Essential Health Sector Actions to Improve Maternal Nutrition in Africa

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Acronyms

BMI	Body mass index
CDC	Centers for Disease Control
CQ	Chloroquine
DALY	Disability-Adjusted Life Year
DHS	Demographic and Health Survey
FAO	Food and Agriculture Organization of the United Nations
HIV/AIDS	Human immunodeficiency virus/Acquired immune deficiency syndrome
ICCIDD	International Council for the Control of Iodine Deficiency Disorders
INACG	International Nutritional Anemia Consultative Group
IUGR	Intra-uterine growth retardation
LAM	Lactational Amenorrhea Method
LBW	Low birth weight
MI	Micronutrient Initiative
RDA	Recommended Dietary Allowances
SP	Sulfadoxine-pyrimethamine
STIs	Sexually Transmitted Infections
UNU	United Nations University
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organization

Executive Summary

Malnutrition among women in Africa results in maternal and infant death and illness. Many women in Africa suffer from chronic energy deficiency, inadequate weight gain during pregnancy, and poor micronutrient status. Insufficient food intake, high-energy expenditure, micronutrient-deficient diets, infections, and the demands of pregnancy and lactation contribute to maternal malnutrition.

Prevalence and Causes of Maternal Malnutrition

Three indicators reflect inadequate food intake in women: low weight-for-height, low pregnancy weight gain, and low birth weight. Many African women consume less than the recommended daily caloric intake. Between 5 to 20 percent of women in various African countries are underweight. Pregnant women in industrialized countries gain on average twice as much as pregnant women in Africa. In 12 out of 17 African countries, ten percent or more of babies are born with low birth weight.

Inadequate micronutrient intake—particularly of iron, vitamin A, zinc, folic acid, riboflavin, iodine, and vitamin E—is also common in Africa. Iron deficiency is caused by inadequate dietary intake of bioavailable iron, increased iron requirements during pregnancy, and blood loss from parasitic infections. Anemia is the most commonly measured indicator to screen for iron deficiency. In 12 African countries surveyed, anemia rates among pregnant women ranged from 43 to 80 percent.

Hookworm and malaria contribute significantly to high anemia rates. The prevalence of hookworm infection among African women 15 to 45 years is estimated at 32 percent. Hookworms attach to and feed upon the intestinal epithelium. This causes bleeding and results in fecal loss of blood and iron. Women in Africa often have low iron stores, making them especially vulnerable to developing iron deficiency anemia from chronic blood loss due to hookworm infection.

Malaria, which destroys red blood cells, is the primary cause of anemia in many endemic areas. In malarious areas, pregnant women develop malaria more frequently and have more severe infections than non-pregnant women, particularly in their first or second pregnancies. More than 90 percent of the world's malaria cases are in sub-Saharan Africa.

HIV infection also heightens women's energy and nutrient needs. Nutrient malabsorption accompanies frequent bouts of diarrhea commonly experienced by people with HIV/AIDS. Approximately 12.9 million African women between 15 to 49 years of age were living with HIV/AIDS in 2000.

Other factors affecting women's nutritional status are energy expenditures and the demands of pregnancy and lactation. African women frequently maintain high levels of physical activity throughout pregnancy without compensating for the increased energy demands. If a woman's energy intake is not sufficient to meet the requirements of pregnancy, her energy stores are depleted to make up the deficit. If energy intake is not adequate after delivery, fat stores are used for lactation. A short interval between births may not provide women with enough time to replenish lost energy stores before another reproductive cycle begins. A Demographic and Health Survey review of birth intervals found that in most African countries analyzed, more than half of birth intervals were less than 36 months and approximately a quarter were less than 24 months.

Consequences of Maternal Malnutrition

The combination of infections, chronic energy deficiency, poor weight gain in pregnancy, short birth intervals, increased reproductive risks, anemia, and other micronutrient deficiencies contribute to maternal and infant deaths and illness. Anemia is responsible for an estimated 20 percent of maternal deaths. In addition to being at greater risk of hemorrhage, anemic women are more likely to experience prolonged labor, which predis-

poses them to sepsis. Sepsis is one of the major causes of maternal mortality. Direct consequences of chronic energy deficiency include increased susceptibility to infection, reduced activity levels, and lower productivity. Infections, especially those associated with fever, can decrease appetite while increasing energy and nutrient needs. Deficiencies in several micronutrients, such as vitamin A and zinc, increase the incidence or severity of infections.

Maternal malnutrition also has serious consequences on infant health and survival. Intrauterine growth retardation—largely the result of maternal malnutrition prior to and during pregnancy—causes approximately two-thirds of low birth weight in developing countries. Neonatal mortality rates are two to three times higher for low birth weight babies than for normal weight babies. Low birth weight has additional consequences during adulthood. Low birth weight, thinness, and short body length at birth are associated with increased rates of cardiovascular disease and non-insulin dependent diabetes in adult life.

Micronutrient deficiencies in zinc, iron, iodine, vitamin A, folic acid, vitamin B_6, vitamin D, calcium, and magnesium can increase the risk of low birth weight, preterm births, premature rupture of membranes, and fetal death. Micronutrient deficiencies can result in birth defects, lower cognition, and compromised immune functions.

Role of the Health Sector

The health sector can play an important role in addressing the nutritional needs of pregnant and lactating women through contacts with women during antenatal, delivery, and postpartum care; child health visits; and family planning services. The essential health sector actions identified in this paper focus on pregnancy and lactation. They aim to achieve five outcomes that would improve maternal nutrition:

1. Adequate food intake during pregnancy and lactation
2. Adequate micronutrient intake during pregnancy and lactation
3. Reduction of malaria infection in pregnant women in endemic areas
4. Reduction of hookworm infection in pregnant women in endemic areas
5. Birth spacing of three years or longer

The outcomes and the health sector and maternal actions to support them are summarized in Box 1.

Box 1. Health Sector and Maternal Actions to Improve Maternal Nutrition in Africa

Outcomes	Essential Health Sector Actions	Maternal Actions
1 **Adequate food intake during pregnancy and lactation**	• Encourage increased food intake during pregnancy and lactation • Monitor weight gain in pregnancy • Counsel on reduced energy expenditure	• Eat at least one extra serving of staple food per day during pregnancy and the equivalent of an extra meal per day during lactation • Gain at least one kilogram per month in the second and third trimesters of pregnancy • Rest more during pregnancy and lactation
2 **Adequate micronutrient intake during pregnancy and lactation**	• Counsel on diet diversification • Prescribe and make accessible iron/folic acid supplements OR multiple micronutrient supplements • Assess and treat severe anemia in women • Distribute vitamin A to postpartum women	• Increase daily consumption of fruits and vegetables, animal products, and fortified foods, especially during pregnancy and lactation • Consume daily supplements (iron/folic acid—60 mg iron + 400 mg folic acid—or multiple vitamin/mineral supplements) during pregnancy and the first three months postpartum • If anemic, consume a daily dose of 120 mg iron + at least 400 mg folic acid for three months • Consume a high dose (200,000 IU) of vitamin A immediately after delivery or within the first eight weeks after delivery if breastfeeding and within six weeks after delivery if not breastfeeding
3 **Reduction of malaria infection in pregnant women in endemic areas**	• Prescribe and make accessible anti-malaria curative and/or prophylactic drugs for pregnant women (according to local recommendations) • Treat clinical infections • Promote use of insecticide-treated materials	• In the second and third trimesters, take anti-malarial drugs as a curative treatment regardless of symptoms OR take weekly anti-malarial prophylaxis starting at first antenatal visit • Seek treatment for fever during pregnancy; take drugs to treat malaria and reduce fever; take iron/folic acid supplements to treat anemia • Use insecticide-treated materials, including bednets
4 **Reduction of hookworm infection in pregnant women in endemic areas**	• Counsel on preventive measures (sanitation and footwear) • Prescribe and make accessible anthelminthics after first trimester of pregnancy	• Wear shoes and dispose of feces carefully to prevent infection • Take a single dose of albendazole (400 mg) or a single dose of mebendazole (500 mg) in the second trimester of pregnancy as a treatment for hookworm. If hookworms are highly endemic (>50 percent prevalence), take an additional dose in the third trimester of pregnancy
5 **Birth spacing of three years or longer**	• Promote optimal breastfeeding practices • Promote family planning as a health and nutrition intervention; counsel on the need for a recuperative period to build energy and micronutrient stores • Consider breastfeeding status when prescribing contraception • Promote safer sex	• Initiate breastfeeding in the first hour after birth, breastfeed exclusively for about six months, and continue breastfeeding for two years or more • Practice family planning to space births for at least three years; delay pregnancy so that there are at least six months between the period of breastfeeding and the subsequent pregnancy • Use contraceptives that protect breastfeeding • Use condoms prior to the decision to become pregnant and during pregnancy and lactation

Introduction

In spite of the importance of maternal nutrition on maternal and infant survival and health, maternal nutrition has received little attention within health, population, and nutrition programs. Maternal nutrition interventions have often been dismissed as too complicated or too expensive.

In many African countries, chronic energy deficiency, poor weight gain in pregnancy, anemia, and other micronutrient deficiencies are common among women. Sub-Saharan Africa leads the world with the highest fertility rates and the highest percentage of adolescent pregnancies, HIV/AIDS infections, and malaria cases (Baker et al., 1996). These conditions further undermine nutritional status.

Improving maternal nutrition will depend in part on changing maternal behaviors. These changes can be encouraged by support of the health sector. This paper proposes a set of essential health sector actions to achieve five nutrition-related outcomes (Box 2). The epidemiological and programmatic data presented in the paper show that these outcomes will improve maternal nutrition and benefit maternal and child health. For maximum effect, improving nutritional status of women should begin prior to pregnancy. The actions discussed in this paper, however, begin in pregnancy, a time when health systems can more easily reach women. The goal is to provide policy makers and program managers with the background necessary to introduce these important actions into existing health programs.

The paper is divided into two sections. Section I includes a chapter on the prevalence and causes of maternal malnutrition in Africa and another chapter on the consequences of maternal malnutrition. Section II includes a chapter for each of the five outcomes. The five chapters outline actions the health sector and women can take to achieve these outcomes. These chapters conclude with a discussion of program experience in implementing the essential actions.

Box 2. Outcomes of Essential Health Sector Actions to Improve Maternal Nutrition

1. Adequate food intake during pregnancy and lactation
2. Adequate micronutrient intake during pregnancy and lactation
3. Reduction of malaria infection in pregnant women in endemic areas
4. Reduction of hookworm infection in pregnant women in endemic areas
5. Birth spacing of three years or longer

Section I

Prevalence, Causes, and Consequences of Maternal Malnutrition in Africa

Chapter 1. Prevalence and Causes of Maternal Malnutrition in Africa

Many women in Africa suffer from chronic energy deficiency, inadequate weight gain during pregnancy, and poor micronutrient status. This chapter discusses the prevalence of these conditions in Africa and the following contributing factors:

- Inadequate food intake
- High-energy expenditure
- Micronutrient-deficient diets
- Infections
- Demands of pregnancy and lactation

Inadequate Food Intake

Many women in developing countries maintain pregnancy on dietary intakes lower than those recommended by international agencies (FAO/WHO/UNU, 1985). The recommended daily allowances vary according to weight, basal metabolic rate, and level of activity during pregnancy. For women ages 18 to 30 that weigh from 40 to 60 kilograms, the range is 1700 to 3335 kilocalories per day. Studies conducted in Kenya in the mid-1980s found that pregnant women consumed on average 1442 kilocalories per day; lactating women consumed 1749 kilocalories (Allen, 1993). In The Gambia, studies among pregnant women reported intakes of approximately 1500 kilocalories per day (Prentice et al., 1987).

Three indicators reflect inadequate food intake in women.

- Low weight-for-height
- Low pregnancy weight gain
- Low birth weight

Low weight-for-height

Between 5 to 20 percent of women in various countries in Africa are too thin (low weight-for-height as measured by body mass index less than 18.5) (Figure 1).

