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NUTRITION - FERTILITY INTERACTIONS IN DEVELOPING COUNTRIES:

IMPLICATIONS FOR PROGRAM DESIGN

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Preface

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Project Director

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Introduction

This report takes yet another look at nutrition-fertility interactions. Our present effort has three goals. The first is to synthesize recent research findings in areas where controversy continues because underlying physiological and psychosocial phenomena still are poorly understood. The second is to bring together in one volume a consideration of the different levels of nutrition-fertility interaction that have simultaneous and interlocking implications for policy formation and program design. The third is to define the program design implications of these interactions in terms that can be understood at the program operational level.

The links between food and reproduction are so extensive that we have been forced to limit ourselves to factors that have major design implications, at the expense of considering other technically important points. 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 pills and injectables must be avoided in postpartum programs. Similarly, we do not discuss the effects of contraceptives on maternal nutritional status, beyond noting that iron status of the users of intrauterine devices (IUDs) should be monitored.

The first chapter reviews physiological interactions between nutrition and fertility, looking first at the contraceptive effects of breastfeeding, then at the impact of nutritional improvement on fertility, and finally at the effects of uncontrolled fertility on

fertility, and finally at the effects of uncontroled fertility on nutritional status and mortality. The second chapter, reviewing psychosocial interactions, opens with a discussion of the demographic transition and of the changing value of children with socioeconomic development. We then examine 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 integrating nutrition and family planning programs and discusses factors that appear to be important for successful program development.

Chapter 1. Physiological Interactions Between Nutrition and Fertility*

This chapter reviews the physiological interrelationships between nutritional status and fertility from a policy and programming perspective. Section A, Mechanisms by which Nutritional Change Affects Fertility, identifies conditions under which nutrition interventions and food air programs may induce accelerated population growth, the size and likelihood of such effects, and their implications for program design.

Section B, Mechanisms by which Fertility Affects Nutritional Status and Mortality, details the physiological effects underlying the need for family planning as a component of nutrition and primary health care programs. As will be evident, 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. Mechanisms by which Nutritional Change Affects Fertility

Changes in nutritional status or in dietary practices may exert physiological effects on fertility in three major ways. Reduction in the duration or frequency of breastfeeding induces the rapid return of ovulation following childbirth and thus increases fecundity if contraception is not used. Improvement in maternal nutritional status from a borderline malnourished to a normal state may increase fecundity in a number of different ways. Finally, improvement in nutritional

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

status of mothers and infants reduces 0 to 5 year mortality rates and thus increases the number of surviving children per family. As shown below, the first and third of these mechanisms give evidence of greater potential for accelerating population increase than the second. Program leverage for offsetting all three types of increase by increases in family planning acceptance appears to be excellent in favorable policy environments.

1. 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 breastfeeding proportions explained an average of 85% of the variation between populations in the proportion of menstruating (and hence ovulating and fertile) women (Billewitz, 1979). Thus in the absence of contraception, differences in fertility explained by lactation 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 postpartem (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. n.d.). 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).

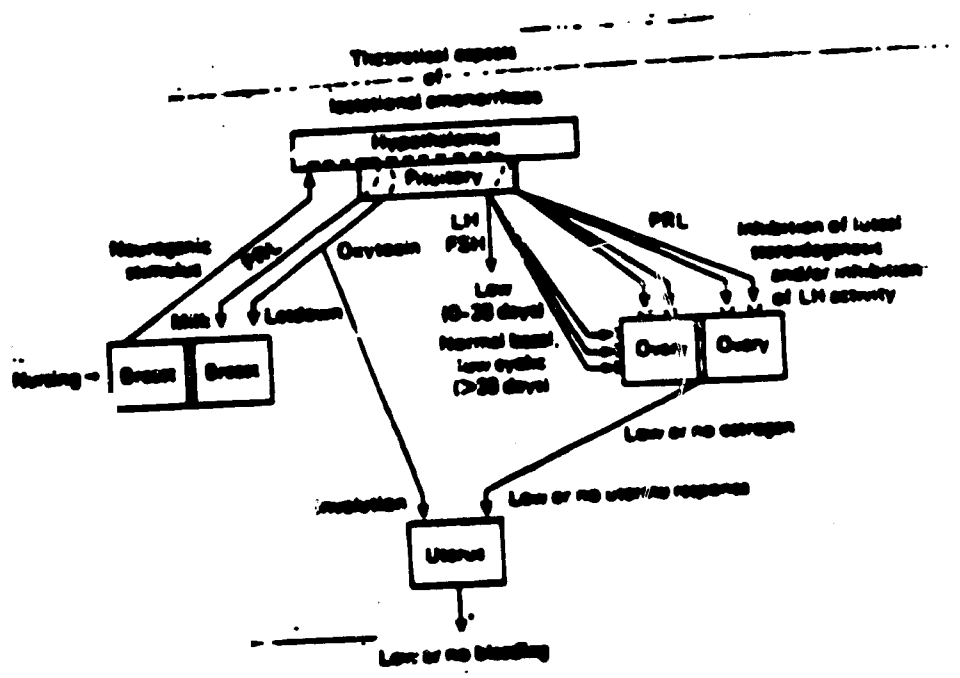
Tyson (1977) proposed the mechanism for lactational amenorrhoea that is given in the following diagram, and accompanying explanation: (See Figure 1 next page).

PRL may also 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

Text-fig. 1. possible mechanism for the maintenance of lactational amenorrhoea. Nipple stimulation from 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 gonadotrophin 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. A reduced ovarian steriod production then results in a quiescent uterus. Nursing also induces release of oxytocin from the pituitary causing milk let-down, but it may also have a uterine effect.

*Figure



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

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 hypothesize that ovulatory cycling returns when the regression line of inter-nursing interval on age reaches a level that is approximately equal to the half-life of prolactin in human plasma. They postulate that impaired luteal function or interference with implantation may further lengthen the 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 frequency probably drops off more rapidly (Perez et al., 1972).

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 able to postpone the return of fertility for about 6 months, as in the case of the Hutterites, a breastfeeding and noncontracepting 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 (Nokin et al., 1972). 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 Ginnekan (1975) reviewed 6 studies that indicated that one fourth of the women who begin nursing in population where amenorrhea lasts an average 10 to 11 months are likely to resume menstruation within six months after birth. Only very early menstrual cycles tend to be anovulatory. Perez and coworkers (1972) used a variety of methods to study the return of ovulation in 200 Chilean women for an average of 4 months after delivery. They found no ovulation during the first 30 days postpartum, but that about half of first 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 Ginniken 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%. 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.

Policy and Programming 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 in breastfeeding does not appear in most cases to 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 bottle feeding and modern contraceptive methods both have been adopted by urban groups in such a manner that contraception has more than compensated for the loss of the contraceptive effects of breastfeeding. 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 (1[illegible]) 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; Gaolu, 1973).

Loss of the contraceptive effects of breastfeeding does frequently have a disastrous impact, however, on individuals and population 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. Shaefer (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 in marginal metropolitan areas in Guatemala (Teller et al., 1977), low income bottle feeders experience high rates of infant mortality and the nutritional consequences of shortened birth intervals and increased infection, (Lebshtein and Behay, 1976; Kanawati and McLavery, 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 further interpret the policy significance of the lactation-fertility interactions. The first is whether 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 wellbeing. Although these issues need further study, the evidence seems to be that PRL level is not the only or possibly even major determinant of milk volume (Lunn et al., 1980) and that 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 (Chavez 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 probably would be counterproductive for breastfeeding, in that they 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, and with monitoring, usually is sufficient to guarantee the baby's physical and emotional wellbeing; but this advice cannot guarantee contraceptive protection for the mother.

