978.

Iron and diets of 194 pregnant women and their newborns at a public and a private Maternity Hospital were studied. Blood samples were withdrawn from each woman before delivery and from the cord at the delivery of the placenta. The following determinations were made: hemoglobin, hematocrit, serum iron, and total iron-binding capacity (TIBC). The mean value of maternal hemoglobin was 13.8g/100 ml in the private group vs. 11.1g/100 ml in the public group. Mean birth-weight was 3.34 kg and hemoglobin was 15.57g/100 ml in the private vs. 3.17 kg and 14.72g/100 ml in the public group. Mean values of serum iron, percent saturation of transferin and MCHC were significantly lower; and TIBC and hematocrit level were significantly higher in cordblood of the public group when compared to the private group.

The private, higher socioeconomic status group had reached menarche at an average age of 14, versus 15 years for the public group. Diets calculated from total family weekly food consumption showed that the private group received nearly twice as much meat and eggs and three times as much citrus fruits (686g per mother per day) as the public group. Less than 7% of either group had taken vitamin or mineral supplements. Average parity was 1.8 in the private versus 2.3 in the public group.

The study concluded that the higher hemoglobin concentration and the reduction of several associated biochemical signs of iron-deficiency in the private group were possibly due to a lower parity and also to a higher intake of animal protein and vitamin C.

143. IRAN. Geissler, C. Lactation and Pregnancy in Iran II: Diet and Nutritional Status. Am J Clin Nutr 31(1):341-354, 1978.

This paper examines the role of diet and nutritional status in lactation failure of Iranian urban women of lower and middle socioeconomic status. Dietary intake during pregnancy close to term and in the third month postpartum was assessed by the 24 hour recall method. Blood samples were taken for hormonal and nutritional evaluation. The low socioeconomic group ate less animal products, fruit, and vegetables. Both groups consumed less than 80% of recommended energy, vitamin B6, folacin, calcium, iron, and zinc. In the lower group, only average intakes of vitamin C, thiamin and protein met the standards. Significant differences were found between the groups in hemoglobin, hematocrit, serum total protein, and protein fractions, but not in weight and height . The only parameters of nutritional status significantly correlated with adequacy of lactation were postpartum weight and percent of standard weight for height in the low group, and hematocrit values in the middle group. Differences between pregnant and postpartum individual values of the blood parameters were in general greater in the middle group than the low group.

144. IRAN. Geissler, C., Calloway, D. H., and Margen S. Lactation and Pregnancy in Iran: 1. Social and Economic Aspects. Am J Clin Nutr 31(1):160-168, 1978.

Adequacy of lactation was assessed in Teheran, Iran, among women of low (LSE) and lower-middle (MSE) socioeconomic status in the 3rd month postpartum as part of a study linking nutrition, hormonal status, and lactation. Subjects were selected randomly from women with uncomplicated pregnancies who attended 2

clinics in Teheran within 2 weeks of the expected date of birth. The study collected anthropometric data, a blood sample for hormonal and nutritional evaluation, socioeconomic data, medical history, and dietary intake information. The criteria of lactation adequacy used were based primarily on the classification of nutritional status in early childhood as proposed by McLaren and Read. Fifteen to thirty percent of the LSE and 40-55% of the MSE mothers had a fully adequate milk supply in the 3rd month. Substitutes used and affordable by the LSE mothers were nutritionally inadequate, and reflected traditional food beliefs. The low percentage of lactation adequacy even among the MSE mothers indicates that other social or health factors associated with urban living conditions may be as important as economic and nutritional factors in lactation failure.

145. IRAN. Ajami, I. Differential Fertility in Peasant Communities, A Study of Six Iranian Village, Pop STUDIES 30:453, 1976.

Fertility behavior is affected by changes in socioeconomic status. The author interviewed 235 husband and wife households in 6 rural villages North of Shiraz. A socioeconomic status (SES) index was constructed based on landholding, ownership of durable goods, husband's occupation, and husband's level of education.

If SES rises, this may promote fertility. A positive association existed between landholding and fertility. Large farm operators had 5.8 mean-number of children compared to 4.9 for small and medium owners and 3.8 for landless couples The relationship between landholding and number of living children also correlated positively. Husband's occupation and number of children were positively but not significantly correlated. Literacy and fertilify were inversely but not significant.

Peasant couples desired large family, the mean fertility value was 5.9. High fertility value was attributed not only to children's labor value but to high prevailing rates of infant mortality, mean value 27% per couple. Contraceptive use did not impact on fertility, as women began to use contraceptives only after a large number of children had been born, regardless of SES.

In order to treat the complexity of the relationship between SES and fertility, variables such as miscarriage, sterility, stillbirth, nutrition, location and postpartum abstence must be included in rural surveys. Efforts to curtail fertility only through promotion of contraception will be inadequate unless an integrated approach including education and public health measures is undertaken.

146. IRAN. Ghadimi, H. Child Care in Iran. J Pediatr 50:620-628, 1957.

Breast feeding on demand was the rule in Iran, and it was continued for two years or more. It was generally believed that girls should be breast fed for 24 months and boys for 22 months. In the second year bread, rice, soup, sour milk and cheese were introduced gradually. However, meat was rarely given.

147. IRAN. Hedayat, S. H., Koohestan, P. A., Ghassemi, H., and Kamali, P. Birth Weight in Relation to Economic Status and Certain Maternal Factors, Based on an Iranian Sample. Trop Geogr Med 23:355-364, 1971.

This statistical survey is of 2123 single live births at three hospitals, in Teheran, during the period October 1969 to August 1970. The patients admitted to the hospitals were from various socioeconomic levels of the community. The results were as follows:

The male infants were found to be heavier than the females.

A significant direct positive correlation between economic status and birth weight was found.

There was a systematically increasing trend in the birth weight for the maternal age group up to 30 years. The correlation was significant.

The birth weight increases according to the order of birth up to the third, and shows a significant correlation.

The mean birth weight according to level of education was significant when the illiterate was compared with secondary and the primary with university level of education.

A significant correlation between birth weight and the intake level of eggs and milk was found.

Maternal age at first delivery was significantly higher for those with a better economic status.

The occurrence of complications of pregnancy was higher in the lower income groups.

148. IRAN. Polak, H. E., Toubia, N., and Bamdad, N. Problems of Infant Nutrition Amongst the Urban Population of Iran. J Trop Pediatr 9:98-104, 1964.

Of 95 infants born during 1959 to parents in poorer urban households, 44 were entirely breast fed to 12 months of age; the others at from 3-12 months received supplements of dried skimmed milk. Only small quantities of fruit juice, soup and vegetable puree were given during the nursing period. In another series of 60 infants born in 1961, 19 received breast milk alone for up to 12 months and supplements of skimmed or full cream dried milk or fresh milk were given to 4, 17 and 20 between birth and 3 months, 3-6 months, and 6-12 months respectively.

149. IRAN. Sadre, M., Emawis, E., and Donoso, G. The Changing Pattern of Malnutrition. Ecology Food Nutr 1:55-58, 1971.

The authors describe a change in the pattern of malnutrition in young children in Teheran, Iran, with declining lactation performance. The trend is towards marasmus in the first year of life.

150. IRAN. Tolnay, S. E. The Experience of Visitors to Family Planning Clinics in Shiraz, Iran: Contraceptive Practice, Side Effects and Rumors. Pahlavi Med J 9:367-387, 1978.

This paper describes the characteristics of a random sample of 357 visitors to urban family planning clinics in Shiraz, Iran. It finds them to be relatively young, uneducated women who married and began childbearing at an early age. An inquiry into their contraceptive practices shows that most repeat the national family planning slogan as a reason for contracepting ("Fewer children -- better life"). It further shows that few of them were non-contraceptors before visiting a clinic. Many of the women claimed to have experienced some side effect from their contraceptive, but did not change methods because of the difficulty. The 30% of women who had heard rumors concerning side effects were more likely to report side effects than those who had not. Nervous problems, headaches, dizziness and bleeding or discharge accounted for 65% of side effects reported.

151. NEPAL. Nepal Ministry of Health, Nepal Family Planning and Maternal Child Health Project, and the World Fertility Survey (London). Nepal Fertility Survey, 1976. First Report, Kathmander, August 1977.

Nepal is a country of 145,689 square kilometers and of over 12 million inhabitants. The agricultural sector provides two-thirds of the total gross national product. There are severe regional disparities in gross domestic product and in general development. The Fifth Plan has identified 20 small areas for integrated development purposes in order to close the gap in regional development. Many are in the less developed hill region and the extreme Western region. One of the goals is to reduce migration to urban areas by involving rural populations in an integrated development program in forestry, home science, nutrition and family planning. Popular support, evaluation of progress and demographic factors are mentioned among criteria for success.

152. PAKISTAN. Ahmad, I., Roghani, M. T., and Shaha, W. A Study of 123 New Born Infants. J Pakistan Med Assoc 26(7):165-166, July 1976.

Thirty private ward (upper social class) and 93 general ward (lower and middle social class) neonates were weighed and measured. The average weight of the babies born to women on the private ward was 3.44 kg, higher than the 2.75 kg average for babies born on the general ward. Average chest and head circumferences were also higher on the private ward (34.3 cm and 35.5 cm respectively) than on the general ward (31.5 cm and 34.3 cm respectively). Higher rates of prematurity (19.3% vs 0%) and small-for-date babies (2.15% vs 0%) were noted in the general ward, as well as higher incidence of congenital anomalies. It was postulated that better nutritional status among the private ward women was the major cause of the differences. There was no difference in average length of the babies (47 cm).

153. PAKISTAN. Baum, E. M. A Comparison of the Factors Influencing Husband/Wife Use of Contraceptives in Pakistan. Paper read at 1978 Meeting of the Population Association of America. Richard Katon Associates, One Central Plaza, Box 22, N300 Rockville Pike, Rockville, MD 20852.

The decision to use contraceptives should represent a consensus arrived at by the couple. Most studies of contraceptive practice focus on either husbands or wives. This study focuses on both, with the aim of showing that the factors influencing use are different for husbands and wives.

Two models were formulated linking selected socioeconomic and demographic variables to use. The first omitted the prior decisions, opinion of family planning, and desire to use; while the second included them. The difference between the results for the two models were extreme for husbands, but minor for wives. Desire to use was an important part of the final husband model, but was not part of the final wife model. This could indicate a dominance by husbands in the realm of family planning.

The study found distinct sexual differences, which implies that neither spouse can be used as a proxy for the couple.

154. PAKISTAN. Chowdhury, A. K. M. A., Kahn, A. R., and Chen, L. C. The Effect of Child Mortality Experience on Subsequent Fertility: Pakistan and Bangladesh. Popul Stud 30(2):249, 261, 1979.

This paper presents an empirical analysis of the effects, behavioral and biological, of child mortality experience on subsequent fertility in two South Asian Islamic nations. Data for the investigation came from retrospective pregnancy histories of 2,910 currently married women interviewed in the Pakistan National Impact Survey (1968-69) and from longitudinal vital registration data (1966-70) of 5,236 women residing in a rural area of Bangladesh collected by the Cholera Research Laboratory. The aim of this study was to assess the importance of the child-replacement motivational response to child death experience after biological effects had been controlled adequately.

A common approach employed previously has been to examine cumulative fertility according to child death experience. In Pakistan and Bangladesh, a consistently positive relationship was demonstrated between the number of children ever born and the number of child deaths. This method, however, did

not exclude the inverse relationship, the influence of fertility on mortality, nor did it dissect ou behavioral from biological effects. Utilizing the measure of subsequent fertility, live-birth-to-live-birth intervals, the study further illustrates another common pitfall. Since the risk of infant death, which leads to shorter birth intervals is associated with the mothers' reproductive history, women with child mortality experience are more likely to experience shorter intervals because of the biological effect of subsequent infant death. Behavioral influences may, therefore, be observed by considering only those birth intervals in which the first-born child survives to the end of the interval.

With these limitations controlled, very few, if any, behavioral influences were noted in the Pakistan and Bangladesh data. Median birth intervals in Pakistan varied between 35·0 and 41·2 months, increasing with parity. Within each parity group, no consistent difference was observed between women with and without previous child loss. In Bangladesh, the median birth interval for all women with a surviving infant was 37·2 months. This was shortened to 24·1 months by an infant death. When intervals with infant deaths were excluded, little or no behavioral influence was detected among women of the same parity, but with varying levels of previous child loss.

Even without behavioral effects, elimination of infant mortality in Bangladesh would reduce fertility by prolonging the average period of postpartum sterility. In the Bangladesh setting, however, the size of the effect was only about four percent. This modest effect, moreover, was counterbalanced by an overall increase of net reproduction by seven percent due to better survivorship of infants.

155. PAKISTAN. Khan, M. A. and Sirageldin, I. Son Preference and the Demand for Additional Children in Pakistan. Demography 14:481-496, 1977.

This paper tries to take into account the sequential element in fertility decisions and continues an investigation originally begun by Namboodiri. We examine the extent to which the "desire to have additional children" can be explained by a variety of economic, sociological, and demographic variables. The probit maximum likelihood estimation procedure is utilized, and the analysis is based on cross-sectional data on 2,910 currently married women obtained from a national survey conducted in Pakistan in 1968-1969. The principal finding is the presence of a strong son preference both for the husband and for the wife.

156. PAKISTAN. Rahimtoola, R. J., Qureshi, A. F., and Ramzan, M. A Study of New-Born Infants at Jinnah Postgraduate Medical Centre, Karachi. J Pakistan Med Assoc:258-261, Jan. 1977.

Thirty-one hundred fifty-six newborn infants, delivered consecutively from January to December, 1973 in the Department of Obstetrics, Jinnah Postgraduate Medical Centre, Karachi, were studied. The rate of prematurity was 24.3% and that of perinatal mortality was 96/1000 compared to 10/1000 in the U.S.A. The highest rate of perinatal deaths occurs in premature infants (45.3%). The incidence of congenital defects was 2.5%. Infants of diabetic mothers showed an average fasting blood sugar level of 65.9 mg% and none was born hypoglycemic.

High rate of prematurity (39%) but low rate of perinatal mortality (8.2%) were found among infants of anemic mothers. The authors were intrigued by,but

did not determine the causes of the high incidence of small-for-dates in the sample. The authors also recommend establishing more maternity and child health centers in refugee colonies where prematurity and perinatal mortality are high.

157. PAKISTAN. Shah, N. M. and Smith, P. C. Non-Familial Roles of Women and Fertility: Pakistan and the Philippines Compared. Paper presented at the Annual Meeting of the Population Association of America, 1979.

Distinct and large differences between the occupational structures of Pakistani and Filipina women raise some interesting questions about the possible significance of such differences for the roles and status of working women in the two countries. Many more of the employed Filipina women were employed in professional and clerical activities compared to Pakistani women -- 20% and 3% respectively. Similarly, a very large proportion of Filipina women were in sales occupations compared to Pakistani women. More than fifty percent of all Pakistani women were working as self-employed craftswomen compared to less than one-fifth of Filipina women in this category.

Work participation seems to have a strong negative effect on fertility (births in 5 years prior to survey) in the Philippines while the relationship is negative but insignificant in Pakistan. Working women in Pakistan, however, have a significantly smaller number of children-ever-born than non-working women.

158. SRI LANKA. Robinson, P. Infant Feeding in Ceylon. Q Rev Pediatr 12:208-209, 1957.

Breast feeding was almost universal in Ceylon. However, only 50% of the infants were fully breast fed at three months of age. Partial breast feeding combined with feeding of condensed and dried milks was continued for long periods. In poorer classes, the average period of partial breast feeding was twenty months; among the middle classes, the average was nine months. There was a weaning ceremony at about the 14th month. The weaning food was usually rice gruel diluted with water. As soon as rice was given, milk was discontinued because of the belief that a mixture of rice and milk breeds worms.

159. ASIA. Integrating Family Planning with Nutrition and Parasite Control. Asian Population Programme News 6(3):11, 1977.

At the Inter-governmental Coordinating Committee workshop on an integrated approach towards family planning and health programs held at Kuala Lumpur from March 23 to 25, 1977, the feasibility of integrating family planning with nutrition and parasite control through the proper planning of motivational considerations, resource allocation and coordination was studied in detail. Discussion focused on the experience of participating countries in generating community participation in total health programs. Malaysia reported that in the expansion of the national program into the rural areas functional integration has been the approach. In Indonesia nutrition has been an important objective of maternal and child health services. A total integrated development approach has been the objective in the Philippines where family planning information-education-communication has been integrated with nutrition programs and a pilot project on integration of family planning and parasite control has been conducted. Thailand reported on the introduction of an integrated family planning and parasite control program, while Sri Lanka reported on an integrated approach that included family planning with maternity and child health services. A recommendation of the meeting was that experimental pilot projects be established which include nutrition and parasite control elements within the framework of family planning services.

160. BURMA. Folls, C. V. The Perils of Childhood in Upper Burma. J. Trop Pediatr 4:127-26, 1958.

A study in Chouk, Upper Burma, in 1956, found that the majority of the children were breast fed on demand for at least two years, and a few for up to five or six years. Generally no milk other than human was given to an infant, although a few mothers attempted bottle feeding with condensed milk, usually with poor consequences for the infant. Rice was introduced at about 2 years. The child was then weaned directly onto curry and rice with fresh fruits and vegetables when available.

161. BURMA. Robinson, P. Infant Feeding in Burma. Q Rev Pediatr 12:14-15, 1957.

Breast feeding was not found to be as universally in Burma as in India. Mothers usually began to breast feed their infants, but by the second quarter of the first year of life the prevalence of breast feeding had dropped considerably. The reasons for early weaning were varied: many women worked, practitioners encouraged weaning if mother was deficient in certain nutrients because they claimed the milk produced was poisonous to the child, mothers feared excessive development of the breast. The main weaning food was polished rice. Although milk drinking was not traditional, milk was given to infants if it was consensed or dried milk and did not come from the "sacred" cow.

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162. MALAYSIA. Anonymous. Decline in Breast Feeding Endangers Infant Health, Leads to More Births Unless Contraception Is Used. Int Fam Plann Perspect Dig 4(3):95-96, 1978.

A survey was conducted among more than 1200 ever-married Malaysian women in 1976. Survey data included information on childbearing, breast feeding, contraceptive practice, and menstrual experience. The data indicated that the average birth interval has become shorter for all age groups in the last 30 years due to a marked decline in the practice of breast feeding. Use of contraception increased in recent years, causing a decline in fertility rates, but contraceptive practice is not widespread enough to counteract the effects of declining breast feeding. The decline in breast feeding carries with it an increased risk of child mortality. For these reasons, family planning clinic personnel have been trained to support breast feeding.

163. MALAYSIA. Balakrishnan, S. and Hussein, H. B. H. Breast Feeding in Kelantan. J Trop Pediatr 23:80-82, 1977.

Four hundred and sixty-one mothers were interviewed to determine the duration of breast feeding (without supplemental foods), at what age solids were introduced and to assess the mothers' awareness of the benefits of breast milk. Eighteen percent of mothers were breast feeding fully up to three months and 9% without added solids up to six months. Seventy-eight percent of the mothers were introducing solids before the third month; of these, one-third as early as the first month. Eighty-six percent agreed that breast milk was

the best milk but only 59% agreed that breast fed children got infections less frequently. Sixty-five percent were aware that after six months, solids should be introduced.

164. MALAYSIA. Palmore, J. A.; Hirsch, P. M.; and Marzuki, A. Interpersonal Communication and the Diffusion of Family Planning in West Malaysia. Demography 8:411-425, 1971.