Figure 1. Low Weight-for-Height (Body Mass Index) among Women Ages 15 to 49 (DHS 1990–1998)

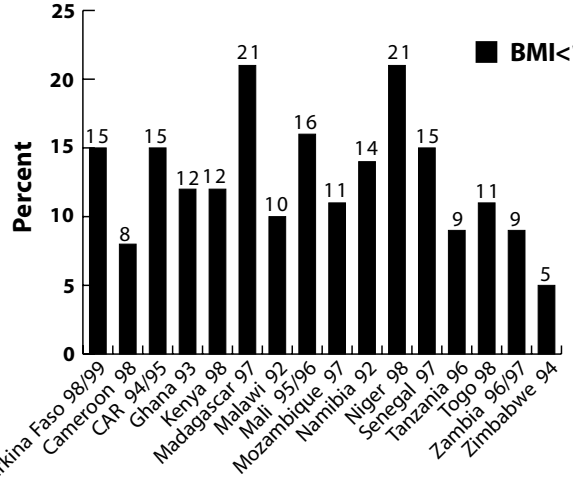
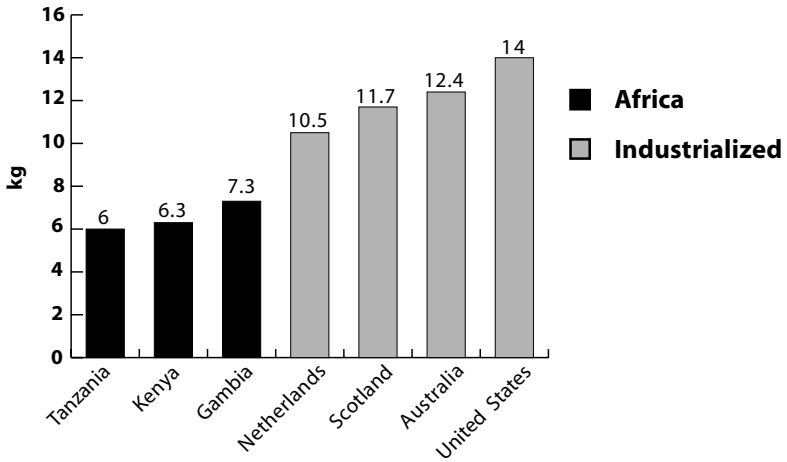


Figure 2. Average Pregnancy Weight Gain in African vs. Industrialized Countries



Source: Durnin, 1987; Truswell et al., 1987; Newmann et al., 1992; Moller et al., 1989; Schieve et al., 2000.

Low pregnancy weight gain

Low weight gain during pregnancy is another indicator of women's poor nutritional status. Weight gain in Africa is low compared to weight gain in industrialized countries (Figure 2).

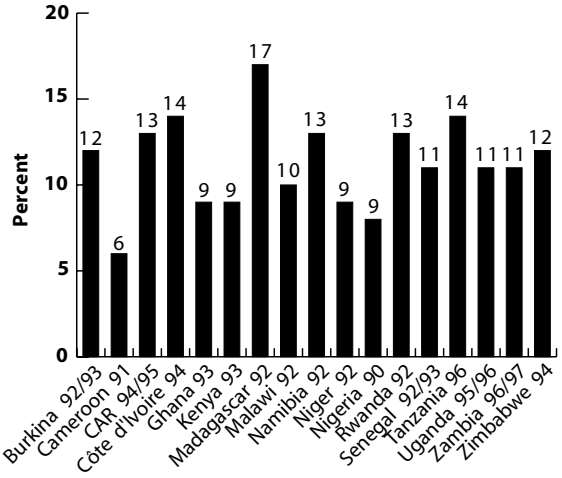
Low birth weight

Low birth weight reflects malnutrition in women. The percentage of recent live births for which the mother reported that the birth weight was less than 2.5 kg is 17 percent in Madagascar and 10 percent or more in 11 out of 17 other African countries for which Demographic and Health Survey (DHS) data are available (Figure 3).

High-energy Expenditure

African women engage in physically demanding activities requiring high levels of energy. In sub-Saharan Africa, women contribute 60 to 80 percent of agricultural labor to produce food for sale and household consumption (FAO, 1995). They often maintain high levels of activity throughout

Figure 3. Percent of Recent Live Births in Africa for which the Mother Reported that the Birth Weight Was Less than 2.5 kg



Source: DHS Comparative Studies, 1997

pregnancy, which increases the amount of energy needed from their diet.

Micronutrient-deficient Diets

Recent surveys of pregnant and lactating women in Africa indicate that deficiencies of several micronutrients are common, particularly iron, vitamin A, zinc, folic acid, riboflavin, and iodine. Low intakes of calcium and vitamin E are also found. The high prevalence of multiple deficiencies can be accounted for by low dietary intakes and/or poor bioavailability of micronutrients (Allen, 1993). Minimal consumption of animal products and fortified foods also contributes to multiple deficiencies.

Iron deficiency

Non-pregnant women need about 1.2 mg of iron per day to meet basal needs and replace iron lost during menstruation. Pregnancy causes loss of iron for fetal tissue formation and increased blood supply (Table 1). Blood loss from hookworm and shistosomiasis, destruction of red blood cells from malaria, and HIV and associated chronic disorders result in additional iron losses. Iron deficiency also results from low intake of iron that the body can absorb and use efficiently (the bioavailability of the iron). In African countries, commonly consumed foods such as millet, sorghum, and maize are poor sources of iron. A large amount of iron may be present in these foods, but the absorption of that iron is very low, only 1 to 2 percent (Gillespie, 1999).

Anemia is the most commonly measured indicator used to screen for iron deficiency, but it only represents the severe stage of iron deficiency when the level of hemoglobin falls below a cut-off point of 11.0 g/dl for pregnant women and 12.0 g/dl for non-pregnant women. It has been suggested that for every anemic woman, there is an additional iron-deficient woman who is not anemic (UNU/UNICEF/WHO/MI, 1999).[1]

Anemia rates among pregnant women in Africa range from 43 percent in Nigeria to 80 percent in Tanzania (Figure 4). A recent cluster sample survey in Zambia found that 40 percent of women of reproductive age were anemic (Luo et al., 1999).

Other micronutrient deficiencies

In addition to iron deficiency, other micronutrient deficiencies are common in Africa, including vitamin A, zinc, folic acid, riboflavin, and iodine.

Vitamin A deficiency exists in pregnant and lactating women in many areas of Africa. In a national survey in Zambia, 22 percent of mothers were deficient in vitamin A[2] (Luo and Mwela, 1997). Levels of vitamin A in breastmilk were deficient in 69 percent of women tested in Tanzania (Mazengo et al., 1997 as reported by Ndossi and Taylor, 1999).[3]

Zinc deficiency was observed in 36 to 46 percent of pregnant women studied in Malawi (Gibson and Huddle, 1998) and among lactating women studied in The

Table 1. Basal Iron Requirement and Losses for a Typical Woman

Source	Iron Cost (mg/day)
Basal iron requirement	0.72
Iron loss through menstruation	0.44
Iron loss through pregnancy	2.14
Iron loss through lactation	0.23
Iron loss through moderate hookworm infection	
N. americanus	1.10
A. duodenale	2.30

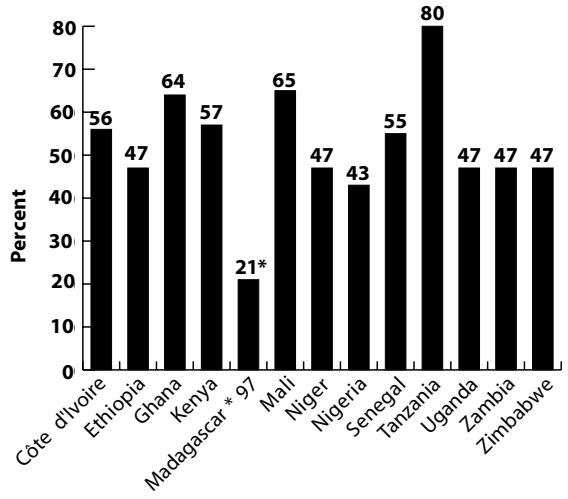
Source: Stoltzfus et al., 1997

1 This means that when 40 percent of women are anemic during pregnancy, about 80 percent are probably iron deficient, and when 50 percent are anemic, 100 percent are iron deficient.

2 The survey was of mothers with children under age five years. Deficiency was measured by serum retinol levels <20 mg/dl.

3 Less than 30 mg/dl in breastmilk

Figure 4. Rates of Anemia in Pregnancy in Africa



Source: Population Action International 1995, *DHS (Madagascar)

Gambia (Yan et al., 1996) and Zaire (Arnaud et al., 1994). Diets in Malawi, as in many other parts of Africa, are low in bioavailable zinc due to the high phytate and fiber content of the diet and low intake of animal foods (Gibson and Huddle, 1998).

Folic acid deficiency is common in pregnant and lactating women in many parts of Africa (Metz, 1970; Baynes et al., 1986).[4] Malaria-infected women require more folic acid, which is needed for synthesis of all cells. Depletion of folic acid can lead to megaloblastic anemia among infants born to these women. A recent study in Malawi illustrated the relationship between malaria and iron/folic acid deficiency in pregnant women (Huddle et al., 1999).

Riboflavin deficiency is endemic in The Gambia and common in other parts of Africa (Powers, 1998). Studies reported low intakes of riboflavin by pregnant and lactating women in Tanzania (Mazengo et al., 1997 as reported by Ndossi and Taylor, 1999) and Kenya (Allen, 1994). In a survey of refugees in Ngara district, Tanzania, the prevalence of riboflavin deficiency was 10 to 15 percent. In the Kenya study, breastmilk contained low levels of riboflavin.

Iodine deficiency, a result of low amounts of iodine in the soil, remains a major problem in some African countries. Intake of goitrogens (foods, such as cassava, that can suppress thyroid function and induce goiter) and limited seafood consumption aggravate the problem (Joint WHO/UNICEF/ICCIDD Consultation, 1997). The introduction of iodized salt has led to a major decline in goiter, but pockets of iodine deficiency still exist in areas with limited access to iodized salt.[5]

Low vitamin E levels have been reported in pregnant and lactating women in Tanzania (particularly in rural areas) as a result of limited intake of edible oils (Mazengo et al., 1997 as reported by Ndossi and Taylor, 1999). In one rural area of Kenya, the proportion of toddlers and school children with low vitamin E intakes was 85 percent and 43 percent respectively.

Low intakes of calcium have also been documented in many parts of Africa (Prentice et al., 1995; Thacher et al., 1999).

Infections

Infections put an additional burden on the dietary needs of women. Many infections—especially those associated with fever—decrease appetite. Gastrointestinal infections reduce nutrient absorption, and the metabolic stress of illness increases energy and nutrient needs. Three of the major infec-

4 In a Kenyan study, among the 48 percent of pregnant women found to be anemic, 6 to 8 percent of the anemia was related to folate deficiency (Calloway, 1988). In the Ndola, Zambia study, folate deficiency was evident in half of the pregnant women with severe anemia (Fleming, 1989).

5 Goiters decreased among school children from 60 percent to 20 percent in two areas of Cameroon, from about 50 percent to 16 to 35 percent in four areas studied in the Congo, from about 50 percent to 4 to 16 percent in areas in Zambia, and from 38 percent to 9 percent in Zimbabwe. However, in several areas studied, goiter rates remain high, at about 26 to 39 percent in two areas of the northeast of Lagos in Nigeria and between 31 percent in Iringa and 60 percent in Mbeya Region in Tanzania (Joint WHO/UNICEF/ICCIDD Consultation, 1997). Although salt iodization was legislated in Kenya in 1970 and was available at the community level, one study in rural Kenya in the mid-1980s found that 18 percent of non-pregnant women and 24 percent of pregnant women had goiters (Calloway, 1988).

tions affecting maternal nutrition in Africa are hookworm, malaria, and HIV.

Hookworm infection

Hookworm infection can be a significant cause of anemia, particularly in areas with diets low in bioavailable iron or in individuals with increased iron requirements during growth or pregnancy (Pawlowski et al., 1991; Stoltzfus et al., 1997). In addition to profound iron deficiency, persons with heavy hookworm burdens can develop protein malnutrition from chronic blood loss and show signs and symptoms of kwashiorkor (Guerrant et al., 1999).

Hookworm infection is common in rural areas of the tropics and subtropics. Over one billion people are believed to be infected with hookworm *(Ancylostoma duodenal, Necator americanus,* or both), and as many as 44 million pregnant women may be infected at any given time worldwide (Guerrant et al., 1999; de Silva, 1999). In sub-Saharan Africa, fertility data suggest that approximately 24 million women were pregnant in 1990. With prevalence of hookworm infection in this age group (15 to 45 years) estimated at 32 percent, approximately 7.5 million women in sub-Saharan Africa were both pregnant and infected with hookworm in 1990 (Bundy et al., 1995).

Hookworm infection appears in almost all age groups in an endemic area. Prevalence increases with age in children, usually reaching maximum levels at age 15 to 20 years and leveling off in adulthood. Intensity of infection also increases with age but does not necessarily level off during adulthood. In fact, intensity frequently increases in older adults (Stoltzfus et al., 1997). Different groups in the population may be more affected by hookworm infection than others, depending upon who is exposed to transmission. Women are often more affected than others in areas where they do most of the agricultural work.