The pattern of 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 (Konota, 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 Masnik (1978) those women most in need of contraception frequently have no learning time because they conceive with the first contraceptive mistake.

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. However, because of the erosion of postpartum abstinence with modernization (Caldwell and Ware, 1977; Ring and Scragg, 1973), 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.

2. Effects of Maternal Nutritional Status on 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 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.

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) as well as girls reach puberty later than well nourished children.

The fertility 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 total fertility 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 have 9.5 births per woman compared with 7.2 among the poorly nourished in Bangladesh. However the Hutterites introduce pacifiers and early solid foods to their infants in place of frequent breast-feeding. 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.

These intercultural comparisons, however, don't guarantee that a food program that improved nutritional status without changing cultural factors within a given group would not result in increased birth rates within that group. Feeding programs, or 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 17 kg 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 also inadvertantly 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.

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

- <u>menarche</u>: There is strong evidence that poor nutrition can delay menarche from an average of 12 to 13 years to about 19 years at the extreme upper limit. Forms of malnutrition that produce stunted chubby children as in Peru or Guatemala may not delay menarche. Nutritional delays to about 15 years of age are not uncommon in developing countries. However, average age of marriage in developing countries ranges from 2 to 10 years older than age at menarche. For this reason, various methods of calculating fertility increases that might occur from reducing the age of menarche yield estimates that do not exceed about 4%.
- <u>menopause</u>: 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.

- <u>Inhibition of ovulation by lactation</u>: As noted in the previous section, length of lactation amenorrhea depends mainly on the frequency of breastfeeding, which is a matter of cultural and personal style. Studies of the effects of nutrition on length of amenorrhea have compared groups of women within the same culture, who differ with respect to 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 nutritional effects. 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 of highest and lowest nutritional status groups, in groups having typical mean birth intervals of 2-1/2 to 3 years.
- <u>Regularity of Ovulation and Quality and Quantity of Sperm</u>: Mean waiting time to conception of menstrutating 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. This 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 the writer who conducted indepth 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 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 threshhold below which they become amenorrheic, and will resume menstruation when weight becomes normal (Frisch, 1978). In every society, a very few individuals experiencing abnormal circumstances 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 threshhold.

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

At the clinical and epidemological 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 have much lower incidences than the problems that remain critical in developing country settings.

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 annovulation is yet to be done. Some of the methodological weaknesses that he notes also are applicable to other nutrition fertility research. This section on flaws in data quality references items that are from our own rather than Masnick's review of the literature. Methodological weaknesses in current estimations include the following points:

1. 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 (1965) concluded in the Khana study that fetal death rates were underreported.

On the other hand, Chen and coworkers in Bangaldesh (1974) still report observed abortion rates of only 34% after correcting for usual reporting errors by means of ostensibly careful prospective methods, (including anthropological probing?).

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).

2. 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 frequently are unregistered.

3. 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.

4. 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.

5. Comparisons between Boston and Taiwanese data suggests 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.

6. 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, supplement breastfeeding, and to wean relatively early.

7. Errors in age estimation, retrospective study designs, and lack of measurement of type of malnutrition (thinness versus stunting with 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.

8. A wide range of animal studies suggest that animals on low calorie diets are more fertile than when calories are overly abundant. Current infertility rates of up to 15% in the United States are higher than those usually reported from developing countries. These high rates may be caused primarily by 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.

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 (Thompson et al., 1966). Similarly among the San Bushmen of the Kalahari, 32% of bushfood dependent nomadic mothers conceived in June to August when calorie and protein intake were highest and individual weights were at their peak (Wilmsen, 1978). Births of settled San women, who consumed domestic foods and whose weights averaged 4 kg. higher than those of bushfood eaters, were distributed more evenly by season (Wilmsen, 1978). Huffman and coworkers (1978) found seasonal trends of termination of postpartum amenorrhea. Women giving birth in February and in September in Bangladesh both had median amenorrhea which resulted in termination of amenhorrea in December of

January, following the harvest. Chen and coworkers (1974) found more conceptions in Bangladesh occurring in the cold season when food was plentiful. Pasternak (1978) concludes from studies of two villages in Taiwan that the food production cycle exerts a greater influence on birth seasonality than time of marriage or attributes of temperature, rainfall, or workload.

These findings strongly suggest a relationship between nutritional status and fertility that is not supported by cross sectional studies noted previously that divide women into weight for height or dietary categories. Huffman notes 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 is consistent with findings from Guatemala.

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, regardless of maternal nutritional status.

A second comprehensive hypothesis that appears to the writers to fit the evidence is that individual women have individual nutritional threshholds below which their fertility is reduced in part via lactational mechanisms, but that these threshholds 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 threshhold pattern. Frisch's hypothesis has been shown not to fit data from Bangladesh (Huffman and coworkers, 1978) or from the United States (Zacharias et al., 1976).

A theory of individual threshhold's is consistent with data from anorexic women and from famines.

Lunn and coworkers (1980) have shed further light on seasonal nutrition - lactation interactions with a comparative study of 3 groups of Gambian and group of British breastfeeding mothers. The Gambian women had different average levels of nutrient intake: 1500 calories for the preharvest rainy season group, 1650 for the post-harvest dry season gruop, and 2300 for a dry season group receiving a food supplement. The British women averaged 2450. The 3 Gambian groups aggregated 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 low calorie Gambians mean PRL concentrations about twice as 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 governed the length of postpartum infertility. They claimed that frequency of suckling was not an important determinent 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). The writer of this section, who has observed and interviewed African

mothers concerning frequency of laction in Upper Volta, Ghana, Nigeria, and the Sudan respectfully questions the meaningfulness of this estimate of lactation frequency among the Gambian groups. She has commonly seen infants take the breast 10 times or more during an hour's interview, and has concluded it is impossible to accurately estimate the number of nursings at night when some babies are reported to suck continuously while their mothers sleep.

Well established evidence that breat milk volume decreases with decreasing nutrient intake of the mother makes it appear more likely that the infants of the low calorie group were in fact nursing more frequently and thereby increasing the mother's PRL levels and their 24 hour milk output.

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 breastmilk production decreases according to individualized control mechanisms, inducing increased suckling 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 near absence of cross-sectional effects by weight category if it is assumed that nearly equal proportions of women in each weight category are above their individual thresholds at any given 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 with seasonal malnutrition 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.

A catch-all third hypothesis is that a variety of cyclic, physiological and cultural factors also contribute to a rhythm of birth seasonality that maintains its own momentum. It is known, for example, that women who live in close proximity maintain similarly timed menstrual cycles that are controlled by olfactory cues. Pregnant women tend to go into labor at the full moon. Analogous cyclic phenomena might 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, and festivals and abstention periods, such as Lent. Certainly cultural factors can play a role, and sometimes

an extreme one, as in western Abelam, New Guinea, where villagers abstain from sex for up to six months per year to magically protect the growth of their yam crop (Scaglion, 1978). Chen and coworkers (1974) suggested that seasonal temperature affected sexual behavior in Bangladesh.