Using data from a 1966-1967 probability sample of West Malaysian married women 15-44 years of age, this paper analyzes the characteristics of women who were active in diffusing information about family planning. The woman's age and her parity, her educational attainment, her race, her present residence (urban-rural), and whether or not she wanted more children were significantly related to opinion leadership in bivariate tables. However, these relationships appeared to be substantial mainly because these social and demographic characteristics were highly related to whether the woman participated in discussions about family planning with other women. Among women who did participate in such discussions, the social and demographic variables were not substantially related to opinion leadership. In fact, the critical variables for opinion leadership appeared to be participation in the discussions, greater knowledge of family planning, and a higher level of family planning use. An attempt is also made to assess the effect of interpersonal communication on the adoption of family planning among women in the sample.

165. PHILIPPINES. Balderrama-Guzman, V. and Tantengco, V. O. Effect of Nutrition and Illness on the Growth and Development of Filipino Children (0-4 years) in a Rural Setting. Journal of the Philippine Medical Association 47:323-336, 1971.

The diets of 589 children of the town of Victoria,Laguna,from the ages of 1-4 years were studied. Of the children, 75% were breast fed to 6 months of age, 20% were given mixed diet and 5% were bottle fed. Most babies were weaned at 12 to 18 months. Within 3 days after birth, over 70% of babies had their diet supplemented with a rice bran extract. The usual weaning diet of the children was rice mixed with fish broth and a little fish.

166. PHILIPPINES. Bulato, R. A. Values and Disvalues of Children in Sequential Childbearing Decisions. Paper presented at the Annual Meeting of the Population Association of America, 1979.

The values and disvalues that wives and husbands at different parities attach to having another child are described and analyzed. It is argued that the value of children is not unidimensional, but involves different kinds of values and disvalues, often incommensurable, relevant at different parities. The data come from national surveys in the Philippines, South Korea, and the United States. Loglinear models applied to value rankings demonstrate that country is an important determinant of which value is ranked first but sex is not. Parity, on the other hand, has interesting and consistent effects, with values and disvalues changing across parities in a predictable though nonlinear manner. Further controls are introduced for education, residence, and marriage duration, but the basic patterns across parities hold up. It is argued, finally, that these patterns are consistent with changes in the value of children in the fertility transition.

167. PHILIPPINES. Cruz, P. S. et al. Maternal and Infant Nutritional Practices in the Rural Areas. Journal of the Philippine Medical Association. 46:668-680, 1970.

Ninety children aged 7-18 months were chosed at random from 417 registered births in 1968 in the town of Bay, Laguna. Of the 90 children, 9 were bottle fed, 48 were breast fed and the rest fed by both methods.

Most mothers weaned at 13-18 months. Supplementary foods in the form of "Kanin eluroq", "am", "pula ng itloq" and potatoes were given as early as one month, but the majority of mothers interviewed (72%) would give these foods at 5-8 months of age only.

168. PHILIPPINES. del Mundo, F. and Adiao, A. C. Lactation and Child Spacing as Observed among 2,102 Rural Filipino Mothers. Philippine J Pediatr 19(3):128-132, 1970.

A comparative study of nursing and non-nursing mothers in non-urban communities was carried out by interviews. A child-spacing of 24-35 months was observed in 51.2% of the lactating mothers who breast fed beyond the sixth month. This study emphasizes the importance of prolonged breast feeding (7-12 months) for maximum child-spacing effect, in the absence of any other family limitation measures.

169. PHILIPPINES. Engel, R. W. and Caedo, M. Nutrition, Population, and Family Planning. Paper presented at the Nutrition Forum, "Nutrition in National Development," University of the Philippines at Los Banos, January 6-7, 1975.

This paper presents data relating family size and birth intervals to prevalence of malnutrition and to subsistence costs in Bulacan Province, Philippines. Prevalence of malnutrition among preschool children is shown to increase from 35.5% to 48.5% as number of preschoolers in the family increases from 1 to 3. Prevalence of malnutrition by interval until next sibling in families with 2 children only is 55% for an interval of 18 months or less, declining to 28.5% for intervals of 31 months or more. The minimum daily cost of food is shown to increase from 41% of the minimum wage for a family of 3 to 101% for a family of 7.

The impact of nutrition and family planning programs on births, deaths, and net population growth is also presented. Family planning alone reduced population growth over the rate of a control population by 12%, without major changes in mortality rates. Integrated family planning and nutrition programs reduced population growth by 11% and also achieved significant reductions in infant and child mortality.

170. PHILIPPINES. Guthrie, H. A. Infant Feeding Practices in a Corn-Eating Area of the Philippines. Trop Geogr Med 19:48-55, 1967.

Mothers of 41 infants from the lower and middle class urban areas of Cebu City in the Philippines and 33 infants in a small rural town near the sea were interviewed about their infant feeding practices when the infants were 18-36 months old. Equal percentages of rural and urban children were completely breast fed for 6 months; the average length of time for breast feeding was 7-9 months for both groups, but 30% of the urban and 43% of the rural mothers breast fed for more than 10 months. Rice in the form of a prepared product, "Pablum", or as a thin gruel or porridge called linugpaw was chosen by most mothers as the first supplement to milk, as it was considered more easily digested than other cereals. A maize porridge was added several months later. Fish was used much more by the rural mothers and eggs and meat by urban mothers. Urban infants were more likely to have carbonated beverages, vegetables and fruits other than bananas, but otherwise rural and urban practices did not differ significantly.

171. PHILIPPINES. Madigan, F. C. et al. Purposive Concealment of Death in Household Surveys in Misamis Oriental Province. Popul. Stud 30(2):295-304, 1976.

The randomized response technique was used in a household survey of approximately 2,000 rural and 2,000 urban households in Misamis Oriental Province in the southern Philippines in order to determine the extent of purposive concealment of death. The estimated number of deaths deliberately not revelaed to the interviewers was 50 percent or higher. Adjusted crude death rates of 11.5 and 13.4 per 1,000 population were computed for urban and rural areas, respectively, by adding estimated concealed deaths to deaths reported to the interviewers. Application of stable population techniques and of model life tables suitable to the Philippine setting, while not permitting definite conclusions, provided reasons for believing that these adjusted death rates are close to the true mortality situation in the study areas. Randomized response data further indicate that approximately 75 percent of urban deaths and 47 percent of rural deaths of the population studied were not registered with municipal authorities. The authors postulate that failure to register deaths with municipal authorities, together with fear of legal involvement if this failure becomes known outside the immediate neighbourhood, is a major reason for the purposive concealment of death in household surveys.

172. PHILIPPINES. Nurge, E. Infant Feeding in the Village of Guinhangdon, Leyte, Philippines. J Trop Pediatr 3: 89-96, 1957.

Neonates in Guinhangdon, Philippines, are given a purgative immediately after birth and are not nursed until the second or third day of life. Occasionally a child is breast fed by a wet nurse for various reasons. Some mothers make use of canned condensed milk that is diluted with water as a supplement or as a weaning food. Most mothers begin supplementary feeding at 6-8 months. The first foods are usually mashed bananas or rice and water gruel. Weaning is usually completed between 1 and 1 1/2 years. Reasons for earlier weaning may be pregnancy or the child is judged to be ready. Complete weaning is accomplished in from 3 days to 2 weeks.

173. PHILIPPINES. Osteria, T. S. Variations in Fertility with Breast Feeding Practice and Contraception in Urban Filipino Women: Implications for a Nutrition Program. In Nutrition and Human Reproduction, ed. W. H. Mosley. New York: Plenum Press, 1978.

This is a prospective, truncated study among 794 married women resident in Manila who delivered at one urban hospital in two month interval. Follow up was at monthly intervals for 24 months by questioning with regard to breast feeding and infant supplementation practices, amenorrhea, contraceptive usage and eventual pregnancy. Nutritional status was not related to either the proportion or duration of breast feeding. The median duration of breast feeding was 10.3 months. The median interval between resumption of menses and conception was more than 24 months. This is a careful study in which the findings are disaggregated in more detail than can be readily summarized.

174. PHILIPPINES. Popkin, B. M. Economic Determinants of Breast Feeding Behavior: The Case of Rural Households in Languna, Philippines. In Nutrition and Human Reproduction, ed. W. H. Mosley. New York: Plenum Press, 1978.

Selected determinants of breast feeding behavior were analyzed in a multivisit survey of 314 infants in the higher-income province of Languna, Philippines. Depending on whether household wealth fell above or below 5000 pesos, the sample was divided into "rich" and "poor" groupings. Ninety-three percent of the infants were breast fed, a practice more frequent among less educated and lower-income mothers, for a mean duration of 11.4 months. While working mothers had a lower probability of breast feeding, they did so longer than their nonworking counterparts. Mothers regarding breast milk as better for the child were 22% more likely to breast feed. The value of the working mother's time (measured by her wage rate) was related to the extent of breast feeding, with higher wage rate associated with decreased breast feeding. Breast feeding was not significantly related to compatibility of mother's job with child care or to her nutritional status. The presence of girls aged 13-15 in the household reduced breast feeding participation in poor homes but significantly increased both participation and duration in rich homes. The presence of other household members allows nonworking mothers to increase their child care and breast feeding time. Visits by milk company representatives did not produce a significant effect. The regression results explained less than 25% of the variance in breast feeding behavior.

175. PHILIPPINES. Shah, N. M. and Smith, P. C. Non-familial Roles of Women and Fertility. Paper presented at the Annual Meeting of the Population Association of America, 1979. (See PAKISTAN)

176. PHILIPPINES. Stinner, W. F. and Mader, P. D. Sons, Da ghters or Both? An Analysis of Family Sex Composition Preferences in the Philippines. Demography 12:67-79, 1975.

This study presents an analysis of family sex composition preferences as well as the relationship between actual family sex composition and desire for no additional children among a national sample of Filippino women. An emphasis on balance or son-daughter equivalence was strongest in Metropolitan Manila. Son preference was highest in rural Mindanao and Sulu, primarily due to the concentration of Muslims in this section of the country and secondarily to its pioneer environment and the presumed utility of sons in such a milieu. The importance of eliciting sex composition preferences from both husbands and wives as well as distinguishing the "striking for a balance" from sex-linked preferences in future research is discussed.

177. PHILIPPINES. Zeitlin, M., Masangkay, Z., Consolacion, M. and Nass, M. Breast Feeding and Nutritional Status in Depressed Urban Areas of Greater Manila, Philippines. Ecology of Food and Nutrition, 1978, Vol. 7, pp. 10-113.

Marasmic infants were weaned from the breast earlier than nutritionally normal infants in depressed areas of Greater Manila, Philippines. However, bottle feeding was not a statistically significant cause of malnutrition in a sample of 513 six to forty-eight month old children. Marasmic children were affected by other significant variables such as mother's education, birth order, morbidity, parental employment, and family stability.

Among six to twelve-month-old infants, mean weight for age of those bottle fed or weaned by two months was slightly greater than for those still breast fed, although both groups were severely malnourished. Incidence of bottle feeding was highest in depressed neighborhoods in which the nutritional status of infants was highest.

Because poor urban Filipina mothers, with an average sixth grade education, do bottle feed as adequately as they breast feed, they could theoretically feed their infants well if instead of purchasing milk they breast fed and used the savings to buy weaning foods.

178. SINGAPORE. Millis, J. The Feeding of Chinese, Indian, and Malay Infants in Singapore. Q Rev Pediatr 14:42-48, 1959.

A study of 680 Chinese, Indian and Malayan infants in Singapore revealed that the mothers preferred to breast feed.

Chinese mothers used processed cow's milk for artificial and complementary feedings and delayed the introduction of foods other than milk until the infant was 6 months, although well-to-do mothers introduced foods earlier. Most infants receive a mixed diet at 12 months. The consumption of milk dropped rapidly after the introduction of a mixed diet.

Indian mothers used powdered and condensed milks for artificial and complementary feedings. Their infants seldom received solid foods in the first 6 months, but after 8 months, the majority were eating cereals.

Prolonged breast feeding was common among the Malayan mothers who continued into the second or third year. Among poor women, the major cause of weaning was failure of lactation. Among wealthier women, breast feeding was usually discontinued because of the inconvenience.

Some mothers gave rice porridge as early as 3 months. Condensed cow's milk was the usual complementary feeding. The majority of infants received only milk and starchy foods during the first 12 months.

179. SINGAPORE. Nevill, W. The Birth Rate in Singapore. Popul Stud 32(1):113-134, 1978.

A declining birth rate in Singapore since the 1950s has been in keeping with official policy and an active programme of family planning. However, while there is no doubt that such measures have contributed to a notable real fertility decline, age structure and patterns of nuptiality have also played a major role in influencing the direction and scale of change in the birth rate. The relative significance of change in age-sex distribution, nuptiality patterns and marital fertility to birth-rate decline are examined by a decomposition procedure for each of the main ethnic groups. Association of certain social and economic characteristics with fertility levels is then discussed briefly. The concluding section attempts to assess overall policy implications.

180. THAILAND. E.S.C.A.P. Population Growth and Economic Development in Subnational Regions: Report of an Expert Group Meeting. Section IV: Cast Studies of Subnational Planning. In Asian Population Studies Series #40. Bangkok, Thailand, 1977.

Planning was described at four levels: national, regional, provincial, and subdistrict. The country was divided into five regions and 72 provinces for development planning purposes. Grass roots planning and implementation occurred at the subdistrict level. The local units provided training and education, aid to agriculture, women and youth programmes, family planning programmes, roads and other infrastructure, and so on. Each subdistrict designed its development projects with the cooperation of elected village headmen and government officials. The plans were then submitted first to the provincial government, then to the community development unit of the Ministry of Interior for approval. Maldistribution of social services, land tenancy problems, disparity of income, and the dominance of Bangkok in all spheres of activity were cited as major obstacles to development at the subnational level.

181. THAILAND. Goldstein S. Interrelations Between Migration and Fertility in Thailand. Demography 10:225-241, 1973.

Based on special tabulations of 1960 census data on migration within Thailand, this analysis attempts to assess the role of migration in the urbanization process and the relation between migration and fertility. The importance of migration to urban growth was evidenced by the clearcut positive relationship between the percentage of persons classified as either lifetime or 5-year migrants and the urban character of their 1960

place of residence. Yet, the evidence also pointed to an increasing proportion of urban growth in recent decades attributable to natural increase. The specific relation between fertility and migration varied depending on the measure of migration used: Compared to nonmigrants in their place of destination, the fertility levels of lifetime migrants were not very different; but those of 5-year migrants were considerably lower. Regardless of migration status, however, fertility level was markedly lower for the urban than for the rural population.

182. THAILAND. Khanjanasthiti, P., and Dhanamitta, S. Breast Feeding Practice and Growth of Infants in Thailand. J. Med. Assoc. Thailand, 61(6):340-344, 1978.

Trends in breast feeding are studied among three groups: rural, semi-rural and "marginal" urban. Breast feeding incidence declines and weaning occurs earlier, in that order (going from rural to urban). In the rural area (6 Mae Kong Provinces), 95% of children were breast fed at birth; 81% were still breast fed at 7-12 months; and 37% were still breast fed at 19-24 months, according to a 1976 survey. For the semi-rural Bang Pa-In area, breast feeding was practiced by approx. 62% (in 1972) and 66% (in 1975) of mothers surveyed, but breast feeding dropped off sharply when the child was 13-18 months old. In the "marginal" urban areas of Bangkok (Ban Manangkasila, Prempracha, Wat Lard, Bou Kaw, and Makasan), 75% of women surveyed breast fed at birth in 1971, with the other 25% bottle feeding their children. By one month, however, only 46% were still breast feeding exclusively, and another 18% were supplementing with milk or formula. By 13-24 months only 6% were still breast feeding. While the semi-urban Pang Pa-In infants followed the Bangkok standard weight curve for the first six months, their weights dropped off thereafter. The "marginal" Bangkok areas showed a drop of the curve at 1.5 months, with children developing primary protein-calorie malnutrition (PCM) by six months. The prevalence of PCM is 71-78% in these areas (three times that of Bang Pa-In). The authors attribute this to improper bottle feeding by working mothers and non-working mothers who turn away from traditional breast feeding practice.

183. THAILAND. Knodel, J. and Prachuabmoh, V. Desired Family Size in Thailand: Are the Responses Meaningful? Demography 10: 619-637, 1973.

Data for both rural and urban women in Thailand indicated that the large majority of respondents were able to provide numerical responses to questions concerning desired family size. Although there was evidence that some women rationalized the number of children they had when stating the number they would want if they were recently married, the vast majority of respondents preferred a number which was different from the number of living children they had at the time of the interview. Women who had already reached or exceeded their desired number almost universally stated that they wanted no additional children, whereas only a minority of women who had yet to reach their desired family size said they wanted no more children. The proportion of women who practiced family planning was substantially greater among women who had already achieved or exceeded their desired family size than among women who had fewer than their desired number. The results thus suggest that, in Thailand at least, responses to family size preferences need to be interpreted with caution but nevertheless can be of use to the population analyst.

184. THAILAND. Koetsawang, S. Injected Long-Acting Medroxyprogesterone Acetate Effect on Human Lactation and Concentrations in Milk. J. Med. Assoc. Thailand, 60(2):57-60, 1977.

In a study of 165 mothers at Siriraj Hospital complaining of inadequate milk supply, 92 received a 150 mg intramuscular injection of depot medroxyprogesterone acetate (DMPA), (a contraceptive,) while 73 who used nonhormonal contraceptives acted as controls. After three months nearly half of the DMPA-treated mothers reported moderately increased lactation, compared with only 14% of the controls. In six mothers receiving DMPA, concentrations of medroxyprogesterone-related material in milk as measured by radioimmunoassay were low (6.6 to 16.5 ng/ml) one week after injection, and undetectable by four weeks. In four patients the assay was unable to distinguish between the drug and its metabolites , which may or may not be biologically active. No ill effects were observed in the nursing infants.

185. THAILAND. Pongthai, S. et al. Return of Ovulation at First Postpartum Visit. J Med Assoc Thailand 16(11):627-632, 1968.

The return of ovulation in 210 healthy, recently delivered women at Ramathibodi Hospital was studied by endometrial biopsy. Ovulation occurred in 3.4% ,8.5% and 8.9% of the women making their first postpartum visits at the 6th, 7th and 8th week respectively. Pattern of breast feeding plays the major role in delaying ovulation. 12.8% of women who partially breast fed ovulated prior to first checkup while only 7.1% of women who breast fed ad libitum around the clock ovulated. Age plays a role. In the under 20 year old women and over 35 year old women, no ovulation occurred prior to the first postpartum visit, while 10% of the women aged 21-35 ovulated. Parity also is associated with resumption of ovulation: 12% of primiparous women ovulated compared to 1.4% of multiparous women. Resumption of sexual relations seems to be a factor in early occurrence of ovulation in women who partially breast fed their babies and in those who artificially fed their babies. Type of supplementary foods and nutritional status of the mothers were not discussed.

186. THAILAND. Rodgers, G. B. Fertility and Desired Fertility: Longitudinal Evidence from Thailand. Popul Stud 30(3): 511-526, 1976.

The validity and usefulness of 'desired additional children' and "'ideal family size'" as predictors of fertility are analyzed in this paper on the basis of longitudinal survey data from Thailand. First, the extent of measurement error in these variables is considered, and it is concluded that the error variance and the true variance are of similar orders of magnitude. Secondly, the changes in attitudes subsequent to births and deaths of children are investigated. It is found that the number of additional children desired is decreased by births and increased by deaths, but less than would be expected if 'desired additional children' represented an unchanging target family size. 'Ideal family size' is almost unaffected by births and deaths. Thirdly, the contribution of attitudinal variables to behavioural models is examined. It is found that desired fertility is explained no better than fertility in a standard economic model. A birth function separating desired children from identifiable physiological factors as explanatory variables indicated that the former was just significant. A model of contraceptive acceptance also found desired fertility to be a

significant determinant. Thus, desired fertility can be successfully integrated into behavioural models. But on the whole, its explanatory power was weak, and it was concluded that the independent use of this variable does not significantly improve on models which relate fertility to socio-economic variables directly.