A hookworm infection of moderate intensity may cost a woman as much or more iron as required during pregnancy. A concentration of 10 mg/g fecal heme represents a daily loss of more than 2 mg of iron, comparable to the amount of iron required during pregnancy (Stoltzfus et al., 1997).

The degree of iron deficiency or anemia associated with hookworm infection is dependent on a number of variables, including:

- Worm burden (intensity and duration)
- Type of hookworm (*A. duodenale* causes more blood loss than *N. americanus*)
- Woman's iron reserves and diet
- Woman's overall nutritional status (Guerrant et al., 1999).

A wide range of intensities—equivalent to burdens of 40 to 160 worms—is associated with hemoglobin levels below 11g/dl, the threshold for anemia in pregnancy. Pregnant women may become ill with even smaller worm burdens (Bundy et al., 1995). Because of low iron stores, women and young children in Africa are especially vulnerable to chronic blood loss from hookworm, resulting in iron deficiency anemia (Stoltzfus et al., 1997).

Stoltzfus et al. (1997) studied the relationship between hookworm infection intensity and iron deficiency anemia in Pemba Island, Zanzibar, and in the Terai region of Nepal where diets are very low in iron. Mean hemoglobin levels were below normative definitions of anemia for both hookworm-infested and non-infested persons. Among Zanzibari women and children and pregnant Nepalese women, the hemoglobin concentration fell about 5g/L per 2000 hookworm eggs per gram of feces. The proportion of moderate to severe anemia attributable to hookworm infection was 56 percent for non-pregnant women in Zanzibar and 41 percent for pregnant women in Nepal (Table 2).

Malaria infection

Malaria causes anemia through the destruction of red blood cells (hemolysis) combined with suppression of erythropoiesis (the process of developing red blood cells). Malaria infection is the major cause of anemia in many malarious areas. In endemic areas, pregnant women develop malaria more frequently and have more severe infections than non-pregnant women.[6] Women pregnant in their first

6 Pregnant women are especially vulnerable to increased biting by mosquitoes carrying malaria. A study in rural Gambia found that pregnant women attracted twice the number of Anopheles gambiae complex (the predominant African malaria-carrying mosquito) than non-pregnant women. Physiological and behavioral changes occurring during pregnancy may be responsible for this increased attractiveness. Physiological factors include more exhaled breath and higher abdominal temperatures than non-pregnant women, resulting in the release of substances from the skin surface that allows mosquitoes to detect women more easily at close range. In addition, women in the study left the protection of their bednets (probably to urinate) more than twice as often as non-pregnant women, thus increasing their exposure (Lindsay et al., 2000).

Table 2. Proportion of Anemia Attributable to Hookworm Infestation in Different Populations

Population Group	Type of anemia*	
	Iron Deficiency Anemia	Moderate to Severe Anemia
Zanzibari schoolchildren	41 %	57 %
Zanzibari non-pregnant women	19 %	56 %
Nepalese pregnant women	29 %	41 %

* Iron deficiency anemia is defined as protoporphyrin > 80 u/mol heme and hemoglobin < 11 g/dl in pregnant women and schoolchildren or < 12 g/dl in non-pregnant women. Moderate to severe anemia is defined for all groups as hemoglobin < 9g/dl.

Source: Stoltzfus et al., 1997

pregnancies (primigravidas) are at increased risk for malaria and its adverse consequences—anemia and low birth weight. The prevalence and density of malaria parasitemia in pregnant women decreases with increasing number of pregnancies (Menendez, 1995).

Worldwide prevalence of malaria is estimated at 300 to 500 million clinical cases each year. More than 90 percent of all malaria cases are in sub-Saharan Africa (WHO, 1998). Malaria is endemic in most of Africa; however, the burden of illness attributable to malaria varies substantially between countries within tropical Africa and between different regions of the same country (Greenwood, 1999). Malaria often is undetected because peripheral smears may not identify the infection and symptoms may not be apparent.

HIV infection

High rates of HIV infection among women affect their energy and nutrient needs. Approximately 12.9 million African women between the ages of 15 to 49 years are living with HIV/AIDS (UNAIDS, 2000). Nutrient malabsorption accompanies frequent bouts of diarrhea commonly experienced by people with HIV/AIDS (Piwoz, and Preble, 2000). Some HIV-infected people have increased nutrient malabsorption even when asymptomatic (Keating et al., 1995). During the early stages of HIV infection, weight loss is mainly associated with reduced dietary intake and secondary infections, particularly diarrhea (Macallan, 1999). Anemia is often a side effect of AIDS.[7]

Malabsorption of fats and carbohydrates is common at all stages of HIV infection in adults and children. Fat malabsorption affects the absorption and utilization of fat-soluble vitamins (such as vitamins A and E), further compromising nutrition and immune status. Inadequate dietary intake to meet the increased metabolic demands for both energy and protein associated with HIV infection is likely to result in weight loss in women (Piwoz and Preble, 2000). This can further reduce a woman's ability to fight infection.

Demands of Pregnancy and Lactation

In most developing countries, women spend a large proportion of their reproductive years pregnant, lactating, or pregnant and lactating. Women in Africa are pregnant or lactating, on average, 30 to 48 percent of the time between the ages of 15 and 45 (McGuire and Popkin, 1990).

If a woman does not consume enough food to meet energy requirements during pregnancy, her body makes up the deficit by depleting energy stores (Krasovec, 1991). If energy intake is not adequate after delivery, her body uses fat stores to support lactation. A short interval between births may not provide women with enough time to replenish lost energy

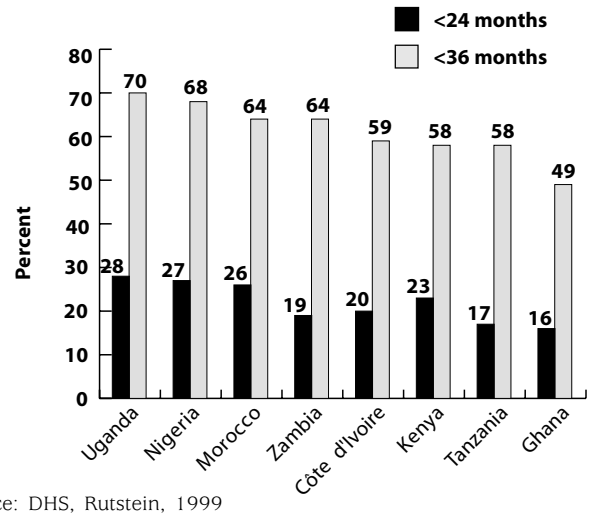
7 This effect is due to anemias of associated chronic disorders such as tuberculosis; HIV action on the stem cells and other precursors; an imbalance of growth factors due to HIV actions on macrophages, fibroblasts, and T-cells; uncontrolled paravirus B_{19} infections; and nutritional deficiencies caused by AIDS, including B_{12}, folate, and B_6 (Gillespie, 1998).

stores before they begin another reproductive cycle. Short recuperative intervals after pregnancy and lactation can result in reduced fat stores for women of marginal nutritional status (Merchant, et al, 1990a, b) and deplete maternal micronutrient stores (Khan, 1998).

Short birth intervals may also be associated with high rates of anemia. Large amounts of iron are lost during pregnancy due to tissue synthesis in the mother, placenta, and fetus, and at delivery due to maternal blood loss. Iron loss during pregnancy totals 600 mg, or 2.1 mg/day, in addition to basal iron loss (Table 1). Extending intervals between births allows a woman more time to replenish her iron stores. It is estimated that preventing a pregnancy saves the equivalent of 588 mg of additional iron absorbed over one year.

Birth intervals of 36 months or more help to ensure child survival and allow mothers time to replenish their nutritional stores. The actual length of birth intervals in many African countries is often much shorter, as shown in an analysis of DHS data (Figure 5). In most of the African countries analyzed, over half of the birth intervals were less than 36 months, and approximately a quarter were under 24 months. For example, in Uganda, 70 percent of birth intervals were less than 36 months and 28 percent less than 24 months. The rates were almost the same in Nigeria.

Figure 5. Percent of Birth Intervals that Are Short



Source: DHS, Rutstein, 1999

Chapter 2. Consequences of Maternal Malnutrition for Women and Their Children

The nutritional status of women is a major determinant of both maternal and infant health. Malnutrition is responsible for a broad range of short and long-term negative consequences for women, including increased reproductive risk, morbidity, and mortality. Women's nutritional status affects the morbidity and mortality of children through its impact on birth weight, prematurity, and nutrient stores in infants. In addition, undernutrition diminishes women's productivity, income-earning capacity, and educational achievement. This chapter discusses the effect of the contributing factors to maternal malnutrition, identified in the previous chapter, on maternal and infant health. Box 3 summarizes the consequences.

Consequences on Maternal Health

The combination of chronic energy deficiency, poor weight gain in pregnancy, anemia, other micronutrient deficiencies, infections such as HIV and malaria, and inadequate obstetric care contribute to high rates of maternal mortality throughout most countries in Africa (Figure 6).

Consequences of energy deficiency

Direct consequences of chronic energy deficiency among women include increased susceptibility to infection, reduced activity levels, and lower productivity (Shetty and James, 1994). Under conditions of food scarcity, resources are divided differently between mothers and fetuses, depending on the mother's initial nutritional status (Winkvist et al., 1998; Winkvist et al., 1994; Kusin et al., 1994). Maternal depletion occurs in women who can provide enough nutrients for their fetus, but at their own nutritional expense. This depletion reaches a lower limit at which it stops, and the birth weight of the infant is affected instead (Winkvist et al., 1998).

Under conditions of chronic moderate-to-severe malnutrition, women have been able to replete themselves during reproduction but with a negative effect on the infant. In very low-weight, unsupplemented women, there appears to be preferential partitioning of nutrients in favor of the mother but at the expense of the infant (Winkvist, 1998). While the partitioning of scarce food resources between mother and child differs depending on the degree of maternal malnutrition, in both situations the mother-child dyad suffers.

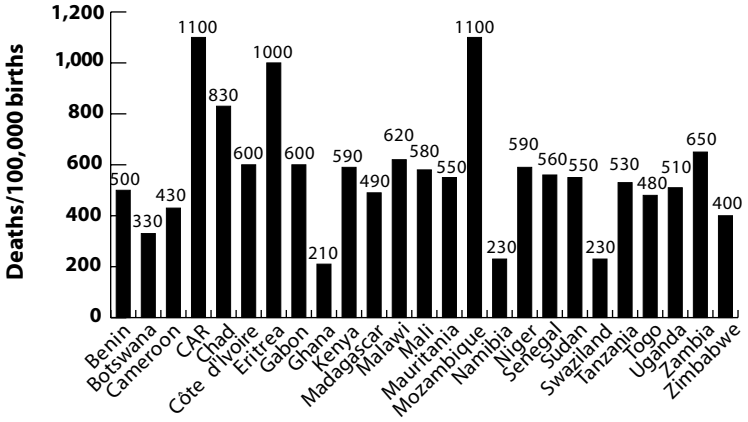
During lactation, low maternal energy intake primarily affects the nutritional status of the mother rather than her capacity to provide sufficient breastmilk. While breastmilk will be adequate for the infant, the mother's nutritional status may deteriorate if her dietary intake and stores are low. The breastfeeding mother is vulnerable to depletion of concentrations of folic acid, vitamin D, calcium, iron, copper, and zinc. Maternal deficiencies should be avoided by improving the diet or providing supplements to the mother. It is safer, easier, and less expensive to give a mother more food than to expose her infant to the risks associated with breastmilk substitutes (LINKAGES, 2000).

Box 3. Summary of the Consequences of Maternal Malnutrition

For Maternal Health
- Increased risk of maternal mortality
- Increased infections
- Anemia
- Compromised immune functions
- Lethargy and weakness
- Lower productivity

For Infant Health
- Increased risk of fetal and neonatal death
- Intrauterine growth retardation, low birth weight, preterm birth
- Compromised immune functions
- Birth defects
- Cretinism and reduced IQ

Figure 6. Maternal Mortality Rates in Africa 1980 to 1998*



Source: UNICEF, 2000

*Note: Maternal deaths are often misclassified or underreported, and data collection methods vary considerably.