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 cites studies from rural China (Notestein, 1963), Poland (Stys, 1957), Central India (Driver, 1963), and West Bengal (Mag, 1968), showing a positive relationship between fertility and landownership. Similar positive associations exist between nutritional status and size of landholdings (Rawson and Valverde, 1976, Valverde et al., 1977). Ajami postulates that "such variables as miscarriage, sterility, stillbirth, nutrition, lactation and postpartum abstinence" would explain these differentials.

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.

Policy and Programming Implications

Improved maternal nutrition per se obviously does not have as large effects on maternal fecundity as does a reduction in the duration and 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 independently of social context.

For example, improved maternal nutrition is known to produce larger infants and to increased risks of maternal and infant deaths during childbirth (Bagchi and Bose, 1962; Sambhi, 1973; Mtinsvelge et al., 1974). In the absence of modern maternity services, the impact of this higher death rate would have to be counterbalanced against any increase in fecundity of the mother. 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 who may experience adverse population growth in response to nutritional assistance programs. Such groups may typically qualify as target groups for such assistance programs. For this reason, programs should be examined individually to attempt to estimate whether their nutritional or other components have adverse effects on fertility.

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, reduction in birth seasonality, and increased fecundity that 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 lability of population growth--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 greater advantage in limiting population growth. The increased fecundity of the Eskimos, adopting bottle feeding, may also be associated with their change from nomadic to settled living conditions. Agencies organizing food assistance to programs 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 to the extent that fertility increases with socioeconomic status within these groups, unless it is integrated with family planning.

Urban migrants have been found to experience a drop in average fertility consistent with urban lifestyles (Ribe, 1980; Goldstein, 1973) (and 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 may also be at risk of adverse fertility effects resulting from government assistance programs. For example, Liebowitz and coworkers (1980) find that teenage girls in California who are re-

cipients of the AFDC or Medi-Cal programs are more likely to become unwed mothers than nonwelfare recipients.

The writers of this paper disagree with Bongaarts to the extent that they conclude 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 with nutritional assistance programs to offset possible increases in fecundity that may be mediated by improved maternal nutritional status, by reduced intensity of breastfeeding resulting from supplementary feeding programs for malnourished infants, and by reductions in infant mortality that inevitably result from improved nutrition. This last and possibly strongest physiological link between nutrition and population growth will be discussed in the next section. At the program level it is an outcome of nutritional improvement that cannot be separated from fecundity effects resulting from the same nutritional inputs.

The Effects of Nutrition on Population Growth, via Effects On Infant Mortality

As discussed in Chapter 2, the population explosion of concern to family planners everywhere largely results from reductions in mortality. This section looks at the extent to which improved

nutrition contributes to reduced mortality.

Wray (1975) summarized the classic findings of Scrimshaw and coworkers (1967a, 1967b, 1968a, 1968b) 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 presents evidence that from 30% to 70% of deaths of children under five years in developing countries have malnutrition as an associated cause. Kielsman and co-workers (1977) reporting a prospective study in Narangwal, India, show that mortality rates of children malnourished 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 1. Chen and coworkers (1978) 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 year 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 children dying who also were malnourished undoubtedly inflate the degree to which malnutrition alone contributes to mortality because they do not 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

TABLE 1

Annual Mortality Rates by Nutritional Status and Age Groups

Age Group (Months)	Nutritional Status (as % of Harvard weight median) <60	60 - 69	70 - 79	80+
1 - 5.9	176	114	89	16
6 - 11.9	206	61	26	8
12 - 35.9	33	22	4	5
1 - 35.9	87	43	21	7

SOURCE: Kielmann et al. 1977.

* Assuming 16% of children 1 - 5.9 months of age, 18% 6 - 11.9, and 66% 12 - 36 months.

status but were much less effective than medical services alone in reducing infant and child mortality (Edozien, 1970; Kielmann et al., 1977). Primary health care alone does not produce normal growth rates. Food supplements combined with primary health care, however, can both improve nutrition and reduce mortality at a level of expenditure only slightly higher than that of each separate component. Programs that teach new weaning practices without distributing foods, such as the nutrition and primary health care program in Yako, Upper Volta (Zeitlin, in press 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 morta[illegible]ts by about 50% during the first few years of operation, without [illegible]arily decreasing the incidence of severe malnutrition (probably because malnourished children who would have died are surviving). Table 2 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:

TABLE 2

Mortality Rates in Four 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)	57.3	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.

SOURCE: Kielmann et al. 1977.

* From official statistics, which are probably low estimates.

** Age 1 - 3 mortality rate.

In conclusion it appears that the extent to which integrated nutrition and primary health care programs can reduce the mortality rates of children under five within a short to medium time frame is roughly of the same order as estimates concerning the proportion of deaths having malnutrition as a primary or associated cause, or in the neighborhood of 50%.

The extent to which nutritional interventions that are not integrated with health care will decrease mortality is difficult to estimate and probably much lower, except possibly in the case of supplements to pregnant women. Low birthweight and prematurity are the commonest causes of death in the perinatal period (not counting neonatal tetanus in some settings). Nutritional supplements during pregnancy have been found to decrease the incidence both of prematurity and of small for date infants. In Narangwal, for example, the provision of iron and folic acid tablets plus supplementary food to pregnant women 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 (Kielmann et al., 1977). Higher birthweight children may also have better long term survival fates regardless of subsequent program inputs.

Supplementary feeding for pregnant women however, is probably most effective when integrated with prenatal health care providing nutrition surveillance because only those women whose nutritional status as measured by weight for height is initially below normal tend to benefit from supplementary calories and protein by showing a reduced incidence of low birthweight infants. Lechtig and coworkers

(1979) recently have reviewed findings from maternal supplementation programs. Types of supplements that prove most effective vary depending on nutrient deficiencies specific to the program area. As in the case of infant feeding, nutrition education to the community may prove a better means than food distribution of improving diets during pregnancy unless income is limiting.

Program Design Implications

Nutritional improvement programs combined with primary health care and food assistance programs that effectively reach large numbers of malnourished pregnant women significantly reduce infant and young child mortality rates. Famine relief reduces mortality directly by preventing starvation. Nutritional improvement combined with improved water supply and environmental sanitation can be expected to reduce mortality. Other forms of nutrition intervention such as food price subsidies, for example, or supplementary feeding to preschoolers given without health care probably have small to negligible effects on mortality.

These findings imply the need to combine active family planning activities with integrated primary health care, nutrition, and sanitation programs. Fortunately, the very program designs 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, 1977). 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., in press). 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 survive, so that they do not need to produce a large excess of children in order to ensure 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 period. These will be discussed further in Chapter 2, section B.

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

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.

Few programs have measured and related changes in fertility, 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, compared to 91 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 as shown in Table 3. Here it can be seen that family planning alone and combined family planning and nutrition programs both succeeded in decrease 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 mortality.

What may be said with some certainty is that low cost integrated primary health care, nutrition and family planning schemes at their best are capable of replicating in low technology underdeveloped settings the same favorable reduction in mortality, improvement in nutrition, and reduction in fertility that occur with economic development in industrialized countries.

A second conclusion is that 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.

Table 3

IMPACT OF NUTRITION AND FAMILY PLANNING PROGRAMS
ON POPULATION GROWTH

Program	Births	DEATHS			Population Growth (in number)	Changes in Population Growth (%)
		Infant	1-4 years	all ages		
Control	1,712,100	80,776	77,264	351,200	1,360,900	0.0
Family Planning	1,540,890	72,698	77,264	343,122	1,197,768	-11.99
Family Planning and Nutrition	1,540,890	65,428	69,538	328,126	1,212,764	-10.88

Source: Engel and Caedo 1975.