187. THAILAND. Supalert, Y., and Chindavaning, S. Effects of Oral Contraceptive Medication on Serum Lipids. J Med Assoc Thailand 59(6):249-256, 1976.

204 women taking various combinations of oral contraceptives were compared with 100 controls. This study was undertaken because of the potential relationship between elevated serum lipids and lipoproteins and the increased incidence of atherosclerosis in women taking combination hormonal contraceptives. Fasting levels of serum triglycerides, cholesterol, and total lipids were significantly increased in the study group. There was no significant change, however, in fasting serum cholesterol or in beta-lipoprotein. Serum alpha-lipoprotein was found to be decreased. A slight increase in serum triglycerides and pre-beta-lipoprotein was observed in women taking the combination of 0.05 mg ethinyl estradiol and 4.00 mg norethrindrone acetate, while the highest increase was found in those taking the combination of 0.15 mg ethinyl estradiol and 5.00 mg lynestrenol. A dose-effective relationship of estrogen to serum lipids was observed. No dietary or nutritional implications were discussed.

188. THAILAND. Temcharoen, P., Temcharoen, P., and Sirivunaboot, P. Mothers' Attitude Toward Breast Feeding. J. Med Assoc Thailand, 62(2), 1969.

From February, 1977, to August, 1977, 210 mothers were interviewed by questionnaire to determine their attitude towards breast feeding. The study was conducted at the well-baby clinic of Children's Hospital and at Ramathibodi Hospital, and data were analyzed by one-way analysis of variance and student rank test using the Newman-Keul method. The average attitude score for all subjects was 137.96 (range: 91-167) out of 180, signifying a favorable overall attitude towards breast feeding. There was no statistical difference in maternal attitude in relation to hometown, educational level, occupation, or economic status. There was a significant difference (p. 0.05) with regard to age (35 years and over scored higher than women in the 15-24 year old age group). Younger women felt that breast feeding would be detrimental to their health.

189. THAILAND. Valyasevi, A.; Benchakarn, V.; and Dhanamitta, S. Anemia in Pregnant Women, Infants and Pre-School Children in Thailand. J Med Assoc Thailand, 57(6):301-306, 1974.

The study included pregnant women attending the Ubol and Ramathibodi (Bangkok) hospitals in 1971 and children below age six in the rural Ubol (Northeast Region of Thailand) and Bang Pa-In (rural area 60 km from Bangkok) villages. The incidence of anemia by age and group was as follows:

Age	Bang Pa-In	Ubol	Bangkok
1-6 mo	38%	31%	23%
6-24 mo	34%	16%	16%
2-6 yrs	11%	8%	6%

The authors suggest that better diet is responsible for the drop (in anemia with age). The age distribution was similar for the Ubol and Bangkok women, with 70%-75% in their twenties and thirties. Parity distribution was different, however: out of 154 urban mothers, 54, 85 and 15 were of parity 1, 2-4, and 5 or more, respectively, whereas 77, 100 and 82 of 259 rural women were of those parities. The age distributions being similar suggests a higher parity/age group ratio for the rural women. There is no significant difference between the incidence of anemia for the women in the two groups (31% in Bangkok versus 38% in Ubol) as determined by hemoglobin levels, despite lower socioeconomic status and higher parity of the Ubol women. The authors infer that dietary intake and habits are similar in these rural and urban regions, although they do not describe the nutritional status of their subjects.

190. THAILAND. Viseshakul, D., Premwatama, P., and Kewsiri, D. The Nutritional Status of Hill-Tribe Children and Their Lactating Mothers. J Med Assoc Thailand 61(1):26-32, 1978.

The nutritional status of 149 Hill-Tribe children under six years old and of their 64 lactating mothers was studied in April and July, 1976 in Chiang Rai Province (North Thailand). The average mother was 30 years old (range: 15 to 40), and her average parity was 5.1 (range: 1 to 12 children). The lactating women were undernourished at an average 32.8 kg (80% of 1966 WHO standards) for a mean height of 145.8 cm (equal to standard), and relatively lean (estimated 15% fat). The mean arm circumference was 24.4 cm.

The children are breast fed on demand during the first year of life. This practice is feasible since the infants accompany their mother to the fields. The infants' diets are supplemented with rice until age three, after which they share the family diet. Breast milk appears to be adequate for the first 18 months, as the child's weight is nearly 95% of Bangkok standards for children until that time.

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191. KOREA. Park, C. B., Han, S. H., and Choe, M. K. Risk of Childbirth Following Infant Mortality in Korea. Paper presented at the Annual Meeting of the Population Association of America, 1978.

This study is based on 23,635 retrospective birth records of 6,285 Korean women who were respondents in the 1971 National Fertility Survey. The findings indicate that during the days prior to the introduction of the family planning program only the "physiological effects" of infant mortality had an influence on subsequent fertility; infant mortality reduced the birth interval but it did not increase the probability of bearing an additional child. Since contraceptive methods were made available throughout the country, marked differences have been observed both in birth intervals and parity progression ratios according to the fate of the last infant, suggesting the emergence of an infant mortality "replacement effect." The proportion of births attributable to infant mortality in this way has increased tremendously in recent years in spite of the decrease in infant mortality. However, the overall magnitude of such births remains rather small.

192. KOREA. Repetto, R. Fertility Decline in Korea and Its Relationship to Development Patterns. Paper presented at the Annual Meeting of the Population Association of America, 1978.

The fertility decline in the Republic of Korea between 1960 and 1975 was one of the fastest in history. It can be explained partly by the end of the 1950s baby boom and partly by the rapidity of economic development. Development provided alternative sources of security, raised the costs of children, and increased both rewards and access to education. It induced rapid urbanization and female labor force participation, especially by unmarried women in urban jobs. Yet, fertility fell equally rapidly among rural, uneducated, nonworking women. The rapid convergence of socioeconomic fertility differentials is related to the relative absence of vertical stratification. Evidence from econometric analysis also supports the important role of the very equal distribution of income in Korea's rapid fertility decline.

193. SOUTH KOREA. Bongaarts, J. A Framework for Analyzing the Proximate Determinants of Fertility. Popul & Devel Rev 4(1):105-132. 1978.

This paper presents a framework for analyzing the relationship between intermediate fertility variables and fertility levels. An intermediate fertility variable is defined as any behavioral or biological factor through which socioeconomic, cultural, or environmental variables affect fertility. The study proposes a complete set of eight intermediate variables and concludes that only four are important determinants of fertility differentials among populations: proportions married, contraception, induced abortion, and lactational infecundability. A simple model that allows quantitative estimation of the fertility effects of each of these four variables is outlined, and its application (to data from South Korea and the United States) is illustrated.

194. SOUTH KOREA. Kim, M., Rider, R. V., Harper, P. A., and Yang, M. Age at Marriage, Family Planning Practices, and Other Variables as Correlates of Fertility in Korea. Demography 11:641-656, 1974.

The relationships between fertility and 13 variables were examined in three groups of married Korean women, about 400 each from urban, rural, and semirural areas. Data were obtained by interview. Age at marriage and family planning practice were the strongest predictors of fertility, accounting for about 10% and 7% of the total variance, respectively. Other factors which accounted for lesser fractions of variability were ideal number of children, rural versus urban residence, education, aspiration for daughters, exposure to mass media, and economic status. Most of the relationships appeared to be stable over time; others, which were associated with modernization, appeared to be changing. The 13 variables combined accounted for a maximum of 40% of variance in fertility.

195. TAIWAN. Coursin, D. B. Maternal Nutrition and the Offspring's Development. Nutrition Today 8(2):12-13, 15-18, 1973.

A study in Taiwan comparing the effects of a vitamin-calorie-supplement with a vitamin-calorie-protein supplement on the incidence of low-birth-weight babies, showed that the mothers receiving no protein in their supplement had significantly smaller babies.

196. TAIWAN. Hermalin, A. I. and Lavely, W. R. Agricultural Development and Fertility Change in Taiwan. Paper presented at the Annual Meeting of the Population Association of America, 1979.

The island of Taiwan, having experienced a modern "green revolution" early in the century, a land reform in the 1950s, and subsequently, a sustained fertility decline in rural areas, offers a relatively unique and well documented perspective on the question of the relations between agricultural development and fertility. Using individual and areal level data from Taiwan, this paper sets out to clarify relations between agricultural and fertility-related variables. Farm size, tenure, crop types, and agricultural extension services are tested for their influence on fertility, and the growth of off-farm employment and part-time farming is considered as a possible factor in Taiwan's rural fertility decline. Farm households that derive income from off-farm sources are found to consider their children more useful, and to have higher fertility, than purely agricultural households. Agricultural variables, salient in conditions of high and stable fertility, have diminished in explanatory power as rural fertility has declined. Ecological variables remain important, however, in explaining the transition from an agricultural to a semi-agricultural rural economy.

197. TAIWAN. Hsu, S. C. Possible Improvement in Quality of Human Progeny by Maternal Dietary Intervention: Implications for Programs of Family Planning and Food Production. Nutr Reports International 7(5):569-583. 1973.

A report is made on the family planning program in Taiwan which emphasizes the integrated problems of population growth, nutrition and health, and food supplies. Nutrition and food supply have greatly improved in Taiwan since 1950, particularly in increases in food energy and protein availability. There has been a corresponding, though not necessarily resultant, decline in maternal and infant mortalities and deaths from gastrointestinal diseases. An official family planning program was instituted in Taiwan in 1964 with the goal of reducing the rate of natural increase from 3.0% to 1.5%. In 1971 the rate was

2.1%. Legalizing sterilization and abortion has been an important part of this program. A major goal is improvement in the quality of people. Reducing the size of the population results in more and better food and educational opportunities. A government study in Sui-Lin Township of Taiwan is investigating the effect of improved maternal health and nutrition on the quality of the offspring. The study is seeking to determine the minimum maternal food intake for proper health and which phase of the maternal diet (pre-pregnancy, pregnancy, lactation) or of the infant's diet is the most important to offspring quality. Also being studied is the possible existence of a maximum level of maternal nourishment beyond which detrimental effects might occur. The answers to these questions may provide important information for national nutrition policies, which are important factors in the family planning program.

198. TAIWAN. Jain, A. K. Pregnancy Outcome and the Time Required for Next Conception. Popul Stud 23(3):421-433, 1969.

In this study of 2,443 Taiwanese women, the average interval between births was 17 months. The average length of lactation amenorrhea was estimated at 8.7 months when the infant lived one year. This was five months longer than for women whose infants died.

199. TAIWAN. Jain, A. K. et al. Demographic Aspects of Lactation and Postpartum Amenorrhea. Demography 7(2):255-271, 1970.

Data from a 1966 Follow-up Survey of Acceptors of an IUD in Taiwan involving 5,000 married women established a positive association between lactation and postpartum amenorrhea. It was found that breast feeding delayed the resumption of menstruation by about 7 months. Multiple regression analysis was used to assess the effects of age, parity, education, and place of residence on lactation and amenorrhea.

200. TAIWAN. Jejeebhoy, S. J. The Transition from Natural to Controlled Fertility in Taiwan: A Cross-Sectional Analysis of Demand and Supply Factors. Paper presented at the Annual Meeting of the Population Association of America, 1978.

Three factors are usually proposed as inducing the transition from natural to regulated fertility. Fertility regulation may occur when the demand for children is reduced, when general attitudes towards fertility regulation become positive, and when factors such as infant and child survival prospects and natural fertility conditions increase the potential supply of surviving children. Applying the Easterlin framework for fertility determination, the author considers the effect of these three factors in the shift from natural to regulated fertility in Taiwan in 1965. Cross-sectional data for continuously married women aged 35-44 are used. The results indicate that at the initial stages of the fertility transition the regulating subpopulation can be distinguished from the natural fertility subpopulation primarily by an increase in the potentail output of surviving children and a decline in the drawbacks associated with fertility regulation. These two factors, rather than a decline in desired fertility, may be said to induce the transition from natural to regulated fertility.

201. TAIWAN. Mosher, S. W. Birth Seasonality Among Peasant Cultivators: The Interrelationship of Workload, Diet and Fertility.

An analysis of the monthly distribution of live births over a 51-year period, 1926-1976, for Cross Harbor, a rural Taiwan fishing community, discovered no birth seasonality. This finding reflects the fact that there was no seasonality in food production because there were enough fish in all seasons to provide for the villagers' protein needs.

This case is shown to be consistent with the suggestion, developed by Pasternak during a study of birth seasonality in two Taiwan farming communities, that for peasant cultivators the annual cycle of food production exerts a more decisive influence on birth seasonality than time of marriage or attributes of temperature, rainfall, or workload.

This paper proceeds to use several sets of data on monthly births in different populations to test the hypothesis that nutritional effects largely explain the seasonality of conceptions and births in population groups that experience significant seasonal variation in diet.

202. TAIWAN. Seasons of Birth and Marriage in Two Chinese Localities. Human Ecology. 6(3):299-324. September 1978.

The author examines the effect of variations in the food supply on fertility in two rural agricultural villages in Taiwan, particularly as they affect first births, the timing of births, and the number of children per family. The study concludes that the agricultural harvest cycle of food production exerts a greater influence on birth seasonality than other seasonal factors, such as time of marriage or attributes of temperature, rainfall, or workload.

203. TAIWAN. Sullivan, J. M. The Influence of Cause-Specific Mortality Conditions on the Age Pattern of Mortality with Special Reference to Taiwan. Popul Stud 27(1):135-159. March 1973.

The relationship between childhood and adult mortality from 1957 to 1968, a period of rapid mortality decline, was investigated in Taiwan. In 1957, the Taiwanese data reflected the severe childhood mortality of the South Model Life Tables. However, by 1968, due to an especially large decline in childhood mortality, this relationship was more moderate and resembled the mortality pattern of the West or East Model Tables. Analysis revealed that a dramatic decline in childhood mortality from gastro-enteritis was primarily responsible for the shift in the relationship between childhood and adult mortality in Taiwan.

While any of several diseases which result in fatalities primarily among children of preschool ages, could cause relatively severe childhood mortality, gastro-enteritis is likely to be a primary contributor to such an age pattern. In the developing areas of the world, malnutrition and gastro-enteritis are usually precipitating and complicating factors of other childhood diseases. Consider the causal components of childhood mortality rates in two populations, Spain and Portugal, known, for certain periods, to have exhibited relatively severe childhood mortality conditions. For the years in which those populations were characterized by the South mortality pattern, gastro-enteritis was the

principal cause of mortality in childhood. Moreover, with the decline in mortality from gastro-enteritis, in Spain and Portugal no longer exhibited childhood mortality rates that were severe relative to those of adult life.

In circumstances where there is evidence indicating substantial childhood mortality from this syndrome and no evidence indicating compensating severe adult mortality, there is reason to suspect that the existing mortality pattern reflects the relatively severe childhood mortality conditions of the South Model Tables. Additionally, where mortality from the gastro-enteritis malnutrition syndrome has been severe in past years, but has been reduced to low levels in recent years, it is probable that the relationship between childhood and adult mortality will shift in favor of the former -- quite possibly, in the manner of Taiwan, from a South to an East or West age pattern.

204. CANADA. Ellestad-Sayed, J., Coodin, F. J., Dilling, L. A., and Haworth, J. C. Breast Feeding Protects Against Infection in Indian Infants. Canad Med Assoc J 120(3):295-298, 1979.

A retrospective study of two Manitoba Indian communities, where infant morbidity and mortality were high, was conducted to determine the relation of type of infant feeding to incidence of infection during the first year of life. 158 infants were divided into three feeding groups: Group A (fully breast fed); Group B (initially breast fed and then changed to bottle feeding); and Group C (bottle fed from birth). The protective effect of breast feeding against infection was confirmed by the very low incidence of infection (mostly lower respiratory tract infection such as pneumonia and bronchitis) and mean number of hospital admissions of breast fed babies. In contrast, bottle fed infants had 10 times more infections and were hospitalized 10 times more than the fully breast fed infants. The protective effect of breast feeding, which lasted even after weaning, did not correlate significantly with family size, overcrowding in home, family income, and education of parents. The nutritional (superiority of human milk to other types of infant formula), psychological (fosters maternal-child bonding) and economic (costs less to produce and reduces cost of hospitalization) advantages of breast feeding should encourage health professionals to promote breast feeding in all communities.

205. CANADA ESKIMO. McAlpine, P. J. and Simpson, N. E. Fertility and Other Demographic Aspects of the Canadian Eskimo Communities of Igloolik and Hall Beach. Hum Biol 48(1):113-138, 1976.

The reproductive histories of 89 mothers in Igloolik and 43 in Hall Beach, two neighboring Canadian Eskimo communities in the eastern Canadian Arctic were compared according to the mothers' reproductive status. A total of 945 fetuses, consisting of 826 (87.4%) livebirths, 28 (3.0%) stillbirths, 90 (9.5%) spontaneous abortions and one (0.1%) unknown outcome were reported. Approximately 25% of all livebirths died before 15 years of age. On the average, premenopausal mothers in Hall Beach experienced menarche about 11 months earlier and had their first baby about 12 months earlier than did their counterparts in Igloolik. The natural reproductive period ranged from 28 to 43 years with the mean age of menopause at 52 years. The average family size per naturally postreproductive female was 11.1+0.9 livebirths plus stillbirths for the two communities combined. Premenopausal women had another child sooner when their previous birth died at less than one year than when it lived longer. If the previous birth lived for more than one year, premenopausal mothers had a subsequent child about 4 months sooner after male than after female births. No patterns of child spacing were found in the records of naturally postreproductive women. Birth rates in Igloolik and Hall Beach were 51.4 and 36.3, respectively. 11.7 sets of multiple births per thousand births were reported. The average birth weight was 3.12 kg Caucasian admixture, as calculated from pedigree analysis, was estimated to be about 3% in both communities. The coefficient of inbreeding in Igloolik was estimated to be about 0.001; no consanguineous matings were reported in Hall Beach.

U.S.A. French, J. G. Relationship of Morbidity to the Feeding Patterns of Navajo Children from Birth Through 24 Months. Amer J Clin Nutr 20:375-384, 1967.

This study of 139 Navajo infants from birth through 24 months of age shows breast feeding as the feeding pattern of choice in 73% of the babies at birth. Bottle feeding took place in 10% of the babies at birth; the other 17% were on both breast and bottle feedings.

Observation of methods used in preparing formula and in feeding indicates that the present methods provide ample opportunity for contamination and the spread of infection.

Breast fed babies show a better gain in weight during the first 7 months of life than bottle fed babies. Both groups showed a sharp decline in weight after 7 months of age, and the decline continued through the age of 24 months.

Bottle fed babies had a significantly higher incidence of diarrhea from birth through 12 months of age than breast fed babies. There was very little difference in the experience of total illness in these two groups. The incidence of hospital experience of the bottle fed babies was significantly higher than that of the breast fed babies for the first 9 months of life, but there was no difference in the morbidity pattern of bottle fed and breast fed babies after that time.

206. U.S.A. Masnick, G. S. and Katz, S. H. Adaptive Childbearing in a North Slope Eskimo Community. Hum Biol 48(1):37-58, 1976.

Examination of Eskimo data in 11 censuses from 1940 to 1970 of Barrow, Alaska, permitted identification of surviving births with their mothers. The fertility of women was traced through several periods of economic depression. Population pyramids, period fertility and cohort fertility were recorded. Women who began reproduction during periods of prosperity had high fertility and short birth intervals which persisted through periods of adversity. Those cohorts that met economic hardship when young had reduced fertility and longer birth intervals then and in subsequent periods of adversity. These findings are at variance with traditional demographic transition theory.