Consequences of micronutrient deficiencies

Micronutrient deficiencies can increase the risk of mortality and morbidity during pregnancy and delivery (Ramakrishnan, 2000). Ross and Thomas (1996) estimate that anemia is responsible for about 20 percent of maternal deaths, including approximately 25 percent of deaths caused by hemorrhage and 10 percent of deaths not directly linked to anemia. Zinc and iron deficiencies can increase the risk of hemorrhage (Kynast and Saling, 1986; Swanson and King, 1987).

In addition to being at greater risk of hemorrhage, anemic women are more likely to have prolonged labor, which predisposes them to sepsis and increases their risk of death (Gillespie, 1998). Iron deficiency anemia is often aggravated by deficiencies in folic acid, riboflavin, $B_{12,}$ and vitamin A—nutrients involved in red blood cell formation (erythropoiesis).

Low calcium intake can increase the risk of pre-eclampsia, high blood pressure, and hypertension. Pre-eclampsia causes about 12 percent of maternal deaths (WHO, 1996b). The risk of hypertension is greatest in adolescents and women during their first pregnancy. Adolescents have a greater requirement for calcium during pregnancy to meet the needs of the fetus and growing mother.

Micronutrient deficiencies also increase susceptibility to infection and/or their duration and severity. Deficiencies in vitamin A (Christian et al., 1998) and zinc (Swanson and King, 1987; Caulfield, 1998; Shankar and Prasad, 1998) increase rates of infections—including reproductive tract infections—during pregnancy and/or lactation. Iron deficiency anemia reduces resistance to disease, causes fatigue, and reduces productivity. Several other micronutrients play essential roles in immune function, including B_1, B_2, B_6, B_{12}, C, E, selenium, and folic acid (Tang et al., 1996).

HIV-infected individuals have lower serum concentrations of vitamins A, B_6, B_{12}, C, E, folate, carotenoids, selenium, and magnesium (Friss and Michaelsen, 1998), even in industrialized countries where intakes of these nutrients are relatively high. Deficiencies of nutrients that act as antioxidants (including iron, zinc, vitamin C, vitamin E, and selenium) can compromise cell-mediated immunity. Oxidative stress may increase HIV replication (Friss and Michaelsen, 1998).[8]

Consequences of malaria

Malaria increases the risk of maternal mortality and morbidity. The consequences

8 For an in-depth discussion of the relationship between HIV/AIDS and malnutrition, readers are referred to Piwoz and Preble, 2000.

of malaria on maternal health depend on whether the area is one of high, low, or unstable (seasonal or epidemic) transmission (Table 3). The level of pre-pregnancy immunity determines susceptibility to infection and severity of clinical manifestations.

Pre-pregnancy immunity is largely dependent on the intensity and stability of malaria transmission in the area (Menendez, 1995). In areas with lower rates of malaria transmission, women have low or no levels of immunity. Consequently, they are much more likely to experience severe complications from *Plasmodium falciparum* infections—such as cerebral malaria, pulmonary edema, or renal failure—than women living in areas of high malaria transmission who have high levels of immunity. These complications may significantly contribute to maternal mortality (Menendez, 1995).

Estimating the overall burden of malaria in sub-Saharan Africa is challenging because national statistics on disease-specific morbidity and mortality data are unreliable. Snow et al. (1999), using a combination of methods to estimate mortality and morbidity rates, concluded that in 1995 malaria was responsible for about one million deaths and just over 200 million episodes of clinical disease in tropical Africa. Since these rates reflect only direct mortality from malaria, they underestimate all malaria-related mortality. Since morbidity rates do not include asymptomatic infections, they too are underestimates (Snow et al., 1999).

Consequences on Infant Health

Intrauterine growth retardation (IUGR)—largely due to maternal malnutrition prior to and during pregnancy—causes about two-thirds of low birth weight in developing countries (Black, 1999). In more than 70 percent of the sub-Saharan countries studied by DHS, 10 percent or more of babies were born with low birth weight (LBW), as reported by their mothers (Figure 3). Neonatal mortality rates are two to three times higher for LBW infants compared to those at normal birth weight (Prentice, 1991; Prentice, 1999). IUGR dramatically increases the risks of infant mortality from diarrhea and pneumonia (Ashworth, 1998). Figure 7 shows the relative risk for neonatal mortality by birth weight using data from both industrialized and developing countries (Prentice et al., 1988).

Higher rates of low birth weight (DHS, 1999) and infant mortality (Hobcraft, et al., 1985) are also associated with short birth intervals. The risk of under-five mortality for a birth interval of less than 24 months is 2.4 times greater than for a 36 to 47 month birth interval. The lowest under-five mortality occurs with an interval of 48 months or more (DHS (Rutstein), 1999).

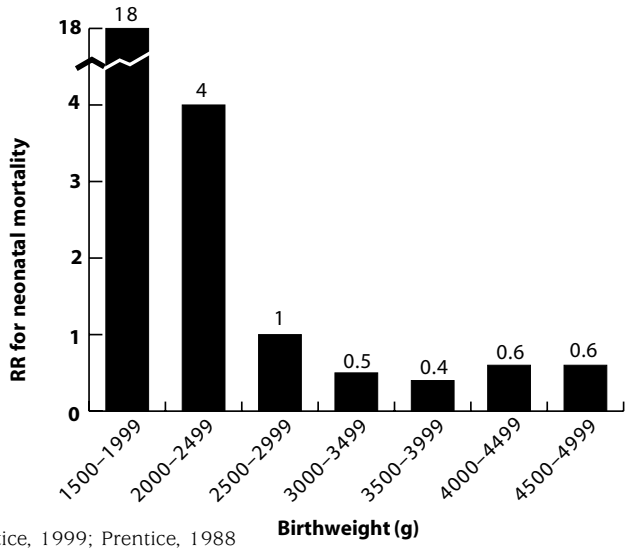
Table 3. Consequences of Malaria in Pregnancy on Maternal Health

Consequence	Level of Malaria Endemicity[a]	
	High transmission of malaria	Low or unstable transmission of malaria
Severe illness, including death	+ indirectly through anemia	+ + +
Maternal anemia	+ + + + mainly in primigravidae	+ + + + all parities
Hypoglycemia	?	+ + +
Placental infection	+ + + + mainly in primigravidae	+ +

[a] (Adapted from Menendez 1995) (+) rare; (+ +) infrequent; (+ + +) not infrequent; (+ + + +) frequent; (?) not known

Note: Because of low levels of immunity, the consequences of malaria are generally more severe in areas of low transmission of malaria than in areas of high transmission.

Figure 7. Relative Risk for Neonatal Mortality by Birth Weight



Prentice, 1999; Prentice, 1988

Studies have shown an increased risk of intrauterine growth retardation for birth intervals of fewer than 18 months (Boerma and Bicego, 1992). Short birth intervals also affect the previous child as a result of shortened breastfeeding duration and competition for maternal care, food, and other family resources.

Another cause of infant mortality is malaria-associated LBW from pre-term delivery and intrauterine growth retardation (Table 4) (Steketee et al., 1996a; Bloland et al., 1996). Levels of immunity and intensity of transmission may determine whether pre-term delivery or intrauterine growth retardation occurs. In areas of intense perennial malaria transmission, IUGR predominates. In areas of seasonal transmission, preterm delivery predominates (Sullivan et al., 1999). However, both IUGR and preterm delivery can occur in the same areas. A recent study suggests that the timing of malaria infection during pregnancy influences IUGR or preterm delivery. In a prospective study among Malawian women during their first pregnancy, each measure of parasitemia at delivery—cord, blood, placenta, and maternal peripheral parasitemia—was significantly associated with preterm delivery.

Table 4. Consequences of Malaria in Pregnancy on Infant Health

Consequence	Level of Malaria Endemicity[a]	
	High transmission	Low or unstable transmission
Miscarriage/perinatal death	?	+ + +
Intra-uterine growth retardation (IUGR)	+ + + + mainly in primigravidae	+ + + + all parities
Prematurity	?	+ + +
Congenital infection	+ +	+ + +

[a] (Adapted from Menendez 1995) (+ +) infrequent; (+ + +) frequent; (+ + + +) very frequent; (?) not known

Note: Because of low levels of immunity, the consequences of malaria are generally more severe in areas of low transmission of malaria than in areas of high transmission.

Parasitemia and/or clinically diagnosed malaria in the antenatal period was associated with IUGR (Sullivan et al., 1999).

Malaria infection and HIV infection in pregnant women have demonstrated synergistic outcomes, with both contributing to LBW (Steketee et al., 1996a). HIV-infected women are more susceptible to malaria. Pregnant mothers who have malaria and are HIV-positive are more likely to pass on their HIV status to their unborn child (WHO, 1998). A study in rural Malawi found that children born of HIV-positive mothers with placental malaria had 3.4 times the risk of dying in the post-neonatal period than did children born of HIV-positive mothers without placental malaria. In addition, the prevalence and density of peripheral and placental parasitemia was similar in HIV-positive women regardless of their number of pregnancies. (The normal pattern of lower prevalence and density of parasitemias with increasing parity was not observed) (Bloland et al., 1996).

Infants born with IUGR have a higher risk of growth retardation in childhood and an increased risk of illness. Even with an ideal environment and good nutrition in infancy and early childhood, the effects of IUGR on growth cannot be entirely reversed (Ramakrishnan et al., 1999a). The associated stunting persists through adulthood. Infants born with IUGR are at increased risk of poor motor, psychosocial, intellectual, and emotional development. LBW infants are at increased risk of breastfeeding problems (Adair and Popkin, 1996; Barros et al., 1987; Yoon et al., 1996).

Deficiencies in zinc, iron, iodine, vitamin A, folic acid, vitamin B_6, vitamin B_{12}, vitamin D, calcium, and magnesium can increase the risk of low birth weight, preterm births, and fetal death (Ramakrishnan et al., 1999b). Folate deficiency can cause neural tube defects (MRC Vitamin Study Research Group, 1991; Czeizel and Dudás, 1992), cleft palate (Shaw et al., 1995), urinary tract defects (Li et al., 1995), and limb defects (Yang et al., 1997). Iron and vitamin B_6 deficiency can decrease women's attentiveness to child rearing, with possible negative effects on children's health and development (McCullough et al., 1990).

The consequences of iodine deficiency to fetal brain development and growth are severe (Hetzel and Clugston, 1999). Severe iodine deficiency in pregnancy results in cretinism in the infant, but even less severe deficiencies are detrimental. Infants born to mothers who are iodine deficient have poorer school achievement and lower cognition. Maternal micronutrient deficiencies compromise an infant's micronutrient status, which can inhibit the infant's immune function and increase the child's susceptibility to HIV and other infections.

When micronutrient intake is limited and maternal micronutrient stores are low, breastmilk may contain reduced levels of some nutrients needed by the infant for optimal growth and health. The demands for most nutrients—other than iron—are even higher among lactating women than among pregnant women. Mothers' micronutrient status affects the concentrations of thiamin, riboflavin, vitamin A, B_6, and B_{12}, iodine, and selenium in breastmilk. Deficiencies in these nutrients have negative effects on infants because they have limited stores of these nutrients at birth (Allen, 1994).

Consequences on Later Health Outcomes

The consequences of nutritional deficiencies at birth do not always reveal themselves until adulthood. Low birth weight, thinness, and short body length at birth are associated with increased rates of cardiovascular disease and non-insulin dependent diabetes in adult life. The "fetal origins hypothesis" proposes that fetal undernutrition in middle to late gestation, which leads to disproportionate fetal growth, heightens the risk of coronary heart disease later in life (Barker, 1995). The hypothesis suggests that coronary heart disease and the allied disorders originate through adaptations that the fetus makes when it is undernourished. These adaptations may be cardiovascular, metabolic, or endocrine and may permanently

change the structure and function of the body in ways that lead to later disease (Barker, 1999).

A study in The Gambia found a strong link between early life events and adult immunocompetence. Persons born during the hungry season were up to 11 times more likely to die prematurely in adulthood of infectious diseases than those born during the harvest season. The authors hypothesize that this relationship is caused by an impairment in the development of the immune system in the fetus (Prentice and Goldberg, 2000).

Low birth weight infants delivered by women who themselves were LBW infants is another example of the effects of early life events on later health outcomes. Prospective data from long-term studies in Guatemala provide evidence of this intergenerational relationship. These studies found maternal birth size to be a significant predictor of child's birth size. For every 100 gram increase in maternal birth weight, the child's birth weight increased by 29 grams. For every one centimeter increase in mother's birth length, the child's birth length increased by 0.2 centimeter (Ramakrishnan et al., 1999a).