Nutritional mechanisms required to keep net reproduction rates at such low levels depend on high mortality and severe deprivation that can be found only at the opposite end of the development spectrum. Any attempt to maintain these mechanisms probably is 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 is very 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 fertility. Differing levels of lactation amenorrhea, of fecundity, and different strategies of family size limitation 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 fertility.

The simulation shows that under conditions of relatively low fecundity, as in India, postpartum amenorrhea lasting an average of 11 months, and consistent practice of family planning according to typical rural family size goals, population growth rapidly rises above acceptable levels with decreasing mortality. Thus if families are assumed to stop childbearing altogether 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 still rises above 1.5 as soon as infant mortality and child mortality drop below 100 and 50 per thousand respectively, and life expectancy rises above 50 years. With similar lactation and fecundity 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.

Brandel 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 (1979) document 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 expentancy 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.

Brandel 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 (with current mortality declines) versus 9,162 (with twice as rapid declines) in the year 2100. The amount of hardship experienced by marginal socioeconomic groups attempting to sustain this level of increase can be expected to be severe. The reader should realize, however, that no

demographic prediction to date has accurately forecast actual population growth.

Program Design Implications

Nutrition programs can 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 effects on mortality have large adverse effects on population growth. However, the momentum of population expansion worldwide is such that increases in current mortality decline that roughly equal the changes that can be achieved by nutrition programs at their current best performance levels are 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 stabilizes and mortality decreases to acceptable levels well before the year 2100.

B. The Effect of Uncontrolled Fertility on Maternal and Child Nutrition and Mortality

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 countries where growth rather than limitation of the 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 desease, 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. (Williams, 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 while the child is being breastfed (and sometimes longer 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

mothers breast milk and make the infant ill. The same cultures that practice prolonged sexual abstinence frequently also perform female genital mutilation (Hosken, 1977) which involves removal of part or all of the clitoris and labia minora. These operations, which are common only in Africa and Indonesia, generally reduce the woman's sexual desire. Cultures practicing abstinence usually are polygamous, so that abstinence is in fact 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 too closely spaced births (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 Huenneman (1976) and some from Austin and coworkers (forthcoming).

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 babies born to women between the ages of 20 and 30, even in industrialized countries. Two factors are at work in this case. On one hand the teenage girls are competing with their infants nutritionally 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, however, 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 older 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 Sao Paulo, Brazil, for example, 104 of every 1000 babies born to teenage mothers died before their first birthdays, compared with only 53 per 1000 born to mothers between the ages of 25 and 29. Kandeh (1979) found that very young mothers had high infant and child mor-

tality rates in Sierra Leone. Wishik and Van der Vynckt (1974) in El Salvador found not only poorer nutritional status and survival of infants of young mothers, 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 number of cycles in a woman's ovaries both decline in number (Gray, 1977) and degenerate to an abnormal state (Jouss, 1975). The incidence of genetic defects detected by amniocentesis increases from about 1.5% at age 35 to about 10% at 44 (Fuchs, 1970). Perinatal mortality also increases because of increasing maternal complications of childbirth. Birth weights, however, do not appear to decrease with maternal age under satisfactory nutritional conditions (Zeitlin and coworkers, in press).

Malnutrition and maternal age interact in the following ways. The efficiency with which the body utilizes nutrients, and particularly proteins, tend 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.

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 defficiency anemia, goitre 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 High 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.

Azar and coworkers (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 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. Corresponding proportions of women with severe anemia--less that 8 g/100 ml were 3.2% and 8.5%.

However the fact that the mother maintains her weight with increasing parity does not mean that she necessarily avoids depletion or that her infants are not progressively deprived of nutrients. Morely 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 117lbs, added an average of 2.3lbs with each birth, whereas the malnourished, who averaged 107lbs, 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., in press), so long as maternal nutrition is relatively adequate. At very high parities, however, the incidence of low birthweight tends to increase (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 4 from Wyon and Gordon (1971) and as found by Radovic (1966) and Roberts and Tanner (1963).

Parity above 5 also is associated with increased maternal as well as infant mortality in industrialized countries (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

Table 4

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.

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 separate 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.

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 parity and family size, however, is that the birth of too many children is detrimental to maternal health and to child's

health and development. Madhedkar and Shah (1975) found that in India 50% of families with more than 3 children consumed less than 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.

Aguirre and Wray, (1965) 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 from 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 pre-

schoolers 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.

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 catchup growth. Holley and coworkers (1969) 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 (1969) found in studying 16,000 consecutive deliveries in Philadelphia that incidence of permaturity 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 (forthcoming) 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 decreased 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 breast feeding 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).

Implications for Program Design

Effects noted in this section are large, universally relevant, 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). 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 be nutritionally abnormal.

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, educational investment on the part of 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 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. In the absence of such support, the negative effects of high fertility on child nutrition and development remains a key message for individual one-to-one counseling.

Chapter 2. Psychosocial Interactions Between Nutrition and Fertility *

The previous chapter considered the involuntary relationship between fertility and nutrition, i.e., the physiology of nutrition and reproduction. This chapter looks at the conscious and subconscious behavior of individuals and societies with respect to nutrition and fertility.

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

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

lower under-fives mortality rates by about 50% in the first few years of operation in several rural developing country settings.

A large body of theory links psychological and social responses to 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 less directly through a range of development indicators and correlates that include level of education, urbanization, per capital GNP, percent GNP from the primary sector, women's employment, and cultural infant feeding practices. Some of these less direct linkages are highly important for 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. 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.

Social and Behavioral Effects of Reduced Mortality on Fertility

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, 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 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. The demographic history of Japan, the most highly industrialized country with a non-European culture, is in accordance with the theory, and 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 infant mortality was correlated with the rate of decline of the birth rate, while Taylor et al. (1976) 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 1970s was a period of almost unguarded optimism about the ability of reductions in child mortality to induce major declines in fertility through preexisting social mechanisms. The United States National Academy of Sciences

(1971), the United Nations Department of 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 socioeconomic 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, 1975)."

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

Since this time it has become evident that population control is *not* an automatic or reliable short term response to mortality decline.

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 and Mexico, in particular (Sewer, 1975). Latin American countries generally (Hout, 1980) 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 Palo 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. A further complicating factor is the finding, discussed in the last chapter, that very strict adherence to family planning and small family size (far stricter than achieved in Palo) is required to offset the population growth effects of modest decreases in mortality.

Pressure on the land and high aspirations for education in rural Indonesia also may make this country situation unique. At the anecdotal level, rural families frequently 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 don't want more children if they can't 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 controling fertility, so that they have the capacity for conscious regulation of family size. The fact that fertility has fallen with development in France and in South Korea (Repetto, 1978) for example, 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 in all cultures 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 univeristy 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.

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 bear children less for the pleasure of the childbirth experiences per se than 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 determining 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 assumes 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 assumes 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.

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 unprofitable. 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 socioemotional change in developing societies.

Caldwell (1977) shows that economic factors in rural areas do not favor the nuclear family over the extended family 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 that a parental strategy of fertility maximization will tend 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 paying out 10% of family income per child per year over 40 years, with no guarantee of old age or disaster security.

Caldwell believes that cultural change is inevitable with urbanization and the adoption of modern sector aspirations. He argues that "a movement towards 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 Western 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 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 introduces uncertainty into the process of fertility decision-making, so parents are likely to decide to have 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 argued 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 may have 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 is 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 (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.