207. U.S.A. Schaefer, O. Nature's Contraceptive. In When The Eskimo Comes to Town. Nutr Today :8-16, Nov.Dec., 1971.

A portion of this article dealing with changing eating habits among Eskimos discusses the advent of bottle feeding and changing fertility patterns. Schaefer reports a jump from 40 births per 1000 in the mid-1950s to 64 per 1000 ten years later. He states that there is a "clear relationship" between the increasing use of bottle feeding, shortening of lactation, and the Eskimos' population explosion.

208. CENTRAL AMERICA. Teller, C. H. and Bent, V. Demographic Factors and Their Food and Nutrition Policy Relevance: The Central American Situation. Paper presented at the Annual Meeting of the Population Association of America, 1978.

The authors examine the contribution that the applied population field can make to food and nutrition policy planning. A conceptual framework is presented which indicates how demographic processes and structures interact with agro-economic structures to affect three important policy areas: family health, food availability, and service demand.

Trends in selected demographic factors related to the food and nutrition situation are presented for Central America and Panama. They suggest the potential advantages in nutrition for a country such as Costa Rica in which the demographic structure has recently been changing radically. Trends in malnutrition for Central America as a whole reveal little evidence of improvement, and a substantial increase in the number of malnourished children aged 0-4 has occurred between 1965 and 1975. There was a modest average yearly increase in per capita calorie and protein availability in 1960-1970, but the increase declined in 1970-1974.

It is concluded that in countries which do not effectively promote income, land, and employment distributive policies, demographic dynamics can place serious constraints on improving the nutritional situation.

209. COSTA RICA. May, J. M. and McLellan, D. L. The Ecology of Malnutrition in Mexico and Central America. New York: Hafner, 1972.

This study found that 10% of the Costa Rican women were anemic in the 3rd trimester of pregnancy and that 21% of pregnant and 17% of lactating women had low levels of riboflavin in their red cells.

210. COSTA RICA. Menchu, M. T.; Flores, M.; and Lara, M. Y. Lactancia y deteste en el area rural de Centro America y Panama (Lactation and weaning in rural areas of Central America and Panama) Arch Latinoam Nutr 22:83-99, 1972.

Lactation and weaning practices were studied in rural villages by interviewing mothers about their youngest child. The lactation period in Costa Rica was the shortest in Central America; about 40% of the children were already weaned at 4 months. Supplementation also began earlier in Costa Rica than elsewhere in Central America. Weaning was generally gradual. The first supplementary foods introduced in order of frequency were milk, rice, eggs and bean broth. At 12 months the percentage of children given supplementary cow's milk was higher in Costa Rica than elsewhere in Central America. By 18 months the children's diet was basically the same as an adult diet.

211. COSTA RICA. Zaltman, G.; Altwood, J.; and Graciela, C. Child-feeding Practices and the Influence of Educational Level and Mass Media in Costa Rica. Bull WHO 45:827-834, 1971.

Three hundred and twenty-two rural mothers were surveyed about their child-feeding practices. The child-feeding practices are in need of improvement,

particularly among mothers with relatively little formal education and especially during the first year of life and during periods of sickness. More mothers, regardless of their educational level, should be encouraged to breast-feed and to do so for longer periods. Currently, the median duration of breast-feeding is approximately 4 months. The most frequent explanation given by the women for cessation of breast feeding is "their milk had dried up." No significant relationships are found between the duration of breast-feeding and exposure to individual mass media, education or receipt of medical care while pregnant. The adequacy of the child's diet (in terms of composition, not quantity) is determined retrospectively. Education is positively correlated with adequacy for children less than one year old. Fatalism is uncorrelated with the adequacy of child-feeding.

212. EL SALVADOR. Menchu, M. T.; Flores, M.; and Lara, M. Y. Lactancia y deteste en el area rural de Centro America y Panama (Lactation and weaning in rural areas of Central America and Panama). Arch Latinoam Nutr 22:83-99, 1972.

Lactation and weaning practices were studied in rural villages in El Salvador by interviewing mothers about their youngest child. About half of the children finished breast feeding by 1 year. Weaning is generally gradual. The first supplementary foods introduced in order of frequency were milk, bananas, maize tortilla and wheat bread. By 18 months the children's diet was basically the same as an adult diet.

213. EL SALVADOR. Wishik, S. M. and Van der Vynckt, S. Collaborative Study on Relationships Between Nutrition and Fertility. Report to Pan American Health Organization. March, 1974. (Unpublished)

The relationship between fertility and nutrition was studied in more than 800 Salvadorean women. Age-specific parity was found to correlate with pre-school child survival. Maternal age and parity accounted for 83% of the family variance in child survival, and the variables of maternal weight and height accounted for 12.3%. Sixty-six percent of the pre-school children who showed "better" nutrition were from families of 4 or less children, while 65% of those of "poorer" nutrition were from families of 5 or more children. Child mortality patterns correlated with the nutritional status of the surviving children. The physical stature of the women correlated with the nutrition of the pre-school children as did body weight, though not as distinctly. Regardless of the present age of the mother, her youngest child was more likely to be in a poor nutritional state if her first pregnancy occurred before she was 18 years old. Postponement of the first pregnancy appeared to be a less crucial factor in child survival than wider birth spacing. A dual program intervention approach is recommended. The first aim would be to improve the caloric and/or protein intake of women during their fertile years and of adolescent women approaching this period. This would also include support for encouraging the appropriate duration of breastfeeding and providing dietary supplements during the post-weaning period. The second aim is to lengthen the birth interval by emphasizing postpartum contraception.

214. GUATEMALA. Anonymous, Guatemalan Program Emphasizes Value of Breast Milk. World Neighbors 11(2E):7, 1978.

A World Neighbors-assisted program in San Jose Poaquil, Guatemala has

taught women to prepare good food using local resources. Three hundred and three women from 24 different groups were attending weekly classes and learning the nutritional value of native leafy green vegetables and breast-feeding. Among Guatemalan women the superstition has long prevailed that the mother's "first milk" was harmful to the infant. The mother would have a friend breast-feed the child or feed it sugar water until she began her regular flow.

215. GUATEMALA. Bongaarts, J., and Delgado, H. Effects of Nutritional Status on Fertility. In International Union for the Scientific Study of Population (IUSSP). International Population Conference, Mexico, 1977. Vol. 1. Liege, Belgium: IUSSP, 1977.

Detailed reproductive and nutritional data were gathered from 400 rural Guatemalan women to analyze the effect of nutritional status on fertility. The population is largely agricultural with good free basic medical care. Due to the clinic system, infant mortality dropped from 150-200/1000 in the 1960s to 50/1000 in the 1970s. At the time of study the crude birthrate was 42.5 and death rate 6.9. Weight, height, arm circumference, and skinfold were used to determine nutritional status. Analysis showed nutrition was positively related to fertility and negatively related to duration of postpartum amenorrhea. However, it had no significant correlation with probability of conceiving o the risk of spontaneous abortion. Women with low nutritional status had a total marital fecund fertility rate of 15.1, those with medium status 16.0, and those with high 16.8. These variations seem to be explained almost entirely by length of postpartum amenorrhea. Several explanations are offered: 1) If under-nutrition reduces volume of breast milk, infants may attempt to compensate by increasing intensity and duration of suckling. This would prolong amenorrhea because the antiovulatory effect of lactation is apparently the consequence of nipple stimulation. 2) Low nutritional status may indicate low availability of food for the family and greater dependence on breast milk to nourish the infant. 3) An undiscovered relationship between nutrition, lactation, and ovulation may exist. (Editor's note: high nutritional status may also be correlated with higher socioeconomic status and a reduced tendency to breast-feed frequently on demand.)

216. GUATEMALA. Delgado, H. et al. Effect of Improved Nutrition on the Duration of Post-partum Amenorrhea in Moderate Malnourished Populations. In Proceedings of the X International Congress on Nutrition, Kyoto, Japan. Aug. 3-9, 1975. p. 605 (Abstract) See fuller article AJCN 31: 1978.

In this study we tested the hypothesis that an improvement in maternal nutritional status would be associated with a decrease in the duration of post-partum amenorrhea. We found in 334 moderately malnourished rural Guatemalan mothers that adequate food supplementation during pregnancy shortened the duration of post-partum amenorrhea ($r=-.142$, p .01). In addition, other indicators of maternal nutritional status, such as home diet, height, weight, head circumference and arm circumference were negatively associated with duration of post-partum amenorrhea. These data suggest that improvement of maternal nutritional status is associated with a decrease in the duration of post-partum amenorrhea and thus may increase the probability of a shorter birth interval. This interaction between nutritional status and post-partum amenorrhea has important implications for population dynamics. (Note: the editors would wish to know whether changes in breast-feeding patterns and frequency resulted from contact between the mothers and the supplementation program staff.)

217. GUATEMALA. Delgado, H. et al. Nutrition and Birth Interval Components: The Guatemalan Experiences. In Nutrition and Human Reproduction, ed. W. H. Mosley. New York: Plenum Press, 1978.

In order to test the hypothesis that mild to moderate protein-calorie malnutrition adversely affects the physical growth and mental development of infants and preschool children, a quasi-experimental design was employed and food supplementation was provided in 4 Spanish speaking, subsistence agricultural villages in the department of El Progreso, Guatemala. In 2 of the villages, a high protein calorie drink was made available daily in a central dispensary. In the other 2 villages, a non-protein, low calorie drink was provided daily. In all villages free outpatient preventive and curative medical services were provided, and these services also provided nutritional rehabilitation when prescribed. The analyses presented included as subjects all pregnant and lactating women with infants less than age 2 in the 4 villages. Food supplementation during pregnancy is the main experimental treatment and groups of mothers were categorized by the amounts of supplemental calories and proteins they ingested during pregnancy, their home diet, and their total calorie-protein intake. The total sample for analysis was made up of all mothers in the 4 communities who had a delivery between January 1, 1969 and February 28, 1973, and who had been followed up to January 1973. Because reliable information on menstruation and lactation was not collected prospectively until the end of 1970, there is prospective information for only 438 intervals. The median duration of lactation was 18 months. The median duration of postpartum amenorrhea was 14 months. The following were found to be positively correlated with the duration of postpartum amenorrhea: the duration of lactation, weight gain of the infant during the first 9 months, parity, age of the mother, and length of previous birth interval. Caloric supplementation ingested by lactating mothers and their infants, caloric intake during pregnancy, and anthropometric measures of maternal nutrition were negatively correlated with the duration of postpartum amenorrhea.

218. GUATEMALA. Early, J. D. The Structure and Change of Mortality in a Maya Community. Milbank Mem Fund Q 48:179-200, 1970.

This paper reports the findings of a demographic analysis of mortality among the Atiteco Indians of Santiago Atitlan during the 1950's and 1960's. Infant mortality was expected to be highest during the first month, decline, and then reach a second peak at 2 years of age. However, it actually declined from birth without a second peak. Mortality during the first month was primarily caused by respiratory infection and difficulties connected with fetal development and birth. During the next 4 months mortality due to respiratory infection remained high. From 6 months to 3 years much mortality was associated with diet. Children were breastfed 3 years, but the milk was nutritionally insufficient after 6 months. Supplemental foods, such as corn, beans, coffee and fruit, were deficient in protein. Consequently, many infants suffered from protein deficiency and kwashiorkor. Weanling diarrhea was also a common cause of death.

219. GUATEMALA. Flores, M.; Flores, Z.; and Lara, M. Y. Food intake of Guatemalan Indian Children, Ages 1 to 5. J Am Diet Assoc 48:480-487, 1966.

A study of 300 children showed that all had been breast fed usually to about 18-20 months and some were breast fed up to 36 months. Foods usually introduced into the diet were white bread, coffee, maize tortilla, bean broth, oatmeal and later banana, rice, green pear and tomato; milk and eggs were given if available.

220. GUATEMALA. Grossbard, A. A Theory of Marriage Formality: The Case of Guatemala. Paper presented at the Annual Meeting of the Population Association of America, 1978.

In this paper, the author considers the determinants of choice between formal and consensual marriage. A theory based on the assumptions of voluntary individual choice and the existence of markets predicts asymmetry in male and female attitudes to formal marriage. That theory is then tested on data from a 1974 Rand INCAP (Institute of Nutrition of Central America and Panama) survey of six Guatemalan communities. Regression analysis confirms the theory by showing that female income and general resources increase the probability of formal marriage for the woman, while this is not so for the male.

221. GUATEMALA. Habicht, J. et al. Relationships of Birthweight, Maternal Nutrition and Infant Mortality. Nutr. Reports International 7:533-549, 1973.

Calorie supplementation during pregnancy is associated with heavier babies in a rural Guatemalan sample. This paper outlines other possible maternal and environmental factors related to birthsize and suggests that increased birthweight is the prime factor in reducing infant mortality among babies born to supplemented mothers. Caloric supplementation during pregnancy has less effect on birthweight than do maternal height and weight at conception, indicating that efforts to improve maternal nutrition should begin in childhood for optimum infant survival, and that during pregnancy, small thin mothers should be supplemented to prevent the birth of "small for date" babies.

222. GUATEMALA. Habicht, J. et al. Maternal Nutrition, Birth Weight and Infant Mortality. In Size at Birth, eds. K. Elliot and J. Knight. Amsterdam: Associated Scientific Publishers, 1974.

This study of 405 Guatemalan births shows that birth weight increases with maternal caloric intake, but the effect levels off as adequate nutritional status is reached. The relationship is supported by evidence that changes in birth weight between successive siblings are associated with changes in maternal energy intake between successive pregnancies.

223. GUATEMALA. Lechtig, A. et al. Food Supplementation During Pregnancy, Maternal Anthropometry and Birth Weight in a Guatemalan Rural Population. J Trop Pediatr 24:217-222, 1978.

A study on the relationship between food supplementation and maternal nutrition, as assessed through anthropometric measurements, was carried out in four rural villages of Guatemala; the relationship of these measurements to birth weight was also explored. Findings revealed that caloric supplementation was positively associated with maternal monthly weight gain during pregnancy after controlling for maternal home diet, height, head circumference, gestational age, parity, birth interval, morbidity, socioeconomic status, and type of supplement (protein-calorie and calorie) (r=0.213; m=294g of weight gain during pregnancy per 10^4 supplemented calories; No.=135; p 0.05). The proportion of mothers with a monthly weight gain equal to or less than 0.5 kg was 15% in the low-supplemented group (_10,000 Cal/pregnancy) and 2.4% in the high-supplemented group (_ 20,000 Cal/pregnancy) (t test: p 0.10). Direct associations between birth weight and all maternal measurements of mass and length

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(weight at first, second, and third trimester, weight gain during pregnancy, height, and sitting height); with all the perimeters measured (biestyloid and bicondylar) were also observed. Associations between birth weight and skinfolds (subscapular, bicipital, tricipital, midaxilar, lateral and anterior thigh, and leg) were less consistent. These results support the hypothesis that food supplementation improves not only birth weight but maternal nutritional status as well. Furthermore, the associations found between birth weight and parameters of maternal size allow the building of simple risk indicators of low birth weight babies (2.5 kg), useful to select population groups requiring prioritary attention in public health programs.

224. GUATEMALA. Lechtig, A. et al. Maternal Nutrition and Fetal Growth in Developing Societies. Am J Dis Child 129(4):434-437, 1975.

In developing countries, the differences between upper and lower socioeconomic groups are often sharp. Women from the latter are shorter, have a lower intake of protein and calories when pregnant and are more likely to give birth to small babies. This study, which is part of a long term investigation by INCAP (Institute of Nutrition of Central America and Panama) on nutrition and mental development, reports some of the interrelationships among socio-economic factors, maternal nutrition and birth weight. The data were collected from four rural "ladino" villages in Guatemala.

A scale was devised based on characteristics of housing, clothing and education of children. As the socio-economic score increases, the percentage of low birth weight babies decreases. The score is also significantly associated with maternal height and head circumference, third trimester weight and maternal morbidity. The findings suggest that socioeconomic status reflects conditions which result in maternal malnutrition and disease, and, in turn, produce fetal growth retardation.

The interrelations of food supplementation, socioeconomic score and maternal height were also investigated. Mothers recording a low score in the tests and subsequently given supplementary food during pregnancy have a much lower proportion of low birth weight babies. Mothers of a higher score are minimally affected by supplementation.

225. GUATEMALA. Lechtig, A. et al. Effect of Food Supplementation During Pregnancy on Birthweight. Pediatrics 56:508-520, 1975.

A prospective study of women in four Guatemalan villages was conducted. The study consisted of giving pregnant women in all four villages daily dietary supplements. In two villages the supplement was a refreshing cool drink (fresco) which provided 59 kcal per cup but no protein. In the other two villages, a gruel (atole) containing 163 kcal and 11 g protein per cup was given. The low-supplement group consisted of 192 women who received on the average 43 kcal per day extra whereas the 165 women in the high-supplement group got 233 kcal. In neither group was there a significant positive correlation between the supplemented calories and birth weight, nor did the fresco group have a significantly greater increase in birth weight per unit of calories supplemented than those receiving atole.

When the two groups were considered together the correlation between supplement and birth weight became significant, the babies gaining on an average 29 g birth weight per 10,000 kcal supplement. The incidence of infants weighing 2500 g or less was 18 to 19 percent in those women who took less than 20,000 extra calories compared with 9 to 10 percent in those who had more than

20,000 kcal. A halving of the incidence of low-birth weight by this modest degree of caloric supplementation is an impressive result. Multiple regression analyses showed that this result was not due to third factors.

226. GUATEMALA. Lechtig, A. et al. Effect of food supplementation on blood pressure and on the prevalence of edema and proteinuria during pregnancy. J Trop Pediatr 24(2):70-76, 1978.

Pregnant women in 4 rural villages of Guatemala were given 2 types of food supplement: "atole" containing protein and energy and "fresco" without protein. At the end of the 3rd trimester of pregnancy, the proportion of mothers with diastolic blood pressure over 70 mmHG was 19.7% in those given more than 20,000 kcal extra energy compared with 30.3% in those given less than 10,000 kcal. All 7 women with systolic blood pressure over 130 mmHG were within the group taking less than 10,000 kcal. The proportion of mothers with edema of lower limbs was 13.1% in the group given more than 20,000 kcal and 7.2% in the other group. There was no association between energy supplement and presence of proteinuria. There was no significant difference between the protein-energy and energy supplements in their associations with diastolic blood pressure and edema of lower limbs. Those relations were basically unchanged after allowing for maternal home diet, height, head circumference, parity, gestational age, duration of disease during pregnancy and socioeconomic status.

227. GUATEMALA. Lechtig, A. et al. Maternal Nutrition, Human Milk Composition and Infant Nutrition in a Rural Population of Guatemala. In Proceedings of the Western Hemisphere Nutrition Congress V, eds. P. L. White and N. Selvey. Monroe, Wisconsin: AMA, 1978.

The objective of this study was to examine the hypothesis that maternal nutrient intake during pregnancy is associated with human milk output and infant nutrition. For this purpose, we studied the relationships between calorie intake during pregnancy and several components of blood, urine and milk in 55 lactating mothers and their infants during the first six months after delivery. It was found that home caloric intake during pregnancy was inversely associated with the non-essential (NE)/essential (E) serum amino acid ratio (r= -0.34; n=55; p .05) and positively associated with maternal serum albumin (r = -0.34; n=55; p .05), the maternal urinary urea/creatinine ratio (U/C) (r=0.40; n=83; p 0.01). Moreover, the ratio of infant weight x U/C, an indicator of infant daily protein intake, was associated with maternal home caloric intake during pregnancy (r=0.48; n=21; p .05). These results are compatible with the hypothesis that home caloric intake during pregnancy is one determinant of maternal and infant nutrition status during the first six months of lactation. In addition, age of the infant was inversely associated with concentration of human milk protein, energy and fat, possibly because of the corresponding increase in total milk volume. Also, high degree of covariation was observed between concentration of several milk components, suggesting that concentration of one component (i.e., fat) may be a useful indicator of the level of the other components of human milk.