Section II

Essential Health Sector Actions to Improve Maternal Nutrition

Chapter 3. Adequate Food Intake during Pregnancy and Lactation

Maintaining energy and nutrient balance has important implications for the nutrition and health status of women throughout their life cycles, but especially so during pregnancy and lactation when nutritional demands are increased. Health sector programs can encourage pregnant and lactating women to increase food intake to meet these additional needs. Increased food intake and reduced workloads require the support of male partners and other family members. Health promoters can counsel women to adopt appropriate behaviors as well as discuss with men and other family members how they can contribute to the health of mother and baby.

Essential Health Sector Actions

Encourage increased food intake during pregnancy and lactation

Pregnant women need to increase food intake by at least 200 kilocalories per day and more if their pre-pregnancy weight was low. For example, one serving of maize porridge and 12 groundnuts would meet this additional requirement (LINKAGES, 1999). Most breastfeeding women in developing countries need about 650 kilocalories—nearly the equivalent of an extra meal per day—to meet energy needs of lactation; otherwise, their own nutritional status will be compromised (LINKAGES, 2000). For well-nourished mothers, some of this extra energy can come from fat stores accumulated during pregnancy. Many women in Africa do not have sufficient fat stores and must rely on dietary intake.

During antenatal contacts, health care providers should ask the mother about her food beliefs and eating practices and counsel the mother and her accompanying family members on an appropriate diet for pregnant women. During immediate postpartum, postnatal, well-baby, and family planning contacts, they should also ask lactating women about their diet and activity level and counsel them to eat more foods—at least one extra meal per day—that are available and affordable to them.

Pregnant women often object to increasing food intake because they are concerned that it will result in a bigger baby, making delivery more difficult.[9] Limited food availability, infrequent meals, and lack of easily available snacks can also stand in the way of women following these recommendations. Women may be more receptive to messages focusing on eating specific foods, giving birth to healthy babies, and feeling better during pregnancy than messages focusing on eating more food. Pre-testing messages will determine which messages will be effective in encouraging pregnant women to gain weight and to allay their fears about difficult labor.

Monitor weight gain in pregnancy

Counseling women on their weight gain can be a useful tool for the health system as long as appropriate messages and counseling techniques are used. Women should gain about one kilogram per month in the second and third trimesters of pregnancy (Krasovec, 1999). When women do not attend prenatal care sessions on a monthly basis, average weight gain during the interval between visits can be calculated and converted to assess whether this rate was at least one kilogram per month.

Counsel on reduced energy expenditure

Reducing energy expenditure is another effective way to improve women's nutritional status and to increase birth weight. Especially in pregnancy, reduction in workloads can help meet energy needs. In a study in Ethiopia, pregnant women who engaged in low levels of physical activity gained more weight and gave birth to infants with higher birth weights than those who participated in heavy activity, even though both groups consumed similar levels of energy (Tafari, 1980). Women should be counseled to take extra rest starting as soon as pregnancy is detected and continuing during lactation. Again, the message for this behavior needs to be delivered to others in the family and not just to the mother.

9 Concerns have been raised that increasing weight gain can result in more difficult labor and cephalo-pelvic disproportion (Garner et al., 1992). However, evidence suggests that increases in birth weight are associated with no or minimal changes in head circumference (Kramer, 1999). In a study in The Gambia, food supplementation resulted in an increase of head circumference of less than three millimeters, about one-tenth of an inch, a difference that would not result in obstructed labor (Ceesey et al., 1997; Prentice, 1999).

Box 4. Actions to Ensure Adequate Food Intake during Pregnancy and Lactation	
Essential Health Sector Actions	**Maternal Actions**
• Encourage increased food intake during pregnancy and lactation	• Eat at least one extra serving of staple food per day during pregnancy and the equivalent of an extra meal per day during lactation
• Monitor weight gain in pregnancy	• Gain at least one kilogram per month during the second and third trimesters of pregnancy
• Counsel about reducing energy expenditure	• Rest more during pregnancy and lactation

Box 4 summarizes what the health sector and a woman can do to help improve maternal nutrition through increased food intake and reduced energy expenditure.

Program Experience

Food supplementation

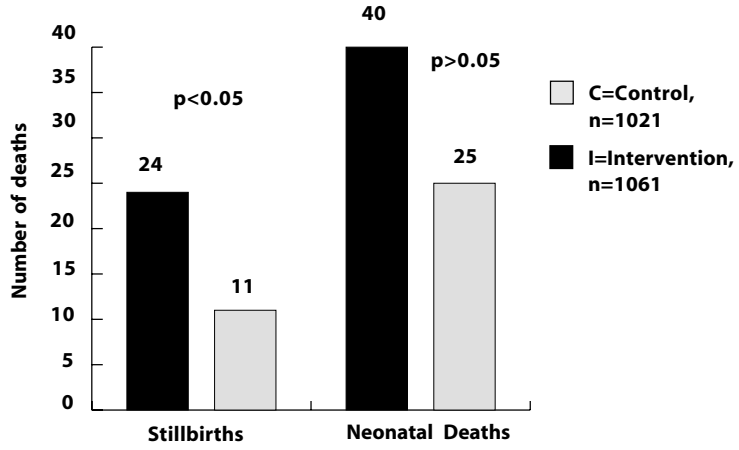
Increased maternal energy intake during pregnancy increases birth weight. The more underweight the woman is prior to pregnancy, the greater the effect on birth weight. Evidence from laboratory studies with animals and from a community intervention study in Guatemala suggests that among very poorly nourished women, increases in energy intake primarily result in higher birth weight. But among better nourished mothers, increases primarily affect maternal weight (Winkvist et al., 1998). Severely malnourished women who weigh less than 45 kilograms or have a Body Mass Index of less than 18.5 are likely to show increases in birth weight. Moderately malnourished women—those weighing 45 to 49.9 kilograms or having a Body Mass Index of 18.5 to 22.9—are likely to show increases in their own weight. Their infants may not show improvements in birth weight unless energy intakes are particularly low, such as during hungry seasons before the harvest (Rasmussen, 1998; LINKAGES, 1999).

In a recent five-year prospective, randomized, controlled trial in 28 rural Gambian villages, the primary health care system distributed high-energy biscuits—around 1,000 kilocalories per day—to chronically undernourished women. The women received biscuits each day starting after 20 weeks of pregnancy and continuing until delivery. Supplementation was associated with significant increases in weight gain in pregnancy, increases in birth weights, and reductions in the prevalence of stillbirths (Ceesay et al., 1997). While there were reduced levels of neonatal mortality (excluding stillbirths), the sample sizes were too small to show statistical significance (Figure 8). Improvement in maternal nutrition in The Gambian studies was greatest in the season of highest workloads and lowest food availability, suggesting that where nutritional stress is seasonal, increasing energy intake at these times can be especially beneficial.

Prentice et al. (1987) used data from supplementation trials in Kemba, The Gambia—where neonatal mortality was about 92 deaths per 1000 live births—to estimate neonatal mortality. They estimate that a shift in birth weight distribution similar to that observed in The Gambia will produce a 37 percent decrease in neonatal mortality as well as a decrease in postneonatal mortality (Prentice et al., 1987).

Only two randomized intervention trials have assessed the impact of increasing energy intake during lactation on breastmilk output (Khin-Maung and Oo, 1987; Gonzalez et al., 1998). In both the Burma and Guate-

Figure 8. Effect of Supplementation in Pregnancy on Stillbirths and Neonatal Mortality in The Gambia



Source: Ceesey et al., 1997

mala trials, food supplementation of mothers who were the most malnourished in their communities resulted in a small increase in infant milk intakes.

Educational messages

Some community-based programs promote increased food intake for pregnant and lactating women. The Nutrition Communication Project addressed maternal nutrition in several of its country programs. In Burkina Faso, the project developed a counseling handout and flipcharts for health workers. Women who reported exposure to the flipcharts and health worker counseling showed higher levels of knowledge on the dietary needs of pregnant and lactating women. However, behavior appeared to be mostly unchanged because the messages did not address women's underlying fear of obstructed labor (NCP, 1995a).

The Bangladesh Integrated Nutrition Project included a community-based nutrition component to bring about sustainable changes in feeding and eating behaviors of children, pregnant women, and lactating mothers. An evaluation found that 84 percent of mothers in the project areas, compared with 52 percent in the control areas, were aware of the additional needs for food during pregnancy. More women in the project areas (56 percent) reported eating additional food during pregnancy than in the control areas (22 percent). In addition, the mean weight gain of women during pregnancy was higher in the project areas than in the control areas (8.4 kilograms versus 7.6 kilograms by UNISCALE, or 8.2 kilograms versus 7.8 kilograms by bathroom scale) (Institute of Nutrition and Food Science, 1999).

The Bangladesh Integrated Nutrition Project also encouraged pregnant women to rest. Sixty-four percent of women in the project areas compared with 35 percent in the control areas reported resting more during pregnancy (Institute of Nutrition and Food Science, 1999). Some programs have encouraged the use of "rest homes" in the last month of pregnancy as a means of helping mothers gain weight.

A program among women in Thailand found that a message to measure weight gain in pregnancy was useful in encouraging women to eat more (Roesel et al., 1990). Health providers reported that when fathers attended classes offered by the health system, the men encouraged their wives to eat more and to gain weight.

Chapter 4. Adequate Micronutrient Intake during Pregnancy and Lactation

Improving micronutrient status is an important step to reducing maternal malnutrition. This can be done through diet diversification and micronutrient supplementation. Changing dietary practices takes time. Moreover, the diet cannot meet all of the iron requirements of pregnant women, especially those who begin pregnancy with low stores. Because of the immediate needs of pregnant and lactating women and the grave consequences for infant health of poor maternal micronutrient intake, the health sector should promote micronutrient supplements during pregnancy and lactation as well as dietary changes.

Essential Health Sector Actions

Counsel on diet diversification

During antenatal, immediate postpartum, postnatal, and family planning contacts, women should be asked about their diet and affordable foods and counseled on ways to increase consumption of fruits, vegetables, animal products, and fortified foods. Increased daily consumption of green leafy and yellow/orange fruits and vegetables will improve the status of many micronutrients. Increased vitamin C consumption from fruits and vegetables will enhance the iron bioavailability from other foods. Also, consumption of fruits and vegetables will increase anti-oxidant levels, which can help strengthen the immune system and reduce the risk of cardio-vascular disease and some cancers.

Animal products are excellent sources of protein, fat, and micronutrients. Many micronutrients from animal products are more easily absorbed and/or utilized by the body than those found in fruits and vegetables. The cost of animal products, however, may limit their consumption.

To prevent iodine deficiency, promotion of iodized salt for use by the entire family is a top priority. Iodized salt promotion programs are essential to maternal and child nutrition and need to be emphasized within health services and community interventions. Pregnant women have an increased need for iodine. In some countries, iodized salt is still not available for use by all pregnant women (Pardede et al., 1998; Sundqvist, et al., 1998).

Health programs should also promote the consumption of fortified food by women. Some countries are encouraging the fortification of flour and other staples with iron and other nutrients. Zambia now has vitamin A-fortified sugar available.

Prescribe and make accessible iron/folic acid supplements

Iron supplements can prevent and treat iron deficiency anemia. Guidelines by the International Nutritional Anemia Consultative Group (INACG), WHO, and UNICEF (Table 5) suggest that all pregnant women routinely receive preventive iron supple-

Table 5. Guidelines for Iron Supplementation to Prevent Anemia in Pregnant Women (INACG/WHO/UNICEF)

Prevalence of anemia in pregnancy	Dose	Duration*
< 40 percent	60 mg iron + 400 ** µg folic acid daily	6 months of pregnancy
> 40 percent	60 mg iron + 400 ** µg folic acid daily	6 months of pregnancy and continuing to 3 months postpartum

* If 6 months duration cannot be achieved in pregnancy, continue to supplement during the postpartum period for 6 months or increase the dose to 120 mg in pregnancy.

** Where iron supplements containing 400 µg folic acid are not available, an iron supplement with less folic acid may be used.

Source: INACG, 1998

Table 6. Treatment Guidelines for Severe Anemia during Pregnancy (INACG/WHO/UNICEF)

Dose	Duration
120 mg iron + at least 400 µg folic acid daily	3 months (after completing this treatment, pregnant women should continue preventive supplementation as shown in Table 5)

Source: INACG, 1998

mentation. Where the prevalence of anemia is high (> 40 percent), supplementation should continue for three months into the postpartum period. Folic acid should be included in the supplement to help prevent anemia and reduce the risk of obstetric complications.