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. "This hypothesis could explain both the secular negative relationship and cyclical positive relationship [in Western countries]. In the short run, 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 relatively advanced Third World countries and in industrialized countires. Aghajanian and Tashakkori (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.

In the by-product model, parents are assumed to be non-contracepting, 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).

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 pro-natalist or anti-natalist), economic organization (farmlife 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 during a couple's old age for support 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 what their ideal family size was. The

responses were stable and unaffected by infant mortality (Rodgers, 1976). Knodel (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) but it does not seem to be the case in Egypt (Hassan, 1966), Turkey (Adlakha, 1970), India (Wyon and Gordon, 1971), and Taiwan (Harrington, 1971).

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. 1976).

Fertility Responses to Infant and Child Mortality

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 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.

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.

The timing of replacement during a women's reproductive span is open to debate. In many countries 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. This is an important theoretical question because it determines what model should be specified for statistical analysis of the mortality-fertility relationship. It is also an important practical question, bearing on the use of contraceptives.

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 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 controled for the biological interval effect due to breast feeding. Based on work in Egypt, Rizk, Stokes, and Nelson (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 controled (Chowdhury et al., 1976).

Rizk and coworkers did find that child mortality to be significantly related to number of additional children desired and 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, Han, and Choe, 1978).

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. 1965; Ajami, 1976).

Contraception in the form of postpartum abstinence is practiced in Subsahran Africa, Indonesia, and New Guinea. Where the practice

is widespread it significantly reduces fertility. If an infant dies, the period of abstinence is curtailed and the birth interval is shorter than if the child had survived and the period of abstinence were maintained (Cassen, 1976).

The evidence on 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; and Heer and Wu, 1975). Ruttstein (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. Balakrishman (1978) analyzed data from Costa Rica, Columbia, Mexico and Peru and found that the sex of deceased child had little influence on subsequent fertility. Repetto's (19) 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 lead to higher survival rates for sons than for daughters.

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 hightened 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."

In addition, research in India found that boys received more food and medical care than girls (Singh, Gordon, and Wyon, 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 (Gordon and Wyon, 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 in Ghana (in press) found female infants to average higher in nutritional status than males. In Upper Volta, child care improves when children are scarce (Retel-Laurentin and Benoit, 1976).

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.

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 larger 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 dies 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. Empirical studies have attempted to relate fertility to different measures of infant mortality to provide the existence of an insurance effect and have met with some success. Pebley (1979) et al., 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 is 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 is correlated to family size

when comparing different communities. However, negative evidence was found by Pebley and coworkers (1979), when they attempted to correlate community mortality levels with family size.

In the developing world the mortality rate is very 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 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 this 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 insurance strategies will depend on the age to which parents target the survival of their children.

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 doesn't mean that the child will survive to adulthood. A strong sequential effect would be consistent with the replacement hypothesis.

To the extent that couples in a society act on the replacement or the insurance hypotheses, it will have policy implications to determine which effects are more important. A country that experiences a sharp decline in infant mortality will want to do what it can to hasten the reduction in fertility that theory predicts should follow. To the extent that a replacement effect is the primary behavioral relationship between infant mortality and fertility, couples will 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. In this case it would be useful to educate the public about the existence of a higher survival rate and encourage the adjustment of fertility behavior accordingly. Although Pebley and coworkers (1979) have found that the level of community infant mortality is accurately perceived by women in the community, a lag time would be expected between the drop in mortality and a change in family size norms.

The Investment Hypothesis

It is possible that a reduction in the rate of infant mortality will reduce uncertainty regarding fertility decision-making and reduce the fatalistic attitudes towards childbearing that are common in subsistence communities (Rutherford, 1975). A result may be that people become more concerned about the quality of their children's lives. This relates to the argument made earlier by Schultz (1975) regarding quantity versus quality in making fertility

decisions. As mortality falls, children will become a better investment; parents will have fewer children and provide for them better. Hopefully people will feel that by offering their children an education they will have an opportunity to secure a better lot in life than they have themselves. In addition according to Nerlove and Schultz's (1970) research in Puerto Rico, child mortality alters the costs of bearing children. On the one hand, decreased child mortality reduces the cost of childbearing in the sense that it reduces the number of unprofitable investments that couples make (Schultz, 1975). This causes the fertility rate to rise. On the other hand, alleviating child mortality makes it easier for a family to reach a target family size and thus decreases fertility (Schultz, 1975 and Ridker, 1976). Furthermore, as the risk of child mortality decreases, 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.

Size of Psychosocial Effects of Mortality Reduction on Fertility

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, Newman and Kelly (1976).

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 behavioral replacement effects has never been found to exceed 50% when proper statistical controls have corrected for physiological interval effects. A compensation value of more than 50% is impossible due to the added effect of the other strategies.

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 occurs to a significant degree but is significantly less than 100%. Schultz on the other hand found that one half of the studies he surveys show that overcompensation exists.

Most of the studies reviewed indicate that both behavioral and biological relationships exists between infant mortality and fertility in contraceptive populations. But it is impossible to generalize the size of the compensation effects from one society to another concerning the size of the compensation effects. One important reason for the variability of the empirical estimates of relationships is that these different countries are in different stages of the demographic trnasition. One would expect to see little or no relationship 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~~ reduction in mortality and the time when the effect on fertility becomes apparent. The lag between a decline in infant mortality and its effect on fertility through the biological mechanism may be one to two years, through the replacement mechanism five to ten years, and through the insurance mechanism 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 psychiosocial 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.

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).

Program Design Implications

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 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 post-partum 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 the 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 less in the traditional setting, but rather that they are valued differently, 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 because 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.

Both family planning and nutrition programs can benefit from design features that encourage modern sector aspirations, increased investment in the individual child, nucleation of the family, and increased parent-child bonding. Some design strategies for achieving these goals are as follows:

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 child-bearing 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. 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.

-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 aren't already the norm. Village level workers should be encouraged to set the example by dressing, feeding and educating their children well (but ostentatiously).

-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 nutritionalls and psychologically (Wellbourne, 1963, Bowlby, 1951) and their dislocation disrupts the nuclear family unit.

The program should organize some functions related to both 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.

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 breast-feed her infant in privacy as soon as the infant has been cleaned following delivery create the maximum amount of instinctual 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., 197).

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).

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 (India) 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 (Zeitlin in press).

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 culturally be more important to establish bonds between the infant and other extended family members in order to strengthen the extended family structure. In much of Africa, the mother is expected to dissociate 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 disfunctionally heighten the pain of loss. However, feeding unhygienic mixtures to the newborn can be expected to reinforce this vicious cycle by contributing to high 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 brandname 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

a. the infant is put to the breast in the minutes following delivery.

b. the baby sleeps with or by the mother.

c. the mother is instructed to breastfeed each time the infant cries.

d. 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 feed to baby unless this procedure is hygienic; she is not permitted to store bottles in refrigerator, etc.

It 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 requires careful thought. In general, customs that don't hurt the baby should be continued. 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.

-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.