228. GUATEMALA. Mata, L. J. et al. Antenatal events and postnatal growth and survival of children in a rural Guatemalan village. Ann Hum Biol 3(4):303-315, 1976.

The biological features of all pregnant women and newborn infants in a

typical rural village of Guatemala were studied from 1964 to the present; 458 pregnancies were analyzed. The mothers had an average height 143.1 cm, weight 52.9 kg and triceps skin fold 9mm. The diet of most was adequate in protein but inadequate in Fe and other nutrients. Infection was common, 2 or more episodes occurring in 40% of pregnancies.

The newborn population had a mean birth weight 2533 g and length 45.6 cm; 34% were less than 2501 g at 37 weeks gestation or over; 7% were pre-term. The infants' growth was followed till age 6 years. Survival correlated strongly with birth weight and gestational age. Pre-term infants showed the poorest survival in neonatal and postneonatal infancy, but the survivors throve thereafter. The full-term small-for-gestational age infants had poor survival in infancy and during the second and third years. Term infants with adequate weight for gestational age had the best survival rate. Postnatal physical growth correlated with birth weight and gestational age but pre-term adequate-for-gestational age infants showed a rate of growth as good as that of term infants.

229. GUATEMALA. Mata, L. J. The Children of Santa Maria Cauque: A Prospective Field Study of Health and Growth. Cambridge, Massachusetts: MIT Press, 1978.

The relationship of nutrition to fetal growth and infant survival, and child feeding practices were studied in rural Guatemala. The sample was 465 pregnancies to 203 women during a 36 year period. Birth weight was negatively correlated with parity, and positively correlated with maternal weight and maternal animal protein intake. Short birth intervals were correlated with poor fetal growth. Furthermore, birth weight, gestational age and long birth intervals were correlated with survival. Maternal undernutrition limited fetal growth and thus increased the risk of mortality. Weaning began at 2-5 months and was completed at 23-24 months.

230. GUATEMALA. May, J. M. and McLellan, D. L. The Ecology of Malnutrition in Mexico and Central America. New York: Hafner, 1972.

Lactation and weaning practices in Guatemala are discussed. Black Caribs add gruel to a baby's diet during the second week, and other solid food is introduced in 10-18 months. Weaning is completed by 2 years. Lower class rural Ladinos wean at 18 months, and lower class urban Ladinos wean before 6 months. In rural areas pregnant and lactating women frequently suffer iron deficiency.

231. GUATEMALA. Menchu, M. T.; Flores, M.; and Lara, M. Y. Lactancia y deteste en el area rural de Centro America y Panama (Lactation and weaning in rural areas of Central America and Panama). Arch Latinoam Nutr 22:83-99, 1972.

Lactation and weaning practices were studied in rural villages by interviewing mothers about their youngest child. More than half of the children continued breast feeding longer than 1 year. Weaning was gradual; the introduction of solid or semisolid foods was very slow. The first supplementary foods introduced in order of frequency were maize tortilla, kidney bean broth, coffee, cereal flours and wheat bread. At 12 months of age the percentage of children given supplementary cow's milk was lower in Guatemala than elsewhere in Central America. By 18 months the children's diet was basically the same as an adult diet.

232. GUATEMALA. Pebley, A. R.; Delgado, H.,; and Brineman, E. Fertility Desires and Child Mortality Experience: A Study of Guatemalan Women. Paper presented at the Annual Meeting of the Population Association of America, 1978.

Using survey data collected by the Institute of Nutrition of Central America and Panama (INCAP) in rural and semi-urban Guatemalan communities, the authors examine the relationship between differential child mortality experience and the desire for an additional child among women of childbearing age. The model assumes that fertility decisions are made at each life cycle stage. Couples may either consciously make fertility decisions based on current mortality conditions, or their fertility desires may be subconsciously influenced by personal experience with child death. The sample is divided into groups based on the number of living children at the time of interview, and a separate discriminant function is derived for each group. The results indicate that child mortality experience appears to influence the fertility decisions only of those who already have five or more living children, and that this effect appears to be subconscious.

233. GUATEMALA. Schutz, Y.; Lechtig, A.; and Bradfield, R. B. Energy Intakes, Energy Expenditures and Weight Changes of Chronically Malnourished Lactating Women in Guatemala. In Proceedings of The Western Hemisphere Nutrition Congress V, eds. P. L. White and N. Selvey. Monroe, Wisconsin: AMA, 1978.

Total energy intakes and expenditures were assessed in 18 lactating women (mean = 10 months postpartum) and in 6 similarly-sized, non-lactating, non-pregnant women living in the same rural villages in the Guatemalan Highlands. Energy intakes were estimated by the 24-hour recall method for four consecutive days. Energy expenditures were determined (by indirect calorimetry) for two days by monitoring heart rates daily and relating heart-rate to oxygen consumption (VO_2) by individually determined regression lines. Six typical activities of different energy expenditure levels were chosen to calculate the individual regression line. The mean of the two-day energy intakes that corresponded to the days in which energy expenditures were measured was estimated to be 1885 $\pm$ 369 kcal/day for the lactating women and 1959 $\pm$ 445 kcal/day for the non-lactating women. (The mean of the four consecutive days was not significantly different: 1929 $\pm$ 360 kcal/day lactating, 1976 $\pm$ 404 kcal/day non-lactating). The two-day mean energy expenditure (not corrected for milk output) was estimated to be 2007 $\pm$ 292 kcal/day for the lactating women (41.8 kcal/kg body weight) and 1966 $\pm$ 382 kcal/day for the non-lactating women (42.3 kcal/kg body weight). The way of life of both groups was judged "moderately active" by FAO/WHO classification (1973). Most of the lactating women had been losing weight progressively during the last six months. Over the ten-week period prior to our measurements, the mean weight loss was more than ten times greater in the lactating group (-34 gm/month). There was a significant correlation ($r = 0.87$, $n = 24$) between weight change and the change in the sum of three skinfolds, suggesting that fat loss mainly accounted for the weight change.

There were no significant differences between the two groups in terms of daily energy intake, daily energy expenditure, the energy cost of specific typical activities and the pattern of activities throughout the day. At the group level, the "balance" between mean energy intake and expenditure, excluding weight loss, was -6% for the lactating group and less than -1% for the non-lactating group. This preliminary study suggests that the total energy cost of lactation for these chronically malnourished women was met to a greater extent by fat loss than by increased energy intake, reduced energy expenditure, or both.

234. GUATEMALA. Scrimshaw, N. S.; Taylor, C. E.; and Gordon, J. E. Interactions of Nutrition and Infection. Geneva: WHO, 1968.

Field observations of acute diarrheal disease among rural Mayal Indian populations of the Guatemalan highlands made during 1958 through 1964 are reported. The peak incidence of diarrheal disease and the mode for completed weaning coincided at about 1 year. Deaths from diarrhea reached the highest rate between 1 and 2 years at 35.6 deaths per 1000 population. Diarrhea accounted for 41% of the deaths in this age group. Diarrheal disease occurred with significantly greater frequency in the malnourished, and attack rates increased progressively with the degree of malnutrition.

235. GUATEMALA. Solien de Gonzalez, N. Breast Feeding, Weaning and Acculturation. J Pediatr 62:577-581, 1963.

The incidence of breast feeding and time of weaning were studied among Indians and rural and urban Guatemalans of Latin ancestry in Guatemala in 1962. Among the Indians, children were never weaned earlier than 18 months of age. The latest age for weaning was 4 years. The ideal age was 2-2½ years. Nursing continued throughout the next pregnancy and the older child was weaned a few weeks after the new birth. Among the rural lower-class Ladinos, weaning took place between 12-24 months. During the first 3-4 days of life, a child was not breast fed by the mother, sometimes a wet nurse was employed or the infant was given sugar water or nothing at all. Early weaning sometimes took place if it was felt that the milk of the mother had become immature. Weaning took place when another pregnancy occurred. If pregnancy did not occur, the usual age for weaning was 18 months. The urban low-class Ladinos frequently weaned their infants before 6 months of age. Children received bottles with very dilute cow's milk or cereal gruel made of cornstarch, oatmeal or cassava starch. Most children in this group were weaned by 18 months. Reasons given for early weaning were: impairing the health of the mother, advice of doctors or nurses, insufficient milk, mother's return to work. The author believed that breast feeding became less common and shorter in the urban group as medical advice became more available.

236. GUATEMALA. Solien De Gonzalez, N. L. Patterns of Diet, Health and Sickness in a Black Carib Community. Trop Geogr Med 15:422-430, 1963.

The Black Caribs of Guatemala initiated breast feeding shortly after birth. In the first 2 weeks breast feeding was supplemented by a past of cassava starch, sugar and flavoring. At about 2 months a bottle of dried milk and water or sweetened tea once or twice daily was often introduced. Solid foods were introduced at about 10-18 months. Weaning was almost always complete by 2 years but often earlier.

237. GUATEMALA. Sosa, R., Kennell, J. H., Klaus, M. and Urrutia, J. J. The effect of early mother-infant contact on breast feeding, infection and growth.

Studies from several areas suggest that early brief separation of the mother and infant during the first minutes and hours after delivery can alter the behaviour of the mother with her child months and years later.

To determine the physical benefits for the infant of early skin-to-skin contact with the mother we studied the effects of early mother-infant contact on breast feeding in poor urban populations of Guatemala City. The mothers in the experimental groups were given their naked infants on the delivery table and then spent 45 min alone with them in a private room. The control group of mothers were separated from their infants according to hospital practices, usually 12 h. We made follow-up home visits when the child was 35 days and at 3, 6, 9, and 12 months old to obtain accurate information about breast feeding habits, infection and weight gain.

In two of the three populations studied there were significant differences between the experimental and the control groups in the mean number of days that the infants were breast fed. In all three studies, infants of early-contact mothers had fewer episodes of infections.

To explore the timing of this sensitive period, we studied another 60 primiparous mothers: 40 mothers had either the experimental or control conditions, as in the previous studies and the other 20 mothers first received their nude infant at 12 h. Observations at 36 h of maternal behaviour showed that only those given early contact (45 min) had significantly more affectionate behavio

These studies suggest that (1) the maternal sensitive period is less than 12 h and (2) early mother-infant contact postpartum has far-reaching effects on infant health during the first year.

238. GUATEMALA. Wyatt, R. G. and Mata, L. J. Bacteria in Colostrum and Milk of Guatemalan Indian Women. J Trop Pediatr 15:159-162, 1969.

Fifty-one samples of colostrum and milk were collected from 31 mothers and analyzed. The range of bacterial concentration is from 10^3 to 10^6/ml, with an average of $3(10^4)$/ml. The duration of lactation is uncorrelated to bacterial concentration. Escherichia coli is present in 18% and alkaligens in 14% of the samples. The presence of enterobacteriaceae in human colostrum and milk may play a role in intestinal colonization.

239. HONDURAS. May, J. M. and McLellan, D. L. The Ecology of Malnutrition in Mexico and Central America. New York: Hafner, 1972.

The nutritional status of lactating and pregnant women is measured. They have no greater vitamin A deficiency than other women, but they have a greater incidence of anemia.

240. HONDURAS. Menchu, M. T.; Flores, M.; and Lara, M. Y. Lactancia y deteste en el area rural de Centro America y Panama (Lactation and weaning in rural areas of Central America and Panama). Arch Latinoam Nutr 22:83-99, 1972.

Lactation and weaning practices were studied in rural villages by interviewing mothers about their youngest child. More than half of the children continued breast feeding longer than 1 year. Weaning was generally gradual. The first supplementary foods introduced in order of frequency were milk, rice, wheat bread, and broth. By 18 months the children's diet was basically the same as an adult diet.

241. MEXICO. Chavez, A. et al. Ecological Factors in the Nutrition and Development of Children in Poor Rural Areas. In Proceedings of the Western Hemisphere Nutrition Congress III, eds. P. L. White and N. Selvey. Mount Kisco, New York: Futura, 1972.

Several significant differences exist between well-nourished and malnourished children of the same socioeconomic class in the town of Solis. Among malnourished children 65% were girls against only 39% among the well nourished. The mother's diet was significantly lower in quantity and quality for the malnourished group. Weaning occurred earlier and more suddenly. Mothers of the malnourished were less Westernized. Both groups were similar with respect to family size, family integration, family and child diseases, literacy of the father, tenure of land and family income. Longitudinal study of a group of supplemented pregnant women and a control group showed that supplemented mothers gave birth to children of significantly greater birth weight. And mother's milk production in the supplemented group reached higher volumes which were sustained longer. The supplemented group of infants were also five times more active than the control group.

242. MEXICO. Chavez, A., and Martinez C. Nutrition and Development of Infants From Poor Rural Areas: III. Maternal Nutrition and Its Consequences on Fertility. Nutr Reports International 7:1-14, 1973.

To test the hypothesis that malnutrition alters fertility, the reproductive pattern of a poor rural community with a high natality rate was studied. Late menarche (15 ± 1.5 years) and early menopause (40.4 ± 2.5 years) were found to result in a short reproductive period of 25 years. In all this period women had 8.8 ± 2.7 pregnancies and 7.9 ± 2.9 deliveries, but only 4.8 ± 2.2 children reached adulthood.

A longitudinal observation was made of two groups, one supplemented and one non-supplemented, both similar in all other respects and both lactating almost continuously between pregnancies. The control group recovered "fertility" 14.0 ± 4.0 months after a delivery while the supplemented group did it after only 7.5 ± 2.6 months; this difference, as well as the difference in recovery times in the experimental group before and after supplementation were highly significant (p 0.001).

The study concludes that undernutrition reduces mothers' fertility through possibly two mechanisms: by reducing the length of the women's reproductive life and by increasing the period between deliveries by more than 40%. (Editor's note: Infants of the supplemented mothers also received food supplements from the third month of life. The effect of supplementation and possibly of contact with the study team in reducing the total sucking time of the infants may have had a stronger effect in shortening the duration of amenorrhea than the supplements to the mothers.)

243. MEXICO. Chavez, A.; Martinez, C.; and Bourges, H. Role of Lactation in the Nutrition of Low Socio-Economic Groups. Ecology Food Nutr 4:159-169, 1975.

A two-year longitudinal study was made of the production and consumption of milk of 17 mother-child units in a poor and inadequately nourished rural community. A comparable group was studied with the exception that the diet of the mother was supplemented from the 45th day of gestation until weaning. The children of these mothers were also given food supplements, vitamins and minerals from the third month of age onwards. It was found that in the first six

months of lactation, the consumption of milk by infants in the non-supplemented group followed a curve with a maximum peak of 650 ml. per day. After the sixth month, there was a tendency towards a plateau of about 560 ml. In supplemented mothers, the curve for the first semester was smoother and the volume secreted was 15 percent higher. There was also a decrease in production after the sixth month. It was also found that the milk of the supplemented mothers was more dilute, but it did not differ significantly in its total solid content from the milk produced by the non-supplemented mothers.

244. MEXICO. Garcia Garma, I. O. Fertility Determinants in Rural Mexico, Paper presented at the Annual Meeting of the Population Association of America, 1979.

A theoretical framework of fertility determinants which incorporates the mechanisms through which socioeconomic factors affect fertility is applied to a sample of women in rural Mexico (1970). The paper analyzes the contribution of each of the "intermediate variables" to fertility and evaluates the role played by socioeconomic factors in determining the level of these variables. The findings suggest that contraceptive practice is not widespread in rural Mexico and that conditions of natural fertility prevail. Any given fertility level is mainly determined by age of entry into sexual unions. While the contribution of secondary sterility, lactation and effective fecundability is especially relevant, the contribution of foetal mortality, coital frequency and contraceptive practice is not. Finally, socioeconomic factors are found to have an important effect on lactation, age at marriage and use of contraception, but their influence on fecundability, secondary sterility, coital frequency and foetal mortality is considerably less and often not significant.

245. MEXICO. Hicks. W. W. Economic Development and Fertility Change in Mexico, 1950-1970. Demography 11:407-421, 1974.

This paper is an attempt to isolate the determinants of fertility in Mexico. Of the variables included, two were significant in accounting for differences in the level of completed fertility in the 32 "states" in 1970. They were the share of the labor force in agriculture, which was directly related to fertility, and the percentage of the population speaking an indigenous language, which showed an inverse relationship.

The most important factors acting to reduce total fertility rates over time were increases in life expectancy and declines in the share of the labor force in agriculture. However, based on the estimated linear relationship, these two variables by themselves were not adequate to achieve a rapid decline in fertility in the future.

246. MEXICO. Martinez, C. and Chavez, A. Nutrition and Development in Infants of Poor Rural Areas: I. Composition of Mother's Milk By Infants. Nutr Reports International 4:139-149, 1971.

This study was designed to know the pattern of mother's milk consumption of infants from poor Mexican rural areas. A standardized sample of 17 mother-infant units was longitudinally studied, in ad-libitum conditions, estimating milk volumes by difference of body weights before and after each breast feed. Average total milk consumption during the first year of life was 183±23 liters. Daily milk consumption started low (423±85ml), raised to a peak of about

650±113 ml, then decreased to a prolonged plateau at 450±80 ml and finally dropped to about 350±44 ml at 18 months. About one half of the cases reached the peak at 8 weeks and the rest at 24 weeks; this difference in presentation of the peak showed relation only with mother's parity and nutritional status. Consumption seems to depend on mother's production since the baby keeps a high demand evidenced by high feeding frequencies and long suckling-times. The gap resulting from decreasing milk production at a time when nutritional needs increase, progressively affects the baby's development and nutritional status.

247. MEXICO. May, J. M. and McLellan, D. L. The Ecology of Malnutrition in Mexico and Central America. New York: Hafner, 1972.

Malnutrition strikes early in Mexico, at 3 to 4 months, because of insufficient mothers' milk. Malnutrition frequently leads to child mortality due to decreased resistance to infection in the malnourished child. Malnutrition also afflicts mothers as revealed by the fact that iron serum levels are inadequate in 68% of pregnant women.

248. MEXICO. Rowe, P. M. and Way, P. O. Patterns of Recent Rapid Fertility Declines in Brazil, Columbia and Mexico, paper presented at the Annual Meeting of the Population Association of America, 1980.

See Brazil.

249. MEXICO. Sanjur, D.; Cravioto, J.; and Van Veen, A. G. Infant Nutrition and Socio-Cultural Influences in a Village in Central Mexico. Trop Geogr Med 22:443-451, 1970.

In a village in central Mexico in summer of 1967, 125 Mestizo families with infants under 12 months were interviewed. All infants were breast fed at first. The foods given in the first 6 months were: herb teas, other milk including fresh cow's, powdered or evaporated and goat's; fruit, especially banana, bean soup, tortillas. Infants generally were weaned at 12 to 18 months; 34% because of a new pregnancy, 27% for teething, 20% for low milk yield, and 6% because the mothers felt weakened by breast feeding. The better educated women weaned earlier and gave a greater variety of foods; the older women weaned later than the younger.

250. NICARAGUA. Culbertson, R. E. and Sarn, J. E. Health Sector Assessment for Nicaragua. U.S.A.I.D. Mission: Feb. 6, 1976.

The leading causes of infant mortality in Nicaragua are gastroenteritis, perinatal and respiratory disease and tetanus. Of the children under 5 years of age 42% are suffering Grade I malnutrition, 13% are Grade II and 2% are Grade III according to the Gomez classification.