Some have suggested the use of weekly rather than daily iron supplements during pregnancy. The evidence favors daily supplementation. Weekly supplementation in pregnancy is less costly but also less efficacious than daily supplementation, based on a recent analysis of the results of 22 completed trials of iron supplementation. Neither is likely to be very effective unless compliance is maintained at high levels. Poor compliance in weekly supplementation would likely have greater negative impact than it would in daily supplementation (Beaton and McCabe, 1999).

Assess and treat severe anemia in women

Health programs should assess whether a pregnant woman is severely anemic (generally defined as a hemoglobin level less than 7 g/dl). In many countries, the cost of routinely testing hemoglobin levels is prohibitive and equipment unavailable. The World Health Organization recommends screening for clinical pallor to detect severe anemia in children (WHO/UNICEF, 1995). Screening for pallor has also been suggested for pregnant women. A recent study compared detection of anemia through hemoglobin levels with detection through screening for clinical pallor. Primary health care settings screened for clinical pallor by assessing palms, nail beds, or conjunctiva (the mucous membrane covering the inside of the eyelid and forepart of the eyeball). Pallor in all of these sites was associated with low hemoglobin concentrations (Stoltzfus et al., 1999). To ensure that most of the severely anemic women can be identified by screening for clinical pallor, these authors suggest screening both conjunctiva and palms. Pallor detected at either site would serve as an indication of severe anemia.

Pregnant women who are severely anemic should receive 120 mg of iron per day for three months and then continue with the preventive use of iron (Table 6). If only tablets containing 60 mg of iron and 400 µg of folic acid are available, pregnant women can take two of them daily (120 mg of iron + 800 µg folic acid). Iron supplements will not sufficiently treat severe anemia in pregnant women who are close to delivery. Treatment for severe anemia should be given in a hospital for a woman who is beyond week 36 in her pregnancy (INACG, 1998). If this is not possible, plans should be made with the family to ensure that the woman is brought to a facility with a blood supply at the time of delivery.

Prescribe and make accessible multiple micronutrient supplements

Iron, as well as other micronutrients, can also be supplied through multiple micronutrient supplements. The composition of a provisional micronutrient supplement (Table 7) was the outcome of a recent UNICEF/WHO/UNU (1999) meeting. This supplement meets the United States/Canadian Recommend Dietary Allowances for pregnant women—a compromise between the needs of lactating women and non-pregnant, non-lactating women—for 15 nutri-

ents. The multiple micronutrient supplement contains 30 mg of iron rather than the 60 mg recommended for pregnant women by INACG/WHO/UNICEF (Stoltzfus and Dreyfus, 1998) for the following reasons:

- Vitamin C, A, riboflavin, and B_{12} present in the multiple supplement will enhance absorption and/or utilization of iron, so lesser amounts of iron may be sufficient.

Table 7. Composition of Proposed Interim UNICEF Supplement, Proposed Tanzanian Supplement, and Supplement Used by Fawzi et al. for HIV+ Pregnant Women Compared to the US/Canada Recommended Dietary Allowances (RDA)

Nutrient	Proposed UNICEF Interim Supplement	Proposed MOH Tanzanian Supplement	Fawzi et al. Supplement for HIV + pregnant women	US RDA during pregnancy	US RDA during lactation
Vitamin A RE	800	600–800		800	1300
Vitamin A IU *	2664 retinol		5000 IU retinol + 30 mg = 3000ug betacarotene = 500 IU	2664 retinol 8000 beta.	4330 retinol 10,400 beta.
Vitamin D IU	200			200 (AI)	200 (AI)
Vitamin E IU	10	10–15	30	15	19
B_1 (Thiamin) mg	1.4	1.0–2.0	20	1.4	1.5*
B_2 (Riboflavin) mg	1.4	1.5–2.0	20	1.4	1.6
Niacin mg	18	20–25	100	18	17
Folic acid µg	400	400–1000	800	600	500
B_6 mg	1.9	2.0	25	1.9	2
B_{12} µg	2.6	1.4–3.0	50	2.6	2.8
Vitamin C mg	70	50–100	500	85	120
Vitamin K µg				65	65
Zinc mg	15	20–25		15	19
Iron mg	30	60		30	15
Calcium mg		100–1000		1000 (AI)	1000 (AI)
Phosphorous mg				700	700
Magnesium mg		100–350		350	19–30: 310 31-50:320
Iodine mg	150			175	200
Selenium µg	65	40–65		60	70
Copper mg	2	1–2		1.5–3.0	1.5–3.0

The most recent RDAs were used. They are reported from the NAS/IOM (1989) for vitamins A and K, iron, zinc, iodine, and copper, and the NAS/IOM (1997) for Ca, Ph, Mg, vitamin D, Fl; from the NAS/IOM (1998) for thiamin, riboflavin, niacin, B_6, folic acid, B_{12}; and the NAS/IOM (2000) for vitamin C, E, and selenium. AI refers to Average Intake, a measure used in the most recent RDAs.

*Conversion from RE to IU based on 1 RE = 3.33 IU vitamin A activity from retinol (Sommer and West, 1996).

- Compliance may be worse with higher iron content. With the inclusion of 60 mg of iron, at least 30 mg of zinc would have to be included in order to ensure zinc absorption. This can cause side effects because of the high mineral load.
- The multiple supplement can be used in conjunction with additional iron/folic acid tablets for treatment of anemia.

As soon as a woman knows she is pregnant, she should take a daily multiple micronutrient supplement through the rest of her pregnancy and, at minimum, three months postpartum. Preferably, she will continue taking the supplement through the duration of exclusive breastfeeding and, if possible, the duration of lactation.

A similar supplement is proposed for use in Tanzania (Table 7). The proposed Tanzanian supplement contains higher iron levels—60 mg instead of 30 mg—than the proposed UNICEF supplement. The Tanzanian supplement is intended to replace iron/folic acid, which was previously recommended in Tanzania at a level of 120 mg iron and 1000 µg of folic acid. The supplement would be taken daily during pregnancy—at a minimum during the second and third trimesters—and during the first six months of lactation to meet the needs of exclusively breastfeeding women (Ndossi and Taylor, 1999).

For pregnant women who know that they are infected with HIV, some government health programs are considering prescription of multiple supplements with higher recommended dietary allowances. This will help meet increased nutrient needs caused by HIV infection and may reduce the risk of poor pregnancy outcome. Table 7 shows the micronutrient levels of a supplement used in a study by Fawzi et al. (2000) that resulted in reductions in low birth weight among infants born to HIV-positive mothers.

A multiple micronutrient supplement can also help prevent anemia and other micronutrient deficiencies in adolescents and non-pregnant, non-lactating women. Supplement use only during pregnancy and lactation is insufficient to build up iron stores. Improving the micronutrient status of women before they become pregnant will help prevent birth defects caused by folic acid, iodine, and vitamin A deficiency. Even daily supplements of vitamin A in severely deficient populations are inadequate to promote optimal vitamin A status in the newborn.

Distribute vitamin A to postpartum women

The health sector can prevent vitamin A deficiency by providing lactating women in endemic areas with a high-dose vitamin A capsule (200,000 IU) as soon after delivery as possible. Because high doses of vitamin A during pregnancy can cause birth defects, they should not be given to pregnant women. That means that high-dose vitamin A must be administered in the first six to eight weeks postpartum since women are at risk of becoming pregnant by six weeks postpartum if not breastfeeding and by eight weeks postpartum if breastfeeding (IVACG, 1998). High-dose vitamin A supplementation is still beneficial for postpartum women taking multiple micronutrient supplements because the supplements, while meeting daily needs, may not be sufficient to build up stores.

Table 8, which illustrates the costs of only the supplement, shows that multiple supplements are about four to five times more expensive than iron/folic acid alone. However, these figures do not include the other major expenses of a supplementation program, including management, training, supply and distribution, education, and counseling. When these costs are included, the amount for additional nutrients represents only a small proportion of total expenditures. This table also does not take into account the cost of lost life, health, and economic productivity. Governments concerned about the cost of increasing the availability of supplements to non-pregnant, non-lactating women might consider providing weekly rather than daily supplements. Due to limited resources, health programs may need to target activities

Table 8. Costs of Micronutrient Supplements for Pregnant/postpartum Women

Micronutrient	Contents	Cost (US cents)
Ferrous sulfate/ Folic acid	60 mg iron 400 µg folic acid	.2 cents x 180 days = 36 cents/ pregnant woman .2 cents x 90 days = 18 cents/ postpartum woman
Mutiple micronutrients	12 nutrients including 30 mg iron (see Table 7, proposed UNICEF supplement)	.8 to 1 cent x 180 days = $1.44 to $1.80 /pregnant woman .8 to 1 cent x 90 days = 72 to 90 cents / postpartum woman
Vitamin A	200,000 IU capsule	2.2 cents/ postpartum woman

and focus at present on pregnancy and the postpartum period.

Box 5 summarizes what the health sector and a woman can do to help improve maternal nutrition through adequate micronutrient intake during pregnancy and lactation.

Program Experience

Behavior change communication

One of the objectives of the Nutrition Communication Project was to increase consumption of micronutrient-rich foods by pregnant and lactating women. In Mali, the project used interpersonal and group counseling as the primary vehicles for reaching women. Women who remembered one of several messages from a flipchart used by health promoters were twice as likely to report consumption of liver in the past 24 hours than those who were not exposed or did not remember the message (NCP, 1995b).

Box 5. Actions to Ensure Adequate Micronutrient Intake

Essential Health Sector Actions	Maternal Actions
• Counsel on diet diversification	• Increase daily consumption of fruits and vegetables, animal products, and fortified foods, especially during pregnancy and lactation
• Prescribe and make accessible iron/ folic acid supplements OR prescribe and make accessible multiple micronutrient supplements	• Consume daily supplements (iron/ folic acid—60 mg iron + 400 µg folic acid—or multiple vitamin/mineral supplement) during pregnancy and the first three months postpartum
• Assess and treat severe anemia in women	• If severe anemia, consume a daily dose of 120 mg of iron + at least 400 µg of folic acid for three months
• Distribute vitamin A to postpartum women	• Consume a high-dose (200,000 IU) of vitamin A immediately after delivery or within the first eight weeks after delivery if breastfeeding and within six weeks after delivery if not breastfeeding

In Niger, the Nutrition Communication Project used several communication channels to promote increased consumption of vitamin A-rich foods: counseling and group discussions about vitamin A, counseling cards, village dramas, and radio dramas and spots. Liver consumption by women increased from 43 percent in the past week to 73 percent after the campaign. The campaign encouraged husbands—who traditionally buy the family's meat—to buy liver for their wives and children to ensure that they consumed a varied diet and adequate quantities of food. Women reporting that their husbands brought home liver increased from six percent to 26 percent (Parlato and Gottert, 1996). The radio campaign and community education or village theater were viewed as critical to the success of the campaign (NCP, 1995c).

A MotherCare project in Malawi with Project Hope and the Ministry of Health developed IEC materials, including flip charts for health workers, and community dramas on the problem of anemia in pregnancy. Reminder cards and small storage bags for iron/folic acid pills were given to women at health centers and in the community by community health workers, including traditional birth attendants. The program also ensured that a regular supply of iron/folic acid tablets was available. Anemia rates were reduced significantly as a result of the project (MotherCare, 1999).

Supplementation programs

Research projects and/or small-scale programs have shown positive outcomes from supplementation trials, as illustrated below.

- *Iron supplementation during pregnancy*:
  Improved iron status and reduced anemia in pregnancy in various studies (Gillespie, 1998; Galloway and McGuire, 1994; Viteri, 1999);
  Reduced fetal and neonatal deaths, increased infant lengths and APGAR scores at birth, and increased serum ferritins at three months in a randomized control trial in Niger (Preziosi et al., 1997, Christian, 1998)
- *Zinc supplementation during pregnancy*:
  Increased infant length at birth in a research study in Kenya (Newmann and Harrison, 1994);
  Improved maternal and neonatal zinc status and neurobehavioral development of infants in Peru (Caulfield et al., 1999, Merialdi et al., 1998)
- *Calcium supplementation during pregnancy* (of women with low baseline calcium intakes):
  Reduced risk of high blood pressure and pre-eclampsia in randomized control studies (Villar and Belizan, 1998)
- *Vitamin A or beta-carotene supplementation (*low dose, weekly supplementation at least three months prior to and during pregnancy):
  Lowered maternal mortality by nearly half (West et al., 1999) and decreased illness rates in late pregnancy (> 28 weeks gestation) (Christian et al., 2000) in a randomized control study in Nepal
- *Multiple micronutrient supplements to HIV-positive pregnant women*:
  Decreased risk of low birth weight, preterm births, and small size for gestational age in HIV-negative infants in a randomized control study in Tanzania (Fawzi et al., 2000)

Going from pilot projects and research studies to large-scale program implementation has often been unsuccessful, although there are some notable exceptions. UNICEF and many non-governmental organizations report success in postpartum distribution of high-dose vitamin A (Vitamin A Global Initiative, 1998). Promotion of the use of iodized salt has been one of the major public health successes in the last several years.