Post partum 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 invesment in the child and is in fact erroding 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 incorrect information. This implies that the staff of programs that integrate nutrition with family planning should:

Teach some variation of the following corrective message:

"Our ancestors recognized the fact that close birth spacing is unhealthy, and that breast milk may change when a woman becomes pregnant because her body has difficulty in feeding two infants at the same time. However, our ancestors had no way of knowing the exact moment that a new pregnancy started. For this reason they believed that it was the semen itself (or the sexual relations) that caused the milk to spoil and hurt the baby (or whatever else the people believe). "The truth is that the milk remains good and the nursing baby remains healthy so long as the mother doesn't become pregnant. If you practice family planning, you can breastfeed and have sexual relations from the time the baby is one month old, and this will be best for your baby because it will keep his father close to him."

This 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 and that it 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 radical social change appears to be improbable.

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.

Nutrition programs that decrease the dependence of the elderly and the costs of caring for them, stand to benefit both nutrition and family planning goals. When possible integrated programs should:

1. Promote subsidized foods for the elderly in order to decrease their cost of living, and thus decrease their dependence on their children.
2. Promote free 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.
3. Promote 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.

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.

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 child bearer. 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

- 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.

An integrated program strategy should also

- Introducing 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.

Such a strategy should also

Tie integrated program 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 seek to link integrated family planning and nutrition services with women's community development activities.

Services should also be targeted to women whose working conditions force them to bottle-feed are doubly at risk of malnutrition and illness of 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.

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 can 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.

The Replacement, Insurance, and Investment Strategies

In the natural course of events the time lag between reduced mortality and reduced fertility 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, 1976) 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 counter-balanced 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. This consists of deliberately informing people that mankind now has the power to substitute a humane for an inhumane form of population control and of deliberately promoting small ideal family sizes.

The first half of this procedure--making people aware of their power to control population size by humane methods--involves thought processes that generally are too complicated to transmit in post-natal counseling sessions with mothers or in radio spots, for example. This information should be transmitted at two separate levels, that of the nutrition-family planning worker training course, and secondly at the popular target group level.

The information 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 should not try 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, but should give them simpler information. Instead they should present the following simpler messages.

The more complicated sequence should 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 allows 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.

The second half of the procedure of accelerating the demographic transition involves taking a policy position that favors an ideal family size of one to three children and using promotional techniques and incentives to make this small family size appear attractive to the community.

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 Family Planning 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 examines community based interventions, focusing on procedures and community structures that are important for successful project implementation regardless of the line 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,

* This chapter was written by Nina Schlossman and Marian Zeitlin

1974; Huenemann, 1975; Jeliffe, 1974; Johnston and Meyer, 1978; Meyer, 1976; Perkins, 1977; Taylor, et al, 1976b; Van Balen, 1976; Winikoff B., 1978), we will open with a rapid summary of the rationale underlying the integration of services.

I. Rationale for Integrating Nutrition and Family Planning 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:

More effective treatment of overlapping problems. Nutrition and fertility constantly interact. Breast feeding, for example, simultaneously 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, <u>even in their own subject area</u>, as well 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.

<u>More efficient outreach at reduced cost</u>. 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 home 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 accomodate both services.

<u>More rapid adoption of new practices</u>. 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.

A factor frequently contributing to poor nutrition is the presence of too many young children for the mother to feed and care for adequately.

II. Introduction

Whatever the umbrella agency for program integration, the packages of services are flexible, since the specific combination of components responds to the needs of the community. Components also may be added or deleted overtime as the public health situation changes and regional development progresses. Existing infrastructure, such as health clinics, maternal/child health (MCH) centers, nutrition units and 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: treatment of anemia; special nutrition education for and surveillance of women using IUD's or taking oral contraceptives which might affect the utilization or the metabolism of certain nutrients; 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; surveillance of infant nutrition and weaning diets and of new contracep-

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 counseled her during pregnancy and delivered 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 for example, family planning acceptors will be more likely to adopt new weaning foods and new pregnancy diets 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 part of this chapter.

<u>A more effective strategy for reducing infant and child mortality</u>. 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 disease. Treating a malnourished child for infection or diarrhea is only temporarily effective if he/she is returned to a poor nutritional environment.

tive users; special nutritional education for mothers of preterm and low birthweight babies, as well as for mothers who cannot or will not breast feed 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.

1. Community Based Programs

Community involvement appears to be critical for successful program implementation regardless of program approach. Either 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 1977/1978).

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 priorities set. The next step is to assess the extent of infrastructure 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, undated)

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 pre-schoolers, 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 goals of self reliance in the long term.

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 integrated development

projects, which are conceived as community based and initiated. 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.

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 fertility 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 Banjar meeting once a month to decide community affairs with all the heads of the village's households. Since 1974, these meetings have included family planning discussion and the "family planning status of each household," and the number of pregnancies, births, miscarriages, dropouts and nonacceptors (of contraceptives) are noted on a map which is displayed in the meeting house (Population Council, 1977). This information can be compiled yearly and incorporated into national 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 successfully integrated into village and family life, there (Ibid, 1977).

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

The Mother's Club

Certain community programs show that basic awareness of nutrition and family planning concepts can be dispersed through diverse community channels taking innovative approaches to existing problems.

Mother's clubs are developing throughout the world where 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, in press). 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 diarrhea, and to supplement their diets during pregnancy and illness. In some cases, women have been instructed in vaccination techniques (Woods, 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 have begun cooperative rice stockpiles as a buffer supply for the village

in times of need. Others have developed small savings and loan operations for starting community gardens.

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 Peru, are noteworthy. The Integrated Day Care Program (IDCP) incorporates 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. In exchange, 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 enjoys a high success rate as measured by increased practice of contraception by the mothers involved. 75% used some form of contraceptive as against 55% from 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 for the child and early mental stimulation; 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).

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, in press) also in Upper Volta achieved extensive success by working directly through the chieftancy system.

2. Health-Based Integrated Programs

Most countries have begun to "integrate" family planning into the existing health services, according to United Nations Report ST/SOA/Series A/51, (1972). This trend is reflected in the reorganization of top level government ministries to incorporate integration at the planning level.

In the early seventies, 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 and 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/51/70). The Integrated Child Development Services Program in India was a spin-off directed at child health and welfare (See Section 4).

The Republic of Korea included family planning under MCH, which, in turn, was under the responsibility of the Ministry of Health (ibid). 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. The Integrated Day Care Program was set up in 1973 in urban areas aimed at lower-income working mothers and their families. Family planning and nutrition education were offered to the mothers, and one free meal a day six times weekly was distributed to each of the enrolled children.

Two broad categories of health based nutrition and family planning combinations can be distinguished. Nutrition and family planning can be 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, 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. Clinic based combined programs which are not necessarily part of larger development schemes, must also have the support of the community, and services must be geared to local customs and practices.

At the sub regional or district level, both the 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.

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 in more than 80% of the projects (listed in d ending prevalence) health education, maternal health, child health, medical/surgical treatment and care, nutrition, environmental sanitation, family planning, specific protection (immunization, prophylactic medicine, etc.), early detection and diagnosis (Karlin, 1976).

Several models for planning expanded health services have been proposed, but 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 to be included:

- use of indigenous health practioners
- sensitivity to cultural practices and attitudes
- community involvement: for needs assessment and volunteers, and resourses such as buildings, local foods
- integrated systems: maximum integration between MCH, family planning, and nutrition programs (differs in each country due to differing government structures)

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

- 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, though it provides a useful framework when considering integration of services and a useful goal to aim towards when working from the bottom up as well as 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. Then followed the six-week training course for uni-purpose workers to become multipurpose workers. Their tasks included nutrition education, immunization, examination of all children under five years of age, with special attention to the mal-nourished 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.