251. NICARAGUA. May, J. M. and McLellan, D. L. The Ecology of Malnutrition in Mexico and Central America. New York: Hafner, 1972.

The nutritional status of lactating and pregnant women is measured. They have no greater vitamin A deficiency than other women, but they have a greater incidence of anemia.

252. NICARAGUA. Menchu, M. T.; Flores, M.; and Lara, M. Y. Lactancia y deteste en el area rural de Centro America y Panama (Lactation and weaning in rural areas of Central America and Panama). Arch Latinoam Nutr 22:83-99, 1972.

Lactation and weaning practices were studied in rural villages by interviewing mothers about their youngest child. About half of the children finished breast feeding by 1 year. Weaning was generally gradual. Supplementation began earlier in Nicaragua than elsewhere in Latin America. The first supplementary foods introduced in order of frequency were milk, maizena, corn starch and oatmeal, and wheat bread. By 18 months the c ildren's diet was basically the same as an adult diet.

253. PANAMA. May, J. M. and McLellan, D. L. The Ecology of Malnutrition in Mexico and Central America. New York: Hafner, 1972.

Lactational practices and the nutritional status of women are discussed. Weaning was begun after 6 months by the Cuna Indians. Pregnant and lactating women were less anemic than other women of the same age.

254. PANAMA. Menchu, M. T.; Flores, M.; and Lara, M. Y. Lactancia y deteste en el area rural de Centro America y Panama (Lactation and weaning in rural areas of Central America and Panama). Arch Latinoam Nutr 22:83-99, 1972.

Lactation and weaning practices were studied in rural villages by interviewing mothers about their youngest child. About half of the children finished breast feeding by 1 year. Weaning was generally gradual. The first supplementary foods introduced in order of frequency were soups, gruel, fruit juice and milk. By 18 months the children's diet was basically the same as an adult diet.

255. BARBADOS. Reddy, S. K. Artificial Feeding in Jamaica and Barbados. West Indian Med J 20:198-207, 1971.

320 women were interviewed about bottle feeding of their children. The bottle was introduced at less than 1 month by 61.3% of the women. The reasons for introducing the bottle in order of frequency were: to get the child accustomed to the bottle, insufficient breast milk, bottle feeding was good, the mother works, and it was the correct age. Although mothers understood the importance of cleanliness, 82% use too dilute a mixture of powdered milk in the bottle. The median age for complete cessation of breast feeding was approximately 4 1/2 months.

256. BARBADOS. Reddy. S. K. Transition to Family Diet in Jamaica and Barbados. West Indian Med J 20:218-224, 1971.

Data from a survey of 320 women revealed that the median age at which solid food was given children was 6 1/2 months. Children started eating from the family pot at 20 months; however, seldom were the protein rich items chosen. Mothers tended to feed children high carbohydrate foods in preference to high protein foods.

257. BELIZE. May, J. M. and McLellan, D. L. The Ecology of Malnutrition in Mexico and Central America. New York: Hafner, 1972.

In Belize City bottle feeding is introduced early, accounting for a high level of fatal diarrhea.

258. CARIBBEAN. Aykroyd, W. R. Nutrition in the Caribbean. J Hyg, Camb 63: 137-153, 1965.

The nutritional status of the people of the following Caribbean territories is discussed: Jamaica, Puerto Rico, St. Thomas, Surinam, Guyana, Grenada, Barbados, St. Lucia, Martinique, Dominica, Antigua, St. Kitts, Trinidad and Curacao. In many parts of the Caribbean there is a high mortality between 6 months and 2 years due to malnutrition and gastro-enteritis. These two conditions are so closely inter-connected that they can conveniently be regarded as a single syndrome called 'weanling diarrhea'. The prevalence of malnutrition and gastro-enteritis in infants and young children is the result of child-feeding practices characteristic of the area. The duration of breast-feeding is shorter than in Africa and Asia. After 3 months or so breast-feeding, if it does not cease altogether, becomes partial, and in general there is a steady change in the direction of less breast milk. In some territories weaning at an even earlier stage in infancy seems to result in the common occurrence of malnutrition in infants under 6 months of age. The foods given to supplement or replace breast milk include processed cow's milk, starchy roots and fruits and cereals. Imported processed milk supplies good quality protein otherwise lacking in the child's diet, but the use of expensive proprietary infant milk foods, out of line with family purchasing power and given in over-diluted form, is among the causes of malnutrition. The use in infant and child feeding of dried skim milk -- much the cheapest kind of milk in terms of nutritive value -- is increasing and this trend should be encouraged.

259. CARIBBEAN. Gurney, J. M. Weaning Practices from Guyana, Rural Trinidad, Grenada, Montserrat and Antigua. West Indian Med J 20: 227-236, 1971.

Considerable variation was found in the pattern of breast feeding. Seven percent of Guyanese and 4% of Trinidadian mothers did not breast feed their infants at all. Ten percent of mothers who did breast feed stopped before the infant was 4 months old. "Mixed milk" feeding was common. Half the babies were receiving semi-solids by 6-7 months in Trinidad, Grenada and Antigua. The most frequent foods used were potato, plantain flour, maize flour or tinned cereal. Legumes, animal products (fish, meat, eggs) and dark green leafy vegetables were given in the latter part of the first year, but probably in small quantities.

260. CUBA. Diaz-Briquets, S. Income Redistribution and Mortality Change: The Cuban Case. Paper presented at the Annual Meeting of the Population Association of America, 1978.

A causal relationship can be posited between mortality and income distribution: at similar levels of development, countries having a more equitable income distribution tend to have lower mortality than countries where income is less equally distributed. The evidence for Cuba reviewed in this paper supports this contention. Beginning in the early 1960s, Cuba began to experience a series of drastic social and economic changes that brought about a substantial reduction in income differentials. These changes, by emphasizing the elimination of social and regional differentials, had a marked effect on mortality decline as health facilities, superior housing, better educational opportunities, etc., were placed within the reach of previously disadvantaged population subgroups. Of particular interest is that the mortality improvements occurred in an economic context that until recently was characterized by an uncertain performance. The Cuban experience suggests that low income countries can substantially accelerate mortality declines by the institution of policies geared to the elimination of social differentials. Some qualifications are noted regarding some of the social and political costs of the Cuban model and its applicability to other developing countries.

261. HAITI. Jelliffe, D. B. and Jelliffe, E. F. P. The Nutritional Status of Haitian Children. Acta Trop 18:1-44, 1961.

From a study attempting to discover the significance of malnutrition in early childhood in Haiti, it was found from a sample of mothers that breast feeding was usually successful (99%) in the first six months of life. In the second half of the first year, it fell to 81%. From 12-18 months, over half of the women were still breast feeding, while from 18-24 months this dropped to 9%. No children appeared to be breast fed after two years of age. Cow's milk was not common in the diet of most Haitian infants. If it was given, it was only in small amounts. However, between 3-6 months many starchy foods were introduced. In the second half of the first year, the diet usually included a variety of carbohydrates. Early in the second year of life, children received the full range of carbohydrate foods consumed by the adult population.

262. HAITI. Wiese, H. J. C. Maternal Nutrition and Tradional Food Behavior in Haiti. Human Organization 35 (2):193-200, 1976.

In Haiti, malnutrition is especially widespread among pregnant and lactating rural women. While numerous attempts have been made to refashion their dietary habits, traditional food ways have usually prevailed. This article posits that successful intervention has not been forthcoming because change agents either have not been cognizant of or have decided to ignore the cultural rationale for dietary behavior.

Local herbalist/midwives are influential among rural folk and supply much of their obstetrical care. A study undertaken of the dietary advice provided by these paraprofessionals suggests that much of it is based on the "hot/cold classification system of foods," which the author discusses.

Two tables are provided. The first presents 74 foods most available to rural women. It places these foods in their respective hot/cold categories. Annotations delineate those foods which are considered staples, those which are only available seasonally, and those which are prohibited to pregnant women. The second table analyzes the nutrient content of the foods available to pregnant women. The data illustrate non-income related reasons for nutrient insufficiency in the breast-feeding group. (Editor's note: the fact remains, however, that income in much of rural Haiti is not sufficient to sustain adequate nutrition.)

263. JAMAICA. Caribbean Food and Nutrition Institute. Interim Report on Dried Milk Powder and Liquid Milk for Infant Feeding. Sept., 1974.

The promotion of infant formulas by commercial nurses was studied. A researcher accompanied nurses from five companies on their visits to hospitals, clinics and homes. The nurses promoted their companies' products and also gave advice on breast feeding, weaning practice and child care in general. The nurses appeared to have inadequate knowledge of weaning practices and mothers were not adequately prepared for breast feeding at hospitals.

264. JAMAICA. Grantham-McGregor, S. M. and Back, E. H. A Note on Infant Feeding in Kingston. West Indian Med J 19:111-115, 1970.

By 6 weeks of age 77% of the 300 infants were receiving bottle feeds of milk and usually a combination of bottle and breast was continued until 6 months. By 6 weeks of age 51% were getting orange juice, by 3 months 41% were receiving meal, usually maize, and by 8 months 99%. By 4 months 25% were getting egg and cheese. The percentage rose to 94% at 1 year. The percentage getting vegetables and fruit rose from 26 at 4 months to 100 at 1 year. The percentage getting meat and fish rose to 17 at 6 months, 39 at 8 months and 93 at 1 year.

265. JAMAICA. Grantham-McGregor, S. M. and Back, E. H. Breast Feeding in Kingston, Jamaica. Arch Dis Child 45:404-409, 1970.

A longitudinal study was carried out on 300 Kingston infants born at the University Hospital of the West Indies. To age 6 weeks most infants were breast fed, then combined feeding methods were used. After 5 months straight bottle feeding was the more popular method. The commonest reason for changing from breast to bottle was that the baby fused the breast. A higher percentage of non-working mothers breast fed their children than those who were working and more mothers in the lower economic groups breast fed, which indicated that socioeconomic and cultural factors played a large part in the choice of methods for feeding infants.

A higher incidence of gastro-enteritis was found in the first 4 months of life among partly or wholly bottle fed babies than among breast fed babies. Weight increments were calculated for the first 3 months of life. A higher proportion of infants with increments in the lowest 25% were bottle fed than those infants with increments in the remaining 75%.

266. JAMAICA. Jelliffe, D. B.; Bras, G.; and Stuart, K. L. Kwashiorkor and Marasmus in Jamaican Infants. West Indian Med J 3:43-55, 1954.

Breast feeding of Jamaican infants was carried out for a variable length of time, depending largely upon whether the mother was working and upon the occurrence of another pregnancy. Children were usually breast fed from 7-9 months. Longer periods were more common in country districts. Feeds might be widely spaced if a mother was working. Complementary feeds were usually given consisting of cornmeal porridge and sugar, mixed with a little sweetened condensed milk. Weaning was usually a gradual process. Weaning foods were usually sweetened cornmeal gruel, crushed Irish potato, and green banana gruel.

267. JAMAICA. Landman, J. P. and Shaw-Lyon, V. Breast Feeding in Decline in Kingston, Jamaica, 1973. West Indian Med J 25:43-57, 1976.

A prospective study of 81 mothers' breast feeding attitudes and practices were conducted. Although 74% of the mothers felt that breast feeding alone was best, only 38% planned to practice it. In fact, only 25% were breast feeding completely after 3 weeks. Four months was the median age at which breast feeding ended completely. The mothers' reasons for introducing bottle feeding, in order of frequency, were: insufficient milk, samples and advice, to accustom the baby, breast troubles and ill mother. The median age for introduction of semi-solid food was 3 months. Abnormal deliveries, high parity, age and mother working were all inversely related to the duration of breast feeding.

268. JAMAICA. Miall, W. E.; Desai, P.; and Standard, K. L. Malnutrition, Infection and Child Growth in Jamaica. J Biosoc Sci 2: 31-44, 1970.

A semi-longitudinal study of factors influencing child growth in a rural community in Jamaica provided an opportunity to explore the relationships between diarrhoea, respiratory infections and body weight.

Respiratory infections and diarrhoea both reached peak incidences between the ages of 6 and 24 months when children were at highest risk of malnutrition. Respiratory infections had no demonstrable influence on growth. Diarrhoea was more common in boys than in girls and more common in underweight children. It had no apparent influence on long-term weight increases, though it did have the expected influence on short-term increments.

The findings suggested that much of the diarrhoea seen in the community of children may have been secondary to undernutrition rather than a cause of it.

269. JAMAICA. Morales, A. De. and Larkin F. A. Influence of the availability of commercial infant foods on feeding practices in Jamaica. Ecology Food Nutr 1 (2):131-135, 1972.

Jamaican mothers, 150 aged 13 to 49 years, were asked about their marital status, occupation, weekly income, the number of pregnancies, abortions and stillbirths and the feeding practices used for the youngest child. The children were aged from less than 1 month to 10 years. Most of the 40% of the children breast fed at the time of the interview were under 6 months old and most children studied were weaned by 1 year of age. Age of weaning was not affected by income or residence and appeared to have no physiological basis. Mothers who obtained information about weaning from friends and relations weaned their babies earlier than those whose information came from doctors or public health nurses in private clinics. Of all mothers 27% used 2 and 14% used 3 or more commercial milk products.

270. JAMAICA. Reddy, S. K. Transition to Family Diet in Jamaica and Barbados. West Indian Med J 20:218-224, 1971.

Data from 5 surveys about child feeding practices are compiled. The data show that the median age at introduction of semi-solid food is approximately 5 months, solid food 9 months, and food from the family pot at 21 months. The middle income group tends to introduce solid and semi-solid food at an earlier age. Families generally exhibit little knowledge of nutrition, and often avoid giving children protein rich food.

271. JAMAICA. Roopnarinesingh, S.; Morris, D.; and Chang, E. The underweight Jamaican parturient. Br J Obstet Gynaecol 78(4): 379-382, 1971.

At week 14 of pregnancy 146 underweight women weighed a mean 94.9 lb. (range 76 to 100) and 146 controls 14 weeks pregnant weighed 135.89 lb. (range 110 to 220). All were Black women of low or middle socioeconomic status. Of the underweight women 38 had anaemia and 15 had prolonged labour; corresponding values for the controls were 14 and 6. Only 5 of the underweight women but 9 of the controls had pre-eclampsia. Mean birthweight for infants of the underweight group was 6.49 lb and for those of the controls was 7.26 lb; 27 babies of underweight mothers and 10 babies of controls were premature.

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272. PUERTO RICO. Pollitt, E.; Gilmore, M.; and Valcarcel, M. Maternal and Infant Behaviors Regulating Early Growth. In Nutrition in Transition: Proceedings, Western Hemisphere Nutrition Congress V, eds. P. L. White and N. Selvey. Chicago: American Medical Association, 1978.

Earlier work has suggested that the interactions of a mother and her infant may determine the child's early physical growth and mental development. According to the author, "nutritional and non-nutritional behaviors of both mother and infant during feedings and weight gain during the first month of life," are related.

An experiment was conducted involving 21 male and 19 female infants selected from the population of newborns at the Central Medico of the University of Puerto Rico Medical School, San Juan, Puerto Rico. Infants were from low income families. Each was full term and weighed at least 2500 grams. The babies were weighed 48 hours after birth, when the mother was brought to a behavioral laboratory with her infant. At this time, the mother was videotaped during a fifteen minute feeding of the baby. Four weeks later, the mother and infant returned to the hospital, and the baby was weighed again.

The tapes were analyzed using a coding system of 60 different behaviors by the mother and 40 of the infant. It was believed that some of these were "nutritionally functional," such as holding the nipple in the mouth. Others, such as talking, however, are not clearly related to intake.

The results indicated that the mothers of heavy infants cleaned, inspected, spoke to and adjusted the blankets of their babies more often than those of light babies. Mothers of the small babies were busier encouraging their babies to suck, while the heavier infants held the nipple in their mouths longer. For those bottle feeding, replacing the sanitary paper nipple cover on the bottle was positively related to weight gain, although cleaning activities were negatively related. Sex was found to have a significant effect on two of the maternal and infant variables. The paper discusses other findings, and the nature of the analyses performed.

In populations with high prevalence rates of malnutrition the problem may further be aggravated by behaviors of the caretaker, by the infants or by the interaction between mother and child. This may explain malnutrition among highly industrialized communities in developed countries.

273. ST. VINCENT. Antrobus, A. C. K. Child Growth and Related Factors in Rural Community in St. Vincent. J Trop Pediatr 17: 187-210, 1971.

In this survey, combined or "mixed" feeding of breast and cow's milk was usual. Breast feeding was stopped between 4-15 months, with a median age of 9.6 months. The median age for the introduction of cow's milk was 2.5 months. Semi-solids were introduced from 1-9 months (median 3 months), and consisted of arrowroot, Irish potatoes, starches and various proprietary cereals.

274. TRINIDAD. Chopra, J. G. and Gist, C. A. Food Practices Among Trinidadian Children. J Am Diet Assoc 49:497-501, 1966.

The mothers of 38 Black and 19 East Indian infants under 1 year old and of 30 and 19 between 1 and 5 years, were interviewed. It was found that breast feeding was a diminishing practice. No East Indian infants and only 26.3% of the Black infants were solely breast fed; 73.6 and 42.1%, respectively were bottle fed only. Orange juice was given daily to 68.4% of the East Indian infants and 94.7% of the Negro infants from a fairly early age. Cereals, which consisted of arrowroot, sago and parched flour, were started as early as 1 month or as late as 10 months. Fruit and vegetables were gradually introduced but green and yellow vegetables were not frequently used. Weaned children were given some milk but animal protein was given only once or twice weekly to Black children and 2-3 times weekly to East Indian children. Dried legumes were given 7-10 times weekly to Black and once to 7 times to East Indian children; mangoes and citrus fruits were eaten fairly frequently.

275. TRINIDAD. Gueri, M.; Jutsum, P.; and Hoyte, R. Breast Feeding Practices in Trinidad. Bull Pan Am Health Organ 12:316-322, 1978.

Efforts are underway in Trinidad to encourage the practice of breast feeding infants beyond the first few weeks of life. This article reports the results of a survey of current infant feeding practices on the island. Survey data reveal where nutrition education is needed and how health personnel can foster breast feeding.

The original sample consisted of 418 mothers, representing the lower and lower-middle socioeconomic classes who delivered healthy infants over 2,500 grams at either of two general hospitals. All participants resided within 20 miles of the hospital. Women were surveyed by specially trained nurses within 48 hours of delivery. Race, education, age, occupation and feeding plans were ascertained along with participant knowledge about breast feeding. A follow-up interview on actual feeding practices was conducted on 348 of these mothers approximately four months after the first interview.

The survey revealed that 98.3% of the women initially planned to breast feed their babies. Over 60% believed that bottle feeding, as a supplement, was necessary before the baby was two months old. The most frequent explanation given for introducing artificial feeding was that the mother had insufficient milk. Unfortunately the supplement used was usually a highly diluted, often contaminated, expensive artificial product made from milk powder.

For 87.1% of the babies, eight hours or more elapsed between delivery and the first nursing experience. And in those infants nursed before the first interview, 45% had received milk powder formula before being put to the breast. This practice of artificial feeding prior to the first nursing session was significantly associated with the end of breast feeding by the second interview.

Almost one-half (40.8%) of the infants had been completely weaned from the breast by the time of the follow-up interview and only a minority relied solely on breast milk.

276. TRINIDAD. Jelliffe, D. B.; Symonds, E. R.; and Jelliffe, E. F. P. The Pattern of Malnutrition in Early Childhood in Southern Trinidad. J Pediatr 57:922-935, 1960.