For over a decade, Thailand, Cuba, and Honduras have been providing multiple vitamin-mineral supplements to pregnant women through the health care system. In the United States, 98 percent of obstetricians and gynecologists recommend vitamin or mineral supplements to their patients during pregnancy, and 92 percent specifically recommend prenatal supplements (Levine, 1993). In the United States, 81 percent of women surveyed reported consuming supplements during their last pregnancy (Yu et al., 1996).

The U.S. government recommends that all women of reproductive age consume daily supplements containing 400 µg of folic acid (Oakley et al., 1998; Dept. of HHS, 1996). Most women obtain their folic acid supplement within a combined multiple supplement that they purchase through the private sector.

Iron supplementation programs for pregnant women have had little success in decreasing the high rates of iron deficiency anemia. A review of these programs revealed that the causes of poor program performance were:

- low accessibility and utilization of antenatal care
- insufficient supply and distribution of supplements
- inadequate training and motivation of health workers
- insufficient and inappropriate counseling of mothers
- lack of motivation of mothers
- failure of effective screening and referral procedures (Galloway and McGuire, 1994).

These important issues will need to be addressed if large-scale iron supplementation programs are to succeed. Improving compliance and supplementation programs will require increasing the awareness of policy maker, provider, and patient; improving the patient-provider relationship; providing quality service and a quality product; and ensuring availability of supplies (Galloway and McGuire, 1994). Experience from the MotherCare Project suggests that iron supplementation programs will also need to address iron supplementation for adolescents and non-pregnant women (Elder, 2000).

Health systems are often unable to reach women early in their pregnancies or to reach women who are not pregnant. Social marketing is another distribution strategy for increasing the use of iron and micronutrient supplements. The social marketing of daily vitamin/mineral supplements to women of reproductive age is underway in areas of Bolivia, Paraguay, and Pakistan and has been used to sell iron to pregnant women in Indonesia and India.

Chapter 5. Reduction of Malaria Infection in Pregnant Women in Endemic Areas

Malaria increases the risk of anemia, intrauterine growth retardation, and preterm delivery. Three of the options for prevention and/or curative care for pregnant women in areas of malaria transmission are: 1) prophylaxis/intermittent therapy, 2) treatment of clinical cases, and 3) use of insecticide-treated materials, along with the ancillary activities of anemia reduction (Garner and Gulmezoglu, 1999).

Essential Health Sector Actions

Treatment and prevention of malaria need to be part of a comprehensive program of antenatal care. Involving the range of stakeholders within the health sector ensures a consistent approach by different groups, particularly those responsible for developing policies and programs for malaria control and reproductive health. Currently, few countries have comprehensive malaria control policies. Safe motherhood programs can play an important role in helping to develop and implement these policies.

Prescribe and make accessible antimalaria curative and prophylactic drugs for pregnant women

Health programs can prevent malaria infections among pregnant women by giving drug prophylaxis to all pregnant women in endemic areas, regardless of whether or not they are symptomatic.[10] This can be done by prescribing either small doses of anti-malarial drugs every week or several larger treatment doses. The World Health Organization has concluded that:

"In areas where there is a high risk of *P. falciparum* infection in pregnancy, where *P. falciparum* is susceptible to sulfadoxine/pyrimethamine and where the regimen can be administered correctly, intermittent treatment with sulfadoxine/pyrimethamine is safe and effective for reducing the consequences of malaria in pregnancy" (WHO, in press).

Health workers should give curative treatment at the first antenatal visit—but not during the first trimester—followed by prophylaxis, depending on national protocol. Treatment and prevention protocols need to be clearly explained to the mother. The three main treatment regimens during pregnancy are:

- Two curative doses of sulfadoxine-pyrimethamine (SP), often referred to as Fansidar, one in the second trimester of pregnancy and the other in the third trimester
- Three curative doses of sulfadoxine-pyrimethamine sometime during the second and third trimesters
- Weekly chloroquine (CQ) prophylaxis

The average cost of drugs for the different treatment regimens is shown in Table 9.

Table 9. Cost per Pregnancy of Malaria Treatment Options

Drugs	Regime	Cost (US cents)/ Pregnancy
Sulfadoxine-pyrimethamine*	1 curative dose 2nd trimester 1 curative dose 3rd trimester	8.2 8.2 16.4 cents / pregnancy
Sulfadoxine-pyrimethamine	3 curative doses sometime within the 2nd and 3rd trimesters	3 x 8.2 = 24.6 cents / pregnancy
Chloroquine**	Weekly prophylaxis	78 cents / pregnancy

*The average price of a 500 mg sulfadoxine and 25 mg pyrimethamine tablet is 2.72 cents (Management Sciences for Health, 1999). For one dose of 1,500 mg of sulfadoxine + 75 mg of pyrimethamine, the cost would be 8.2 cents).
**The average price for chloroquine phosphate is 0.6 cents per 100 mg tablet (Management Sciences for Health, 1999). The treatment regime is 500 mg chloroquine phosphate per week for 26 weeks.

10 Targeting antimalarial interventions may increase their cost-effectiveness (Steketee et al., 1996c). Women during their first and possibly their second pregnancy are the most clearly identified target group. Targeting in the high transmission season and targeting identified HIV-infected women may also be considered.

Table 10. Antimalarial Drugs to Avoid in Pregnancy

Drug	Contraindication
Tetracycline	Possibly teratogenic; causes staining of child's teeth
Doxycycline	Likely to have effects similar to tetracyclines but data limited
Primaquine	Potential risk of hemolytic effect in fetus
Halofantrine	Documentation on safety limited
Artemisinin derivatives	Documentation on safety limited

Treat clinical infections

A woman with a clinical case of malaria should be treated with anti-malarial drugs, either sulfadoxine-pyrimethamine or chloroquine, depending on chloroquine resistance in the area. She should also receive anti-pyretic drugs to reduce fever and iron/folic acid to treat anemia. While a majority of women may experience minor side effects—such as itchiness, dizziness, or gastrointestinal disturbances—from anti-malarial drugs, there are few serious side effects (Steketee et al., 1996d). Several anti-malarial drugs should not be used during pregnancy because of risks to the fetus (Table 10). In some cases they should not be used during lactation.[11]

Promote use of insecticide-treated materials

Health workers should promote vector control measures, such as using insecticide-treated materials (including bednets and curtains) to help lower the risk of infection.

Mathematical models have been used to calculate cost-effectiveness ratios for the main prevention and treatment interventions for childhood malaria in sub-Saharan Africa. The cost-effectiveness for disability-adjusted life year (DALY) averted ranged from US $4 to $10 for insecticide treatment of existing nets; $19 to $85 for provision of nets and insecticide treatment; $32 to $58 for residual spraying (two rounds per year); $4 to $29 for intermittent treatment of pregnant women (primagravidae); and $1 to $8 for improvement in case management.

The total cost of full coverage of the target population of women with intermittent treatment—as a percentage of a typical public sector health care budget in a very low-income country—was estimated to be only 0.17 percent of the budget. This model excluded benefits for adults, so these DALYs averted are only for the children of pregnant women and do not even include DALYs averted for women (Goodman et al., 1999).

Box 6 summarizes key actions to reduce malaria infections in pregnant women in endemic areas.

Program Experience

In October 1998, WHO launched the 'Roll Back Malaria' initiative, which includes as one of its main strategies partnerships with implementing programs, including nutrition, safe motherhood, and the private sector (WHO, 1998). The mix of approaches for preventing and treating malaria must be based upon the local and/or national malaria situation and, where present, malaria control policies and policy implementation. Many anti-malarial regimens have been evaluated. Intervention efficacy must be considered along with safety, availability, affordability, and simplicity of delivery.

Insecticide-treated materials

Vector control measures can lower the exposure to infection. Several studies have examined the impact of the use of bednets by pregnant women. A CDC/KEMRI study in western Kenya showed that women in insecticide-treated bednet villages had less malaria and anemia during pregnancy and at the time of delivery, particularly in the first three pregnancies. In this group, the mean birth weights were higher; preterm

11 For women who continue anti-malarial drugs during breast-feeding, considerations for safety are different from those during pregnancy. The age of the nursing infant is a critical consideration. For example, the sulfadoxine in the SP regimen should not be given to a mother who is nursing a full-term infant under two months of age because of the risk of kernicterus (bilirubin toxicity). After two months, SP may be used. There appears to be sufficient evidence for the safety of anti-malarial doses of pyrimethamine and chloroquine during nursing (Anderson et al., 1999; Bennett, 1996). The amount of doxycycline and tetracycline excreted into milk is small—much less than would be expected to cause tooth staining. No data exist on the safety of halofantrine or artemisinin during breastfeeding (Anderson et al., 1999).

Box 6. Actions to Reduce Malaria Infection in Pregnant Women in Endemic Areas	
Essential Health Sector Actions	**Maternal Actions**
• Prescribe and make accessible anti-malaria curative and prophylactic drugs for pregnant women	• In the second and third trimesters, take anti-malarial drugs as a curative treatment regardless of symptoms OR take weekly anti-malarial prophylaxis starting at first antenatal visit (according to local recommendations)
• Treat clinical infections	• Seek treatment for fever during pregnancy; take drugs to treat malaria and reduce fever and take iron/folic acid supplements to treat anemia
• Promote use of insecticide-treated materials	• Use insecticide-treated materials, including bednets

births were approximately 40 percent lower (ter Kuile, 1999).

Other studies found that insecticide-treated bednets produced health benefits for mothers and their children. Parise (1999) reports that anemia was reduced among pregnant women who used insecticide-treated bednets in three out of four studies conducted in Thailand, Kenya, and The Gambia. Birth weight increased during the rainy season in The Gambia. Results from a multi-center randomized control trial in Africa showed that overall childhood mortality could be lowered by 15 to 35 percent in some areas through insecticide-treated bednets (WHO, 1998-Fact Sheet 94). The health sector can promote their use by families, especially emphasizing the benefits for pregnant women and young children. However, costs and availability are issues (Goodman and Coleman, 1999).

Prophylaxis/intermittent therapy

Most people in Africa have malaria that is resistant to chloroquine treatment. Rural communities are particularly affected, but urban malaria is increasing as unplanned development around large cities takes place. The emergence of chloroquine-resistant strains of *Plasmodium falciparum* presents great problems for developing policies and practices (Steketee et al., 1996b). Although chloroquine is safe and the drug of choice in the few areas where it is still effective (Table 11), the resistant strains have dramatically reduced its effectiveness for both treatment and prophylaxis. In areas where CQ resistance is common, standard weekly prophylaxis with CQ has not been shown to be effective in clearing peripheral parasitemias.

Intermittent therapy with alternatives to chloroquine has emerged as a simple and cost-effective approach to reducing the adverse impacts of malaria infection in pregnancy (Schultz et al., 1996). Intermittent therapy involves the administration of full curative treatment doses of an effective anti-malarial drug at predefined time intervals during pregnancy.[12]

Multiple doses of sulfadoxine-pyrimethamine taken during pregnancy, regardless of the presence of signs or symptoms of malaria, have been shown to reduce the incidence of low birth weight infants born to first-time mothers in rural Malawi (Verhoeff et al., 1998). In another study in Malawi, effective anti-malarial intervention resulted in approximately a 35 percent reduction in risk of preventable low birth weight (risks such as infectious disease or poor nutrition during gestation) (Steketee et al., 1996b). This reduction in low birth weight resulted in a three to five percent reduction in the rate of infant mortality (Steketee et al., 1996c). In achieving these birth outcomes, the interventions

12 Countries that have programs of intermittent SP use in pregnancy include Malawi since 1993 and Kenya since 1998.

Table 11. Countries in Africa with Malaria Susceptible or Resistant to Chloroquine

Countries with chloroquine-susceptible malaria	Countries with chloroquine-resistant *Plasmodium falciparum* malaria		
Algeria	Angola	The Gambia	Nigeria
Egypt (El Faiyum area)	Benin	Ghana	Rwanda
Libya	Burkina Faso	Guinea	São Tome/Principe
Western Sahara	Burundi	Guinea-Bissau	Senegal
Morocco	Cameroon	Kenya	Sierra Leone
	CAR	Liberia	Somalia
	Chad	Madagascar	Sudan
	Comoros	Malawi	Tanzania
	Congo	Mali	Togo
	Congo Republic	Mauritania	Uganda
	Côte d'Ivoire	Mayotte	Zambia
	Djibouti	Mozambique	Zimbabwe
	Equatorial Guinea	Namibia	
	Ethiopia	Niger	

Source: Guerrant R, Walker D, Weller P, 1999

completely cleared the malaria parasites from the mothers, including parasites from the placental vascular space and umbilical cord blood.