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). This example points out a tendency when expanding services to "overload" the auxiliary or paramedical workers by saddling them with too many responsibilities.

Health based integrated services can link family planning with other services important to nutrition. As an 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).

Thailand has been able to reduce its annual growth rate from 3.0% in 1972 to 2.5% in 1976 by incorporating family planning into the health services. (Aziz and Subbiah, 1977). The Lampang Health Development Project continues this tradition.

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.

The mobile team sees two locations per month, usually two days at rural health clinic. 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).

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, 1976).

Most expanded MCH programs are variations on the same theme offering services in health care for women and children, health and nutrition education, and family planning as a basic core. Staff includes nurses and midwives, 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, early detection of malnutrition, disease and complications associated with pregnancy or contraception can be referred to the MCH clinic for treatment. Karlin and co-workers (1977) found that some type of MCH service was offered by almost all of the projects surveyed, regardless of their orientation. Vaccinations, immunizations, and examinations were the most prevalent child health services included. The most frequent maternal health services were health education and prenatal care. Zaire has done a novel approach. Hostels with cooking facilities are available for expectant mothers, in areas where transportation is a problem. The healthcare worker has the opportunity to provide prenatal health and nutrition education and proper delivery supervision (Karlin, 1976).

The Candelaria project in Cali, Columbia 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.

Adequate nutrition during the prenatal period increases the infant's birth wieght and chances of survival. Nutrition services should thus be included in prenatal care.

Few health-based programs have been carefully evaluated, but the pilot field projects designed with an evaluation component lend themselves more readily to study. Ten of these have recently been examined by Gwatkin and co-workers (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 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." 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 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.

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 are integrated with health. Only 44% of these combined programs include a family planning component.

Primary Health Care

At the village or neighborhood level, primary health care is often the responsibility of local health workers. Male or female, they form the health system's network of outreach workers. Outreach is an exceedingly important component of primary health care, as most people do not have access to a health facility within reasonable walking distance. More and more health ministries are training primary health care workers recruited from the communities where they will work.

Retraining of personnel is an important part of any expanded project which uses the existing health, nutrition, or family planning channels as its base. Members of each sector should at 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 are trained in

techniques of primary health shows promising results (Karlin, 1976). In some cases the unipurpose worker originally trained by his/her line 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, however, and avoid overloading the personnel.

Four types of village/community workers will be discussed. The traditional midwife, the primary health care worker, the nutrition monitor, and the family planning field workers. Most integrated services are provided by one or all four of these personnel.

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 post-natal visits when the mothers are most receptive to new ideas.

This approach has been successful in rural Malaysia and the Philippines where most deliveries take place at home. Of the three types of midwives available to rural Malay women (nurse, midwife, semi-trained, and untrained lay midwives) a survey in 1978 disclosed that the untrained lay midwives achieved the "highest levelof rapport" with the women interviewed. 45% of these women also quoted "geographic proximity" as their reason for selecting the untrained midwives who reside 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 this 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 take place at home; at least 50% of total births are attended by local midwive (hilots); 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 post-natal 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. Trained 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. 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 incorporated the tradition of not cutting the umbillical cord immediately at delivery. This procedure decreased the incidence of neonatal tetanus. The rural practice among Guatemalan midwives (Comadronas) of allowing the cord to pulse and the cord blood to flow into the baby for a couple of hours 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 contraindications). Results have been favorable. In Pakistan, Barbados, and the Republic of Korea, statistics show a low rate of complications (comparable to 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 improving basic health, nutrition and family planning practices. It is an MCH based program relying on trained midwive 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%. 81% of children under the age of four were seen at least once. The vaccination campaign

had no impact on infant mortality rates. Tetanus neonatorum did decrease, however, due to hilot training and 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 sterilization 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.

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 ecologic trends in the study area. Age at marriage was a significant factor in the differential fertility rates obtained: by age 20-24, 60% of urban women (Tabilgaran City) had never been married, as compared with less than 2[illegible] 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).

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 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 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 surveilance 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 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; Pop. Council, 1977). The mothers are influential in bringing about behavioral change and in recruiting peers.

Training the Primary Health Care Worker

Educational requirements for village level workers will vary with availability. Although literacy is a desirable prerequesite, illiterate

workers have been found to provide excellent services in areas where literates could not be recruited (Zeitlin, in press). Training is best kept to a minimum, two to three weeks, close to the VHW's work area. Training is of a practical nature and regular retraining should take place in the field. Two way communication is essential (Pyle, (1979: Gwatkin et al., 1979: Taylor et al., to be published). Programs with lowest drop out rates for workers use mature community residents selected and paid or, recompensed by the community.

The Family Planning Field Workers

The family planning field worker usually is responsible for distribution of contraceptives within the community, follow-up of contraceptive users, recruiting 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. Her training will include nutrition (Heiby, et al, 1979).

2. Family Planning Based Programs

Population pressures in parts of the world have motivated governments to adopt policies of fertility reduction. South-East Asia and India in particular have high population to land ratios. Central and Latin America, with the exception of El Salvador, make few family planning efforts, due to the influence of the Catholic Church. West Africa is also a prenatalist region, and family planning has not been popular there.

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 programs serve as a framework through 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 roles. Birth spacing requires that the couple practice contraception regularly and implies more commitment on their part. The target group is the couple during most of their reproductive cycle. The 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. Programs which advocate sterilization have become less popular recently. Many family planning programs encourage contraception for increasing birth intervals since it contributes to the health and well being of the mother and her family.

It became obvious, in the early to mid 'seventies, that a majority of family planning programs that were 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 benefit 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 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 is being 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. In cases of diabetes it is unwise to prescribe birth control pills. 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 IUDs, since blood loss

is often heavier. These interactions point out the need for follow up visits for contracepting women living under marginal conditions. While IUDs and pills can be inserted or prescribed by nominally trained health workers or midwives, the complications must be detected early. Thus supervision is required, even in community-based distribution schemes.

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 to their services. In a recent survey of 92 Planned Parenthood 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 concepts is necessary, as the proper timing of messages -- mass media, audiovisual -- in service delivery is required 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.

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 because of 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, both use youth promoters in the CBD. The Contx/Technical Support (food and nutrition) program in El Salvador is training 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 goal is 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

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%, 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 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

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). Distribution channels include "local shopkeepers, farmers, teachers and housewives. CBFPS Surveys show that "between 1974 and 1976 pregnancy roles had declined by 40%," twice the decrease in the non CBFPS districts (David, 1980).

3. 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 injustices. Health is not considered an end in itself, but rather as an indicator of quality of life in the area. Health services are provided, including nutrition and family planning as support for the improvements in other areas, such as agriculture, land reform (possibly), food distribution programs (possibly), 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 these countries (except for Sri Lanka), 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 (U.N., 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,

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 included supplementary nutrition, immunizations, health checkups, referral services, health and nutrition education, nonformal education for preschoolers, family planning services, and care to expectant and nursing mothers and women at age 15-44. (See same report).

The Chimaltenango Development Project was begun in Guatemala because it was recognized that the high incidence of tuberculosis and high child mortality among Indians were actually symptoms of a larger problem: maldistribution of land. Ninety percent of land in Chimaltenango Province is owned by 2% of the population. The plantations were tilled by migrant Indian laborers who left home to work there. An American physician was hired to set up health care facilities, but instead, he started a small 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). 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 <u>treat symptoms</u> -- they <u>do not make diagnoses</u>. 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 (or 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 are offered to "help the people help themselves." Primary health care servies 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 has been carried out for this project, however (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.