An investigation of malnutrition in early childhood was undertaken in South Trinidad in 1959. Of the 70 children admitted to San Fernando General Hospital and diagnosed as having protein-calorie malnutrition, 86% were between the ages of 1-12 months of age. Studies of their dietary histories revealed that during the first 3 months of life, breast feeding was successful, although in 10% of the mothers some lactation failure had occurred. Also during this 3 month period some haphazardly prepared cow's milk formulas were used. Carbohydrate gruels were also used. During the 4-6 month period, there was a decline in complete breast feeding. Occasional breast feeding (twice a day) was used by some mothers. Bottle feedings increased from 80% to 83%. During the 6-12 month period, breast feeding had stopped in 41% of East Indian and in 33% of Black mothers. Of those children admitted with the primary diagnosis of severe diarrhea the majority were malnourished. In 36% breast feeding had not been initiated; in 39% breast feeding had been stopped at least 2 weeks before the onset of diarrhea; and in 18% breast feeding was only partial. 26% of the children with kwashiorkor had a history suggestive of antecedent bronchopneumonia, and 18% diarrhea. For non-kwashiorkor protein-calorie syndromes, antecedent diarrhea was present in 48% of the cases, and bronchopneumonia in only 1%.

277. TRINIDAD. Roopnarinesingh, S. et al. Vitamin B_{12} and Folate Status in Pregnancy in Trinidad. Trop Geogr Med 28: 206-210, 1976.

This study shows that 58 to 109 pregnant Indian and Black women studied are anemic. The mean vitamin B_{12} level for anemic Blacks and the mean level for anemic and non-anemic Indians is deficient. Furthermore, both serum folic acid and vitamin B_{12} concentration aggravates folate deficiency. This is cause for concern since folate deficient women are more prone to accidental hemorrhage and abortion.

278. ANDES. Abelson, A. E. Altitude and Fertility. Hum Biol 48:83-92, 1976.

Evidence from physiological studies indicates that hypoxia may act as a stress that reduces fecundity; and in human populations resident at high altitude there is evidence of reduced fertility (James, 1966). In this paper the fertility of high Andean populations is described with reference to the ecological and social context. An analysis of high Andean energy flow (Thomas, 1972) indicates that children are an economic asset and consideration of the social organization of high Andean rural communities supports this view. A study of the fertility of migrants from high to low altitude indicates that reproductive performance increased with the removal of the stress of hypoxia (Abelson et al. 1974). It is therefore concluded that the reduced fertility observed in high Andean populations is due to the effect of hypoxia on human fecundity.

279. BRAZIL. Merrick, T. W. Interregional Differences in Fertility in Brazil, 1950-70. Demography 11:423-440, 1974.

Trends and interregional differences in the birth rate in Brazil between 1950 and 1970 are examined. Estimates are based on data from the 1950 and 1970 consensuses. Regional differences in birth measures (crude and general rates) were found to widen between 1950 and 1970 despite a decline in fertility at the national level and a narrowing of regional differences in important socioeconomic variables like income and urbanization. The substantial interregional migration flows which occurred in Brazil between 1950 and 1970 are examined for their possible impact on differentials. The effects are mixed, but the conclusion is that migration contributed to widening differences.

280. BRAZIL. Merrick, T. W. Fertility and Land Availability in Rural Brazil. Demography 15:321-336, 1978.

Differences between the marital fertility of the agricultural frontier and that of the more settled rural areas of southern Brazil are analyzed in this paper. Fertility rates derived from 1970 census data appear to decrease as the degree of settlement increases, suggesting an experience parallel to the decline in U.S. rural fertility in the late nineteenth century, which Easterlin and others have attributed to increased scarcity of land for starting new farm households. Multivariate analysis of the Brazilian data shows parallels between the two situations but also reveals that the importance of literacy, child survival, and access to land is relatively greater than that of the availability of land for explaining fertility differentials in Brazil.

281. BRAZIL. Rosen, B. S., and Simmons, A. B. Industrialization, Family, and Fertility: A Structural-Psychological Analysis of the Brazilian Case. Demography 8:49-69.

This paper addresses itself to some linkages between macro-social structure (industrialization, social class), social psychological variables (husband-wife decision making), psychological variables (attitudes), and fertility. A total of 726 currently mated women with proven fertility in five Brazilian communities were interviewed to determine various attitudes, their work experience, their participation in family decisions, their fertility ideals, and actual fertility. The five communities were selected along a rural-urban-industrialization

continuum to include a village, two non-industrial cities, and two industrial cities (one of which was Sao Paulo). Family size in the industrial cities was small in all social strata, while in the non-industrial cities family size was large in the lower strata and declined in the upper strata. Further analysis revealed that smaller family size is associated with generally higher levels of status among women - higher educational levels, greater social contacts and more skilled employment, and equality in family decision making. Our analysis supports the hypothes s that industrialization influences fertility through shifts in the social status of women, both in their work and at home. New education and work opportunities facilitate the emergence of modern conceptions of the role of women in society and egalitarian decision making in the family. These attitudes and patterns of husband-wife interaction are related to smaller family size ideals and lower fertility.

282. BRAZIL. Rosenburg, O. Aleitamento no primeiro ano de vide de criancas internadas em hospital assistancial de municipio de Sao Paulo, Brazil (Feeding of infants during the first year of life admitted to a welfare hospital in Sao Paulo, Brazil). Rev Saude Publica 7(4):381-388, 1973.

The data presented are for 667 infants in 1969 and 249 in 1972, as recorded on admission to a children's hospital. Excluded were children of municipal employees who received assistance from the hospital, but were of a different social class. Data are tabulated under the headings: natural feeding, mixed feeding, cow's milk, dried milk, other and total, for the 2 years separately and for the 6-month periods separately. The whole-year data are summarized as follows: in the first month breast feeding totalled 23.21% in 1969 and 23.07 in 1972. There was a steep fall to the second month, with 4.06 and 3.33%. Exclusive artificial feeding totalled 89% in 1969 and 92% in 1972. Over the whole year, breast feeding reached 5.85% in 1969 and 3.61% in 1972.

283. BRAZIL. Rowe, P. M. and Way, P. O. Patterns of Recent Rapid Fertility Declines in Brazil, Colombia and Mexico. Paper presented at the Annual Meeting of the Population Association of America, 1980.

Recent surveys indicate that between the mid-1960's and the mid-to-late 1970's fertility fell 29% in Brazil, 41% in Colombia, and 25% in Mexico. This paper examines the relationship of these fertility declines to family planning activities, education, patterns of marriage and other socioeconomic factors.

In Brazil, increasing age at marriage appears to have contributed most to the recent fertility decline, as family planning program activities have been relatively limited. Colombia, with a strong family planning program, had nearly 50% of married women using contraception in 1976. Changes in the age at marriage and in literacy, however, have been relatively minor. Mexican family planning efforts, combined with increases in educational attainment, have contributed to recent declines. Patterns of age at marriage in Mexico have changed very little.

For each of the countries in this analysis, a time series of fertility levels is presented, and changing patterns of fertility are examined.

284. BRAZIL. Santos, I. Dos. Investigacao interamericana de mortalidade na infancia: alguns aspectos do aleitamento materno em Recife e acoes em desenvolvimento (Inter-American study of infant

mortality: breast feeding in Recife and current programmes). Bul Of Sanit Panam 81(5):399-404, 1976.

In Recife, of 1029 children under 5 years, of 64.7% belonging to the lowest socioeconomic group, only 24% were breast fed for 1 month or longer. Breast feeding is encouraged by the use of tape recordings, before and after parturition, to explain its importance to mothers, by educational programmes in outpatient services and by emphasis on its nutritional value in courses for nurses.

285. BRAZIL. Yunes, J. and Ronchezel, V. S. C. Estudo da lactacao em mulheres do distrito de Sao Paulo, Brasil (Lactation in women of Sao Paulo District, Brazil). Rev Saude Publica 9(2):191-213, 1975.

Published data on lactation are briefly discussed, especially in relation to inhibition of ovulation and temporary sterility during lactation. The population studied consisted of 2857 women, 15 to 49 years of age, resident in the District of Sao Paulo in 1965, of whom 2647 had had at least one live-born infant at the time of the survey. Most women suckled their infants, the percentage varying from 87 for parity 4 to 89 for parity 2; duration of lactation rose with age of the mother and parity from 30 weeks for parity 1 to 35 weeks for parity 5. Women who did not use contraceptives had longer lactations than those who did, except at parity 5. In those who used contraceptives there was no correlation of duration with interval between pregnancies; in those who do not, the mean interval increased with longer duration of lactation. Ignoring parity, there was a tendency for women with a higher standard of education to have shorter lactations, and women born in rural areas have longer lactations than women born in the capital.

286. CHILE. Mardones, Francisco. La Mortalidad Infantil y Sus Ultimos Descensos (Infant Mortality and Its Recent Decrease). Mensaje: 577-582, Nov. 1976.

Chile reported a 22% decrease in infant mortality between 1972 and 1975, dropping from 71.1 to 55.4 deaths per thousand live births. This paper argues that the decrease was caused by demographic changes rather than directly as a result of either economic factors (official data show a deterioration in economic standard-of-living, especially unemployment) or changes in national health or feeding programs.

During the period 1972-75, Chile experienced more births in mothers aged 20-34, and proportionately fewer births in large families. A table showing infant mortality as a function of mother's age and birth order in Chile in 1969 demonstrates significantly lower infant mortality for mothers aged 20-34 and birth orders of four or less. By combining these data, the paper arrives at its conclusion that the decrease in infant mortality in Chile from 1972 to 1975 "is not related to increases in the standard-of-living of the population, but is significantly related to a concentration of births in the optimal groups with respect to mother's age and parity."

287. CHILE. Monckeberg, F. Factors Conditioning Malnutrition in Latin America. In Malnutrition is a Problem of Ecology, eds. P. Gyorgy and O. L. Kline. New York: Karger Press, 1970.

Chile has the lowest mortality rate for preschool children and the highest

infant mortality rate in Latin America. The reason is the extremely short duration of maternal lactation. At the third month only 25% of mothers feed their children exclusively breast milk. The median age of complete weaning is approximately 6 months. A sample of 1830 children in the Curico province showed that those only breast feeding exhibited normal growth compared to the Iowa 50th percentile, while infants who received only formulas from the early months of life had varying degrees of malnutrition.

288. CHILE. Oberg, J. Natality in a Rural Village in Northern Chile. In Culture and Population: A Collection of Current Studies, ed. S. Polger. Chapel Hill: Technical Information Service, Carolina Population Center, University of North Carolina at Chapel Hill, 1971.

The structure of the birth interval for 29 parous women was analyzed and discussed. Oberg calculates that lactation amenorrhea accounted for 11.33 months of the 34.10 months between live births. The average period of nursing was 13.33 months.

289. CHILE. Perez, A. et al. Timing and Sequence of Resuming Ovulation and Menstruation after Childbirth. Popul Stud 23(3):491-503, 1971.

The first postpartum ovulation of 200 Chilean mothers was diagnosed by basal body temperature charts, vaginal cytology, and endometrial biopsies. The average period of lactation was 4 months. A significant difference between full and partial breast feeders obtained. During full breast feeding, the resumption of menstruation was preceded by ovulation less than one-half the time, but during partial breast feeding resumption of menstruation was preceded by ovulation in almost 75% of cases. Suspended breast feeding resulted in ovulation preceding first menses in 90% of cases. Conceptions during amenorrhea were low, about 7%.

290. CHILE. Plank, J. and Milanesi, M. L. Infant Feeding and Infant Mortality in Rural Chile. Bull WHO 48:203-210, 1973.

During 1969-70, 1712 rural Chilean mothers were interviewed to see if their feeding practices contributed to infant mortality. There were three times as many deaths among babies given bottles before the age of 3 months as among those who were wholly breast fed. Nearly half the children had started bottle feeding by that age, and it was thus a major factor in infant mortality. Although the death rates per bottle fed babies were similar, whether they continued to receive breast milk or not, mortality was about 70% higher during both the second and third trimesters for those children not given any food but milk. As living standards improved, weaning was accelerated and a higher proportion of children were fed on the bottle alone. The anomalous consequence was that infant mortality rose with income. These observations support the opinion that early weaning is a concomitant of economic development; they also suggest that the risk associated with bottle feeding may be reduced by adding other foods to the diet.

291. CHILE. Rona, R. and Pereira, G. Factors that Influence Age of Menarche in Girls in Santiago, Chile. Hum Biol 46:33-42, 1974.

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In 1970 a study was made of 354 girls 10 to 17 years old, who attended 2 private and 5 public schools in Santiago, Chile.

The age of menarche calculated by the probit method was of 12.6 years for the total group. Age of menarche was lower in girls of worse socioeconomic status (12.3 years), than in those of high status (12.97).

The total sample was partitioned into subgroups, according to the number of foreign grandparents and to the presence or absence of shovel shape incisors. It was observed that among the girls with a greater number of foreign grandparents as well as among those with shovel-shape teeth the age of menarche was higher than among those with no foreign grandparents (12.8, 13.0 and 12.4 years respectively). This suggests that genetic factors as well as nutrition may be important in determining the age of menarche.

Age of menarche was analyzed according to the amount of subcutaneous fatty tissue, measured with a caliper in the sub-tricipital, subscapular and subcostal regions. It was observed that menarche ensued significantly earlier in girls with more subscapular or subcostal adipose tissue. This was not observed in respect to tricipital subcutaneous tissue.

292. CHILE. Wagcher, E. Infant Mortality in Chile, Trends, Differentials and Causes, paper presented at the Annual Meeting of Population Association of America, 1979.

The paper analyzes the infant mortality trends in Chile from 1961 to 1976. The purpose is to attempt to identify and explain the determinants of the recent mortality decline from 109 to 54 per thousand birth between the two mentioned dates.

Analysis is made by considering birth parity, age of mother, and occupation and education of parents. Neonatal, and postneonatal mortality are also analyzed by birth order in different socio-economic groups. Furthermore, the changing proportion of births from different socioeconomic groups due to the decline of the birth rate from 38 to 29 per thousand is also taken into account in this mortality analysis. The paper points out particular aspects that should be taken into account for future reduction of infant mortality.

293. COLOMBIA. Birdsall, W. A cost of siblings: Child Schooling in Urban Colombia. Paper presented at the Annual Meeting of the Population Association of America, 1978.

Data for this investigation come from a 1967-1968 family budget study. The main result is that additional siblings are costly to living children because all children in the family will receive less education. Two stage least squares estimation of jointly determined fertility and investment shows that large family size has a negative effect on child investment in a causal sense. The principal implication is that the high fertility/low education pattern can be broken given improvement in economic conditions through a change in fertility patterns.

294. COLOMBIA. Mora, J. O. et al. Nutritional Supplementation and the Outcome of Pregnancy. III. Perinatal and Neonatal Mortality. Nutr Reports International 18:167-175, 1978.

As part of a longitudinal study of malnutrition and intellectual

development, a randomized trial of the effects of nutritional supplementation (856 calories and 38.4 g of protein) during the last trimester of pregnancy was conducted. Four hundred fifty-six poor families with malnourished children were enrolled in a uniform health care program consisting of free medical care for the mothers during pregnancy and for all children under seven years of age. Nutritional supplements were provided to 226 families while 230 families were not supplemented. No effects of supplementation were noted on the length of gestation. Still-birth, neonatal and perinatal mortality rates were all lower in the supplemented group. Stillbirth rate was approximately one-fourth, whereas the neonatal and perinatal mortality rates were about one-half the rate noted in the control group. The sample was too small to test for significance of the differences observed in specific death rates but when still-births and neo-natal deaths were pooled, significant differences between the two groups were found by the chi-squared test (p .05). These data suggest that supplementation begun during the last trimester of pregnancy in a sample of families at risk of malnutrition resulted in a substantial reduction of perinatal and neonatal mortality in addition to the previously reported effects of supplementation on maternal weight gain during the last trimester of pregnancy and on birth weight.

295. COLOMBIA. Mora, J. O. et al. The Effect of Nutritional Supplementation on Caloric and Protein Intake of Pregnant Women. Nutrition Reports International 17:217-225, 1978.

Four hundred fifty-six pregnant mothers and their families were enrolled in a health program and subsequently randomly assigned either to a supplemented (N=226) or an unsupplemented (N=230) group. Distribution of enriched bread, milk and cooking oil was initiated during the sixth month of pregnancy. Sufficient supplements were given to meet a substantial proportion of the recommended dietary allowance for all family members. Dietary surveys by the 24-hour recall method were conducted during the sixth month of pregnancy prior to supplementation of the intervened group and repeated two months later. The dietary intake of the control group did not change significantly. Delivery of 850 calories and 38 g of protein per day per capita to the pregnant women in the intervened group resulted in net intake increments of 133 calories and 20 g of protein. Three hundred sixty-three of the calories provided were not ingested and 360 replaced calories in the usual diet. Twelve g of the protein provided were not ingested while 6.8 g replaced protein in the usual diet. For both calorie and protein, replacement correlated positively with initial intake. Although significant, the effect of supplementation on calorie and protein intake was much lower than expected. The importance of understanding the causes of replacement and misuse in order to improve planning of supplementation programs is emphasized.

296. COLOMBIA. Mueller, W. H. Fertility and Physique in a Malnourished Population. Hum Biol 51:153-166, 1979.

Anthropometric measures and fertility histories were obtained from 403 rural, moderately malnourished Mestizo families in Andean Colombia. Average family size was found to be 6.5 ± S.D. 2.5. Two classes of body measures were correlated with fertility. First, there is a positive, linear association of fertility with body fat. The wealthier are both fatter and have larger families in this population, suggesting that this trend is the result of socioeconomic factors. Secondly, bony measurements tended to have a curvilinear relationship to fertility such that large and small boned individuals have fewer surviving offspring, the same pattern of stabilizing selection observed in samples from well-nourished industrial societies.

297. COLOMBIA. Oberndorfer, L., and Mejia, W. Statistical Analysis of the Duration of Breast Feeding (A Study of 200 Mothers of Antioquia Province, Colombia). J. Trop. Pediatr. 14:27-42, 1968.

Interviews were obtained with 100 mothers who attended a university hospital for delivery and 100 mothers who were entitled to medical care under social security in Medellin, Colombia. Only mothers who had previously nursed at least 4 children exclusive of the born were included. Statistical evaluation of the data for 1412 babies showed that for the hospital group the average time of breast feeding alone was 3-5 months. The average time of the total lactation period was 6 months. For the other group, corresponding times were 3.3 and 6 months. Thus the duration of breast feeding was practically the same in both groups, in spite of the lower socioeconomic and nutritional status of the hospital group.

298. COLOMBIA. Ribe, H. Comparisons of Migrant and Native Fertility in Colombia. Paper presented at the Annual Meeting of the Population Association of America, 1980.

Since internal migration is proceeding rapidly in many low income countries and fertility is lower in urban than in rural areas, it is important to know the actual level of immigrant fertility and the speed with which it adapts to the urban environment in order to understand better the recent decline in Colombian fertility.

Analysis of the 1973 Colombian census sample reveals no clear association between fertility and migration status among urban residents when age, education and marital status are held constant, except for recent migrants who have fertility slightly lower than city natives. The evidence indicates, however, that some migrants (mostly young low educated city immigrants) delay marriage in comparison to city natives and this lowers their lifetime fertility. It is concluded that migrants are selectively drawn and oriented toward labor force participation and smaller family size goals. The analysis suggests that migration has contributed to Colombia's rapid demographic transition.

299. COLOMBIA. Rowe, P. M. and Way, P. O. Patterns of Recent Rapid Fertility Declines in Brazil, Colombia and Mexico. Paper presented at the Annual Meeting of the Population Association of America, 1980.

See Brazil.

300. COLOMBIA. Wray, J. D. and Aguirre, A. Protein-Calorie Malnutrition in Candelaria, Colombia: I. Prevalence; Social and Demographic Causal Factors. J Trop Pediatr 16:76-98, 1969.

The interaction of breast feeding and demographic factors with malnutrition and mortality was examined using data from a nutritional survey covering 1094 children in Candelaria. The median duration of breast feeding was 18 months; one fourth of all mothers were exclusively breast feeding at this time. Forty percent of the children were malnourished. Absence of breast feeding was associated with PCM and diarrhea. PCM was associated with diarrhea. Parity, birth order, and number of pre-school children were all associated with PCM.

301. ECUADOR. Scrimshaw, S. C. M. Culture, Environment and Family Size: A Study of Urban In-Migrants in Guayaquil, Ecuador. Ph.D. Thesis, Columbia University, 1974.

An anthropological study of child rearing practices in Ecuador shows that many child care practices have the effect of encouraging infant mortality. The age of weaning in mountain areas is 12 to 16 months; typical for rural underdeveloped areas. The traditional intrafamily food distribution pattern is designed so that children receive only low protein foods. The response to measles or diarrheal infection is to severely restrict food intake. Infant mortality is most frequent when births are closely spaced, especially if the previous child survived.

302. ECUADOR. Wolfers, D. and Scrimshaw, S. Child Survival and Intervals between Pregnancies in Guayaquil, Equador. Popul Stud 29(3): 479-496. Nov. 1975.

Intervals between births to 1934 women from poor areas of Guayaquie, Ecuador, were subjected to analysis to determine what effect on survival chances of their children, if any, was exerted by differences in these intervals. The analysis showed that risks of miscarriage and stillbirth were increased when the interval between last termination of pregnancy and conception was either very short or very long.

Postneonatal mortality was strongly influenced by the length of the interval, reaching a minimum where the interval was around three years. The influence of interval length diminished as the level of mortality fell (with improving health standards over time). The possibility could not be discarded that for neo-natal mortality and mortality in the second year of life, extremely short intervals (under three months) carried significant additional risks.

For both periods, intervals longer than three years increased the risk of infant mortality.

Evidence was found that the survival chances of the first child of a pair were seriously impaired during the first year of life where a fresh conception supervened during that period (the earlier this happened the more serious the impairment).

An analysis of 'double intervals' (not presented here) showed that the effects of short intervals were exaggerated when two such intervals succeeded one another.

The principal conclusions remained valid when competing sources of association between short intervals and mortality were excluded, thus lending plausibility to the view that the two are connected by a causal chain.

While no great precision can be claimed, it seems likely that if effective measures were taken to prevent the occurrence of pregnancy intervals shorter than 27 months (corresponding to birth intervals of less than three years) spontaneous abortions might be reduced by one-third and infant mortality by one-half in populations similar to that studied here. These results justify a recommendation that the prescription of contraception for a limited period post-partum in areas of moderate or high neo-natal mortality should become a routine of responsible obstetric or maternity and child welfare care.

303. PERU. Frisancho, A. R.; Klayman, J. E.; and Matos, J. Symbiotic Relationship of High Fertility, High Childhood Mortality and Socio-Economic Status in an Urban Peruvian Population. Human Biol 48:101-111, 1976.

The reproductive, biological and socio-economic characteristics of a sample of 4,952 subjects derived from a Peruvian population of low and medium socioeconomic status were studied. The study suggests that under conditions of poverty there exists a symbiotic relationship whereby low socioeconomic status is associated with a less efficient mechanism to control family size. This characteristic permits the mother of low socioeconomic status to attain a more complete child-bearing period. As childhood mortality is inversely related to socioeconomic status, so, with an increase in childhood deaths there is an increase in live births in a compensatory fashion. High fertility is the net result of these interactions. The implications of these findings to attempts to decrease population fertility through birth control alone are discussed.

304. PERU. Harrison, P. Mothers' Milk and Mortality in Peru. People 4(2): 29-30, 1977.

The reasons for the high infant mortality rates in Peru and efforts to improve conditions are discussed. The Baby Jesus Clinic in Pamplona Alta is trying to break the chain of bad sanitation, poor nutrition, and the decline of breast feeding. The polluted water sold to the shanty dwellers and stored inadequately is a frequent cause of stomach infections and diarrhea. If a child is at preweaning age and develops diarrhea, it may be the beginning of a fatal progression since a child with diarrhea has trouble tolerating milk. A tin of powdered milk is so expensive that mothers are unable to provide enough of it for normal growth. The food is also made up of contaminated water, making the child more likely to be exposed to infection. A nutrition program was started in 1974 at the Baby Jesus Clinic, and Hilary Creed, an English dietitian, and doctors at the clinic have developed special diets to pull children back from certain death.

305. PERU. Kerrins, J. F. Responsible Parenthood Program in the Barriadas of Lima. Paterson, New Jersey: U.S.A.I.D., 1967.

Women attending a family planning clinic in Lima reported the effect of pill use on milk supply. Seventy-five and five-tenths percent of the women taking Ovulen, (a mixture of the progestogen, ethyndiol acetate, and the estrogen, mestanol), experienced reduced milk supply, while 53.3% of those taking Q1-Q2, (a combination of the progestogen, quinquestanol,and the estrogen, quinestrol), experienced reduced milk supply.

306. SOUTH AMERICA. Hout, M. The Role of Household Production and Commodity Trade in Latin American Fertility: 1900-1975. Paper presented at the Annual Meeting of the Population Association of America, 1980.

Despite substantial urbanization, educational expansion, and technical development during the 20th Century mainly Latin American populations have not experienced the fertility declines characteristic of European populations at similar levels of economic development. This paper attributes the weak effect of economic development on fertility in Latin Americ to the role of trade

dependence in economic development. Trade dependence fosters inequality in the distribution of the benefits of development and permits pronatalist family structures to persist alongside Western forms. Both inequality and family structure increase fertility indirectly by mediating the fertility reducing effect of development. Analysis of data from throughout the 20th Century confirms that the effect of economic development on fertility is stronger in Latin American countries with little dependence on foreign trade than in countries that are highly dependent on trade.

307. SURINAM. Van Staveren, W. A. et al. Food Habits of Infants and Preschool Children in Surinam. J Am Diet Assoc 58:127-132, 1971.

In 1967 a team of home economists surveyed mothers regarding the food habits of their preschool children from birth to two years. It was found that breast feeding is rather prolonged, only a minor percentage of infants were not breast fed. In all ethnic groups, the majority of women terminated breast feeding between the age of 9 months and 1 year, although some continued until 2 years or even 4 years, based on the arrival of the next baby. Working mothers replaced breast feeding by bottle feeding after 6 weeks to 3 months. The first additional food might consist of several kinds of porridge, fruit juice or soft drinks. Soft rice was often mixed with soft vegetables or enriched infant biscuits. After 6 months, infants were given fish, cow's milk, rice flours and breads.

308. VENEZUELA. Velez Boza, F. and Baumgartner, J. General Clinical and Nutritional Study of Native Tribes of the Amazon. Federal Territory of Venezuela. Archives of Venezolon Nutricion 12:143-225, 1962.

A study of native tribes in Venezuela showed that infants were breast fed usually for 2 years and sometimes longer. From 6 months of age, supplementary feeds were prepared from sweet potato and different fruits and other diet items as available and in season.

309. COOK ISLANDS. Neave, M. The Nutrition of Polynesian Children. Trop Geog Med. 21:311-322, 1969.

The nutrition of four groups of Polynesian children under 6 years old was studied in the large island of Upolo, on West Samoa, on 2 atolls of the Fokelaus, and one atoll and one high volcanic island in the Cook group. Mothers were questioned about practices regarding breast feeding, weaning, and introduction of solid foods. Average values for duration of breast feeding ranged from 6.6 - 10.4 months, age at first solid food (immature coconut or pawpaw) 4.5 to 5.9 months, and fish was introduced between 6.7 to 9.5 months. Data for individual locations are shown below.

TABLE 1

Results of Dietary Enquiry

	No. of children	Duration of breast feeding (mths)	Age First Solids (mths)	First solid food given
Fakaofo 1968 Tokelau	148	10.4	5.9	Immature Coconut
Nukunonu 1968 Tokelau	93	9.1	5	Immature Coconut
Pukapuka 1964	192	9	4.5	Immature Coconut
Rarotonga 1964 Southern Cook Islands	273	6.6	4.5	Pawpaw
Aitutaki 1964 Southern Cook Islands	177	7.6	5.2	Pawpaw

310. GILBERT ISLANDS. Jansen, A. A. J. Malnutrition and Child Feeding Practice Among the Gilbertese (Including Information on Pregnant and Lactating Women and Attitudes towards Family Planning). Environmental Child Health 23(4): 161-185, August, 1977.

A survey to assess the nutritional status and feeding practices of infants, preschool, and school children in Betio and Tabiteuau-North (Gilbert Islands) was conducted in 1971. Anthropometric and clinical tests indicated a deterioration in nutritional status after the 6th month of life. In addition to moderate protein-calorie deficiency, specific deficiencies such as lack of vitamin A, Riboflavin, and iron were prevalent, especially among preschoolers. To gather data on child feeding practices, a questionnaire was administered to 196 Betio mothers of children under three and to 70 Tabiteuau mothers, all located at mother and child health clinics. Eighty-three percent of families surveyed were found to have incomes inadequate to provide a sufficient diet. Ninety-two percent of Betio infants and 97% of those on Tabiteuau were breast fed within three days after birth, and few were weaned in the first year of life. On Betio, approx. 25% of children 4-8 months old were receiving some form of solid food, 50% were in the 9-12 months age group, and 90% were by the end of the first year. It is suggested that the earlier introduction of solid foods (in the 2nd trimester after birth) could overcome the prevalence of growth

retardation. The diet of pregnant women was found to be largely centered around local foodstuffs. Numerous taboos and restrictions surrounding the diet of both pregnant and lactating women were recorded. The tradition of abstinence (sexual) during lactation served as a form of birth control to some, but its influence was decreasing. The pill and injections were found to be the best known birth control methods on Betio, while the loop was more familiar to Tabiteuau women. Ninety-five percent of Protestant and 83% of Catholic women on Betio thought family planning was worth practicing, while only 50% of the Tabiteuau women surveyed agreed. Seventy percent of Protestant women and 49% of Catholic women wanted intervals of four years or more between children, indicating that a well-prepared family planning program could be successful among the Gilbertese.

311. OCEANIA. LeNoir, R. G. and Gundlach, J. H. The Effect of Integrating Family Planning into an Existing Free Medical Care System on Fertility: An Analysis of the Fertility of American Indians, Guam and American Samoa. Paper presented at the Annual Meeting of the Population Association of America, 1979.

This paper is an indirect assessment of the effect of integrating a family planning program into an existing free medical care delivery system upon fertility.

Beginning in June of 1965 the Indians of the different states and the natives of U.S. trust islands in the Pacific were provided federally funded family planning programs that,at different levels,were integrated into free medical care delivery systems that served different proportions of the populations. The amounts of fertility declined over four years and during the fourth year of the program are calculated and regressed upon the percentages of the appropriate populations served by free medical systems that include family planning programs.

After we control for education, income and female employment, we find that the effect of integrating family planning into free medical systems is to reduce fertility by eleven percent over four years and by twenty-one percent during the fourth year.

312. PAPUA NEW GUINEA. Bailey, K. V. and Whiteman, J. Dietary Studies in the Chimbu, New Guinea Highlands. Trop Geogr Med 15:377-388, 1963.

Infants were entirely breast fed in the Chimbu area until the eruption of the first teeth. Breast feeding was continued until the age of 3 years. The first solid food offered was usually pit-pit (Setaria palmaefolia, the white inner stem) when two or four teeth had erupted (8-12 months of age). Baked sweet potato was the next food introduced, followed (usually beyond 12 months) by other staples like taro, banana, leafy greens and finally beans.

313. PAPUA NEW GUINEA. Becroft, T. C. Child-Rearing Practices in the Highlands of New Guinea: A Longitudinal Study of Breast Feeding. Med J Aust 2:598-601, 1967.

A survey of 125 children of the Engas of Baiyer River, New Guinea Highlands,was done in 1962-65 to study child rearing practices. Surviving children

were spaced five years apart. If a child died, the average interval was 1 year 5 months. A child was weaned at about 4 years 6 months. Ten percent of the group studied were still on the breast at 5 years 6 months. Solid food was not given until the first teeth were cut, or later.

314. PAPUA NEW GUINEA. Jelliffe, D. B. and Maddocks, I. Ecologic Malnutrition in the New Guinea Highlands. Clin Pediatr 3:432-438, 1964.

In the New Guinea Highlands, breast feeding was the mainstay of infant nutrition. Breast feeding was also traditionally prolonged. Another pregnancy might not occur until 2-3 years after lactation. Introduction of foods other than breast milk is often delayed until the later months of the first year of life. As no semi-solid foods are available, softer portions of adult foods are given. As an extension of the solid food approach to infant feeding, the use of peanut butter as a regular infant food has been successful in some Chimbu villages, using home grown and processed peanuts.

315. PAPUA NEW GUINEA. Malcolm, L. A. Growth of the Asai Child of the Madang District of New Guinea. J Biosoc Sci 2:213-226, 1970.

A total of 249 children and 805 adults living in the Asai valley of the New Guinea highlands and consuming a primarily sweet potato diet was examined and measured for height, weight, sitting height and skinfold thickness. Mean ages for groups of children were calculated from regression equations of height on age for different dental stages.

The growth of the Asai child in all measured parameters appeared to be slower than that reported from any other world situation. Average height at age 12 years fell more than four standard deviations below the 1978 WHO reference media, with boys more severely stunted than girls. Menarche was estimated to occur at 19.7 years.

Adult males averaged about 150 cm in height versus about 142 cm for females. Weights and skinfold thickness, in common with other New Guinean populations, show a progressive fall with age, which was more pronounced in women than in men, but did not depend on parity after initial weight loss following the first pregnancy. Breast feeding lasted nearly four years with prolonged post partum sexual taboo. Average number of pregnancies for females past childbearing was 4.6, with 3.5 surviving children. Under five mortality was about 250/1000.

316. PAPUA NEW GUINEA. Malcolm, L. A. Growth and Development in New Guinea: A Study of the Bundi People of the Madang District. Monograph Series No. 1. Madang: The Institute of Human Biology, 1970.

A study of infant feeding patterns among the Bundi of New Guinea showed that a Bundi infant was breast fed until a mean age of 4 years. Breast feeding was on demand and was limited only by the mother's work schedule. Mashed sweet potato, sugar cane, banana and pit-pit were introduced as early as 3-4 months.

317. PAPUA NEW GUINEA. Oomen, H. A. The Papuan Child As a Survivor. J Trop Pediatr 6:103-121, 1961.

Diet and malaria were found to be the two most important factors in survival of the Papuan child. The diet was predominantly starchy and was given too early and in too large quantities to young children. Protein rich foods were not readily available. The average Papuan woman has 5-7 live births with 4 or more lactation periods of about 24 months. About 50% of the infants are breast fed until age 2. There is seldom a sudden suspension of breast feeding. The first foods are introduced gradually and in increasing quantities. Often a toddler and a new infant may compete for the breast. During the study, two grandmothers who had not borne children for 11 and 14 years, were observed suckling a grandchild and apparently yielding appreciable quantities of milk.

318. PAPUA NEW GUINEA. Ring, A. and Scragg, R. A Demographic and Social Study of Fertility in Rural New Guinea. J. Biosoc Sci 5:89-121, 1973.

The commencement of demographic transition with rapid mortality decline and changing fertility patterns has been studied prospectively for 20 years among over 5000 persons in Buka and New Ireland -- two pre-industrial societies of New Guinea. The demographic study has been complemented by a detailed social study of fertility variables in three societies.

At the commencement of the study the New Ireland society had a high level of primary and secondary sterility of gonorrhoeal origin which disappeared among the younger women after mass penicillin therapy. The mean age at marriage is no longer immediately post-menarchal; the mean age of mother at birth of first child varied between 18.7 and 20.6 years; and the mean age of cessation of reproduction approached 44 years.

The three societies each show differing degrees of demographic transition with social patterns in one hardly changed by culture contact through to occasional voluntary use of introduced contraceptive techniques. The most important changes in fertility variables over the 20-year survey were the decrease in duration of post-partum abstinence from intercourse, the increase in continuity of cohabitation in marriage and other pronatal effects.

The demographic assessment of Buka showed age specific fertility rates for 1962-67 of over 300 per each 5-year age group between the ages of 20 and 39 with total fertility reaching a maximum of 8680 and with consequent changes in family size. The mean birth interval for births fell from 3.15 years for persons with first births between 1947 and 1953 to 2.13 years where the first birth was after 1961. There are several levels of reproduction with a mean birth interval for women for the most productive group of 2.00 years. The current mean interval for births of 2.16 years is consistent with a maximum biological level of reproduction for a society using breast feeding as the sole significant negative factor affecting fertility.

The associated rapid mortality decline and improved health of the community were due to the control of malaria and available rural health services as part of authoritarian health measures. Fertility decline consistent with transition theory would require community participation in child spacing to reestablish the traditional family size of three to four surviving children. This would entail the introduction of biochemical and mechanical contraception to fill the role previously taken by postpartum abstinence from intercourse and high infant mortality.

319. PAPUA NEW GUINEA. Scaglion, R. Seasonal births in a western Abelam village, Papua New Guinea. Human Biology (Detroit) 50(3):313-323. Sept. 1978.

The author discusses the correlation between seasonality of births and sexual abstinence which is linked to the cultivation of ceremonial yams. Fertility of yam-growers is compared with that of non-yam-growers, and the impact of climate and nutrition on fertility is discussed.

320. PAPUA NEW GUINEA. Venkatachalam, P. S. A Study of the Diet, Nutrition and Health of the People of the Chimbu Area. Hyderabad, India: Nutrition Research Laboratories: 1-90, 1962.

A study of infant feeding patterns was conducted from 1956-1957 in the Chimbu area of the Eastern Highlands of New Guinea. Up to 6 months, all infants were entirely breast fed. By the end of the first year most infants are receiving some supplement. At the end of the second year, very few infants were entirely on breast milk, although some continued breast feeding for 4 years. First supplements were introduced at the time of the first eruption of teeth, usually between 8-10 months. The first supplement was a type of sugar cane called pit-pit. Foods introduced later were sweet potato, banana, corn and green leafy vegetables. Complete weaning was gradual, taking several months or even years. Breast feeding was discouraged when a child had most of his teeth and was able to move about steadily by himself. This study documents a significant decrease in mean maternal weight with increasing parity. (See Malcolm for study reporting effects of both parity and age).

321. PAPUA NEW GUINEA. Zodgekar, A. V. Maori Fertility in a Period of Transition. Journal of Biosocial Science 7(3):345-352. July, 1975.

After 1945 the Maori population of New Zealand nearly doubled in two decades: until 1961 the Maori fertility was without any change. Analysis of the birth rates after this date shows a decline in birth rates by almost 28% from 1961-72. Only a small part of this decline has been caused by changes in age, sex and marital composition. A decline in the fertility of older women and younger women has been noted. Factors considered to be the prime cause of the fertility decline include: (1) rapid urbanization, (2) a low level of infant mortality, and (3) an increase in the overall level of education. (The relationship between nutrition and infant mortality was not discussed.) Women aged 30 to 49 account for 30% of the total fertility. Further decline in Maori fertility will depend upon the tendency of older women to limit their fertility and on reduced fertility among the younger women. The implications for fertility changes include: (A) decreasing kinship and familial associations, (B) desire for a smaller family due to demands of urban life, and (C) increasing contact of the Maori population with European culture.