Few descriptions or 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 and extension work are equally 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).

It is also important to note that, given the basic inefficiencies within each of the three sectors involved -- health, family planning and nutrition -- there is no guarantee that an integrated program can be efficiently run on a nation-wide scale, especially since these programs require a high degree of behavioral change on the part of the mothers.

4. Other Strategies and Service Options

Improving quality of life via a small healthy family that does not extend past one's resources is the ultimate goal of all the service options discussed. Strategies which do not act on the biological relationships contributing to decreasing family size, are also being tried. These focus on the social relationships between the individual and society.

Income generating activities such as agricultural development and cooperative marketing or manufacturing production efforts can be linked to family planning and food efforts. In 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 receives enough credit to buy three pigs which are then 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 milk fish and frogs.

Incentive schemes can increase family planning acceptance, but the element of coercion must be avoided.

Recommendations for Program Design

Development of Local Initiative

The success of all integrated schemes will be limited by two major factors or constraints. The first of these in 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 branch of central or regional government. 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 single most important but unadmitted cause of malnutrition and high mortality. Table 5 from a major hospital in a developing country capital is from a report that government has been unwilling to release. It shows that infant mortality drops precipitously to industrialized country levels as income rises to a modest US $40 per month.

Lack of management capability may be an expression of lack commitment to equity, when it stems from unwillingness to commit

resources to project management. Psychologically, the two problems are mutually aggravating in cases where an elitist ruling class resists listening to the feedback that would be required from subordinates or from the target group 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. 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

Table 5

MORTALITY RATES BY FAMILY INCOME
1969 - 74

Rupees/person/ month	Deaths/1000 livebirths Neonatal	1-11 mos.	IMR
≤20	77.4	103.2	180.6
21-50	45.0	37.2	82.2
51-100	24.4	21.4	45.8
101-200	12.7	5.2	17.9
201-300	6.2	8.2	14.4
≥301	3.1	9.4	12.5

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 the resources available for its development.

The Dissemination of Innovation

The process by which population groups adopt new behaviors also has implications for program priorities, which can accelerate social change.

The Behavior Change Process

Nutritional improvement and family planning acceptance are similarly dependent on the opportunities to learn new, nontraditional behaviors. Both the level of socioeconomic development and 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 cultures 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 rapdily in cultures that are accustomed to changing behavior frequently. Learning and adoption of new techniques almost always follows a bell-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 (in press) 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:

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

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

3. 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 leads a dehydration and death if imporperly 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, in press).

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 high risk, emotionally charged event -- a time when both paretns 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.

The points mentioned above suggest the desirability of targeting limited resources preferentially to

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, as an optimal behavior change for all families.

A strategy of expanding combined maternity care and family planning services was first advocated by Taylor and Berelson (1968) for the very reasons noted above, and was elaborated into Guidelines by the Population Council (1973). Such a strategy was difficult to implement before the development of community-based primary care services capable of providing inexpensive outreach.

As mentioned in Chapter 2, maternity services should favor parent-infant bonding by initiating breast feeding immediately after delivery and by involving fathers as much as possible in the prenatal arrangements and the childbirth process.

The postnatal period also is critical. The need for a practice period to learn new behaviors applied both to infant feeding and contraception. New practices generally can't 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. 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 trial and error without risking pregnancy. (The mechanisms by which breast feeding 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 creates an ideal learning environment for contraception.

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.

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EXECUTIVE SUMMARY

Nutrition-Fertility Interactions in Developing Countries: Implications for Program Design

by

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June, 1980

Attention to the interaction between nutrition and fertility has included opposing views: on the one hand that decreases in infant and child mortality are important determinants of declining fertility; on the other that improvements in nutritional status may lead to increased population growth. Nutrition-fertility interactions have been examined before, but this paper brings together the physiological and psychological elements of the interrelationship. The authors have synthesized recent research findings in areas where controversy continues, bringing together in one article a consideration of the different levels of nutrition-fertility interaction that have simultaneous and interlocking implications for policy formulation and program design and defining the program implications in practical terms useful at the operational level. Although long the paper provides an excellent thorough review of the subject.*

Chapter I reviews the physiological interactions between nutrition and fertility, looking first at the contraceptive effects of breastfeeding, the impact of nutritional improvements on fertility, and finally at the effects of uncontrolled fertility on nutritional status and mortality.

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* A second volume consisting of an annotated bibliography can be requested from AID/PPC/PDPR/HR.

The second chapter considers the conscious and subconscious behavior of individuals and societies with respect nutrition and fertility. It begins with a discussion of the demographic transition and the changing value of children as socio-economic development proceeds. The authors then discuss 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 integrating nutrition and family planning programs and discusses factors that appear to be important for successful program development.

Based on their review of research to date the authors put forward a number of conclusions with policy and program implications which are briefly summarized below.

The physiological nutrition-fertility interaction

Controversy persists as to the precise relationship between nutritional status and fertility. Some studies suggest no relationship. The authors of this paper cite nutritional and physiological evidence which implies that improved nutritional status may be related to increased fecundity because infants may receive supplementary food and breastfeeding may decrease or they may nurse less intensely because they are receiving sufficient milk. Important elements of the relationship between lactation and amenorrhea are strength and duration of infant suckling. Intense and frequent nursing is critical to sustaining a woman's post partum period of infertility. Despite the relationship between lactation and amenorrhea, the worldwide decline in breastfeeding does not appear in most cases to exacerbate population growth because in most countries bottlefeeding and modern contractives have been adopted simultaneously, more than compensating for

the contraceptive effects of breastfeeding. Among socio-economically deprived groups where family planning acceptance is not prevalent declines in breastfeeding will result in a loss of contraceptive protection.

The integration of family planning into nutrition assistance programs can offset possible increases in fecundity that may be mediated by improved maternal nutritional status, by reduced intensity of breastfeeding and by the inevitable reductions in infant mortality resulting from improved nutrition. Introducing contraceptives that do not interfere with lactation soon after delivery provides a learning period during which the contraceptive effects of breastfeeding are a backstop for contraceptive failure. During this period initial contraceptive use can be monitored in conjunction with post natal care.

Any attempts to maintain very low net reproduction rates as a result of low nutritional status would depend on high mortality and severe deprivation, a situation which is probably incompatible with changes in personal motivation necessary for voluntary adoption of the 2 child family norm.

The psychosocial nutrition-fertility interaction

Replacement, insurance and investment births play a major role in determining family size. Programs to reduce mortality in order to bring down fertility cannot ignore the importance of these intermediate mechanisms. As modernization occurs economic constraints and changing social values combine to encourage fewer children with increased investments per child. Strategies for encouraging smaller family size include: reinforcing modern sector aspirations; encouraging investments (health, nutrition and education) in children; promoting parent-child bonding and nucleation of the family; reducing the social security function of children through the establishment

of programs for the elderly; expanding women's labor force participation and educational opportunities. Also important is the need to convey the message that reducing infant mortality means a couple can achieve desired family size with fewer pregnancies.

The most efficient means to improve health and family welfare and minimize costs involve adding complementary family planning, health and nutrition components to the most popular, powerful and rapidly growing programs in family planning, nutrition or primary health care and focussing on expanding community-based maternity services integrated with nutrition and family planning to the entire population. These two strategies are critical to achieving the behavior change necessary to improve nutrition and lower fertility.