The effectiveness of alternative anti-malarial regimens was evaluated in Malawi (Schultz et al., 1994). Women in their first or second pregnancies were randomly assigned to one of three regimens:

1. CQ/CQ: Chloroquine treatment (25mg/kg) followed by weekly chloroquine (300mg)
2. SP/CQ: sulfadoxine-pyrimethamine treatment during the second trimester followed by chloroquine weekly
3. SP/SP: sulfadoxine-pyrimethamine treatment at the second trimester followed by sulfadoxine-pyrimethamine treatment at the beginning of the third trimester (SP/SP).

The third regimen (SP/SP) appeared to have the greatest impact on malaria infection. Among women receiving one of the treatments, placental malaria parasitemia rates for the various regimens were as follows: CQ/CQ, 32 percent; SP/CQ, 26 percent; and SP/SP, 9 percent.

In addition to being more effective, the SP/SP regimen also proved to be markedly more cost-effective in preventing infant deaths. The SP/SP regimen cost $75 per infant death prevented, which was less than one-sixth the cost of the other regimens (Schultz et al., 1996). While SP's adult treatment dose costs 1.5 times more than CQ, the smaller number of doses required offsets this cost. Further, SP was acceptable to these pregnant women who were accustomed to going to antenatal clinics and were willing to take this tasteless (non-bitter) tablet. Following these and other studies, Malawi modified its national malaria control policy in 1993 by introducing intermittent presumptive treatment with sulphadoxine-pyrimethamine.

Three other recent studies have supported intermittent presumptive treatment of malaria in pregnancy (Parise et al., 1998; Shulman et al., 1999; Verhoeff et al., 1998). Parise et al. compared case management, intermittent treatment regimens in the second and third trimesters, and monthly prophylaxis for women in their first and second pregnancies. The study was conducted in Kenya in an area of intense malaria transmission and high HIV prevalence. All groups used sulfadoxine-pyrimethamine as the anti-malarial drug. The intermittent treatment was substantially more effective in reducing the degree

of placental infections than the case management approach (12 percent versus 27 percent) and also resulted in a trend towards lower prevalence of LBW (8 percent versus 14 percent, P = 0.08). The group receiving monthly SP had the lowest prevalence of placental malaria infections (9 percent) and a similar prevalence of low birth weight to the group receiving intermittent treatment.

For the HIV-positive women studied by Parise et al. (1998), two SP treatments were less effective in clearing placental malaria than the monthly treatment (25 percent versus 7 percent). These authors concluded that "while a two-dose SP regimen may be effective in areas with low HIV seroprevalence, administration of SP monthly during the second and third trimesters of pregnancy should be considered in areas of high HIV seroprevalence to prevent the effects of maternal malaria on the newborn."

The efficacy of intermittent treatment doses of SP was investigated in another area of Kenya with endemic transmission of malaria (Shulman et al., 1999). Authors reported that women during their first pregnancy who received treatment with SP in the second and third trimesters had lower rates of anemia and peripheral parasitemia at 34 weeks gestation than those who received a placebo (5 percent versus 35 percent and 15 percent versus 24 percent, respectively). Even women who received only one dose of SP benefited from the intervention.

The impact of one, two, or three doses of SP during pregnancy on the prevalence of malaria infection and the incidence of anemia and low birth weight was studied in 575 Malawian mothers (Verhoeff et al., 1998). The use of SP was not associated with maternal side effects or perinatal complications. Significant reductions in the incidence of low birth weight were observed with multiple doses of SP, even in women with HIV infections. The reduction in low birth weight was observed even when parasite prevalence at delivery was high because of re-infections in late pregnancy. Reduction of parasite prevalence earlier in pregnancy, as a result of the SP treatment, led to improved fetal growth.

Laboratory evidence and early evidence from clinical trials suggest that interactions between iron supplementation and malaria might increase the risk of malaria infection and illness. This concern has sometimes acted as a barrier to implementation of iron supplementation programs in malaria endemic areas.

Given this concern, a review of the available evidence on the risks and benefits of iron supplementation in malarious areas was carried out (INACG, 1999). The review found that iron supplementation was not associated with a significant increase in the risk of a clinical malaria attack, although it did increase the odds of being slide-positive for *Plasmodium falciparum* at the end of the supplementation period. The overall conclusion was that the risk of iron supplementation increasing malaria morbidity is small or nonexistent, and that the known benefits of iron supplementation are likely to outweigh the risk of adverse effects caused by malaria. The authors concluded that oral iron supplementation should continue to be recommended in malarious areas where iron deficiency anemia is prevalent (INACG, 1999).

Sulfadoxine-pyrimethamine works by interfering with folic acid metabolism in the malaria parasite. For this reason, concern has been raised that the use of folic acid by pregnant women during treatment could diminish the drug's impact. In African children with acute *falciparum* malaria, folic acid supplementation reduced the efficacy of the treatment (van Hensbroek et al., 1995). Based on these results, it has been suggested that on the day a woman receives the drug, she should refrain from taking the iron/folic acid supplement or multiple vitamin/mineral supplement. She can resume the supplement the following day. The continued use of folic acid is important because previous infection with malaria could have caused the woman to be deficient in folic acid. This deficiency should be corrected during pregnancy for both the mother's and infant's health (Huddle et al., 1999).

Chapter 6. Reduction of Hookworm Infection in Pregnant Women in Endemic Areas

Hookworm causes chronic blood loss, resulting in iron deficiency anemia. Hookworms attach to and feed upon the intestinal epithelium. The amount of blood lost with a heavy hookworm infection can be substantial. There are two strategies of hookworm control: breaking transmission and deworming. Breaking the transmission requires disposing of feces carefully (such as using pit latrines) and wearing footwear. Deworming reduces worm loads and thus is likely to have a positive impact on the iron status of women that compares favorably with other interventions (WHO, 1994).

Essential Health Sector Actions

Counsel on preventive measures

Preventive measures include appropriate disposal of human waste and use of footwear to protect feet from contaminated soil. Hookworm transmission occurs mainly through physical contact with soil contaminated by human feces.

Prescribe and make accessible anthelminthics during pregnancy

The World Health Organization recommends a single-dose, oral anthelminthic treatment for hookworm infection for all pregnant and lactating women in areas of high hookworm prevalence (WHO, 1996a). During antenatal contacts, health workers should give pregnant women in hookworm endemic areas a treatment once in the second trimester. If hookworms are highly endemic—greater than 50 percent prevalence—health workers should give women an additional dose in the third trimester of pregnancy.

Several safe and effective drugs are available to treat hookworm infection (Stoltzfus et al., 1997). The choice of these drugs depends upon their safety record, therapeutic effect, cure rate or efficacy, spectrum of activity, the experience of local health professionals, training of staff, and cost. The benzimidazoles (mebendazole and albendazole) are broad-spectrum anthelminthic drugs. At this time, they are the most commonly used drugs to treat hookworm and other intestinal worms. Other choices are available (levamisole and pyrantel), but they have been found less effective and often more costly than mebendazole and albendazole (WHO, 1994). Albendazole is recommended as a single dose of 400 mg. Mebendazole is recommended either as a single dose of 500 mg or as 100 mg twice daily for three days (Pawlowski et al., 1991).

A concern for the safety of anthelminthic treatment in pregnancy has been a barrier to wider adoption of this strategy to reduce anemia, but there is no evidence of such treatment having any adverse effects in humans (WHO, 1996a).[13] In Sri Lanka, mebendazole treatment is recommended to all pregnant women in the second trimester. De Silva (1999) reported no significant difference in the rate of major congenital defects between women who had taken mebendazole as recommended and those who had not. Among 407 women who, against medical advice, took mebendazole in the first trimester, ten (2.5 percent) gave birth to infants with major congenital defects. This was slightly higher (not statistically significant, $P = 0.23$) than in the control group (26/1737, 1.5 percent). These findings support the conclusions of a WHO Informal Consultation (WHO, 1994) that "single-dose, oral anthelminthic treatment can also be given to pregnant and lactating women. However, as a general rule, no drug should be given in the first trimester."[14]

The cost of anthelminthics is low. The average price per 400 mg tablet of albendazole is five cents, and the average price for a 500 mg tablet of mebendazole is three cents (Management Sciences for Health, 1999).

Box 7 summarizes the key actions to improve nutrition by reducing hookworm infection in pregnant women in endemic areas.

13 There is some experimental evidence from rats that both albendazole and mebendazole, at very high doses, have potential teratogenic effects (WHO, 1996).

14 Of the drugs used for hookworm infection, only mebendazole has any published documentation of safety during lactation. Negligible amounts are excreted into breastmilk; infants would not be expected to absorb more than 10 percent of any drug in the milk. There are no data on excretion of albendazole nor pyrantel into milk. But amounts are likely to be far less than the doses that were given to infants in a limited number of cases. In these cases, there were no adverse reactions. No data exist on levaminsole and breastfeeding (Anderson et al., 1999).

Box 7. Actions to Reduce Hookworm Infection in Pregnant Women in Endemic Areas	
Essential Health Sector Actions	**Maternal Actions**
• Counsel on preventive measures	• Wear shoes and dispose of feces carefully to prevent infection
• Prescribe and make accessible anthelminthics during pregnancy	• Take a single dose of albendazole (400 mg) or a single dose of mebendazole (500 mg) in the second trimester of pregnancy as a treatment for hookworm
	• If hookworms are highly endemic (> 50 percent prevalence), take an additional dose in the third trimester of pregnancy

Program Experience

Anthelminthic treatment

Several controlled trials have demonstrated a positive impact of anthelminthic treatment on hemoglobin levels, with the best results obtained in settings where iron intakes were also increased (Stoltzfus et al., 1997). As part of a national strategy to reduce anemia in Sri Lanka, pregnant women are offered a single dose of 500 mg mebendazole at the earliest antenatal visit after the first trimester, in addition to iron/folic acid supplementation. In plantation workers in Sri Lanka, Atukorala et al. (1994) found that anthelminthic therapy significantly increased the beneficial effects of iron supplementation on hemoglobin concentration and iron stores of pregnant women.

Stoltzfus et al. (1997) described studies investigating the efficacy of treatment with different drugs. The three-day dosing with mebendazole appeared to be the most efficacious. However, difficulties with compliance and greater cost with the three-day regimen relative to the single-dose regimen have been reported from Sri Lanka (WHO, 1996a). Albonico et al. (1994) investigated the efficacy of single-dosing regimens of albendazole and mebendazole in treatment of hookworm and other parasites. They reported that albendazole was more effective than mebendazole for treating hookworm infections. Side effects from both of the benzimidazoles are mild (gastrointestinal disturbances) and rare (Pawlowski et al., 1991). The price of albendazole—once substantially higher than that of mebendazole—has fallen over recent years. At the time of writing, there is little price difference between the two. Given the above considerations, for the time being albendazole appears to be the drug of choice in most situations for the treatment of hookworm.

Chapter 7. Birth spacing for three years or longer

Extending birth spacing and giving women longer non-pregnant, non-lactating intervals provides women the time they need to replenish their nutritional stores and improve infant health. For the best maternal and infant outcomes, USAID recommends a birth interval of at least three years. An inter-pregnancy interval of 39 months allows for six months of exclusive breastfeeding, followed by at least 18 months of breastfeeding and complementary feeding, and at least six months of neither pregnancy nor lactation (Labbok, 2000).

Many women in Africa would prefer to have longer intervals between births. In Senegal, the median *preferred* birth interval is 39.8 months while the *actual* median duration of birth spacing is 34 months (DHS, Rutstein, 1999). In Mali, the median preferred birth interval is 37 months while the actual median duration of birth spacing is 32 months (Figure 9). The difference in median duration of actual birth interval and median duration of preferred birth intervals ranges from 0.2 months for Nigeria to 12.7 months for Ghana.

The first step to optimal birth spacing in Africa is to ensure that breastfeeding rates are maintained and that the fertility-inhibiting impact of breastfeeding is maximized. Breastfeeding lengthens the duration of postpartum amenorrhea. In Africa—where contraceptive prevalence is low—the contribution of breastfeeding to birth spacing is many times greater than that of all modern contraceptives combined (Thapa et al., 1988).

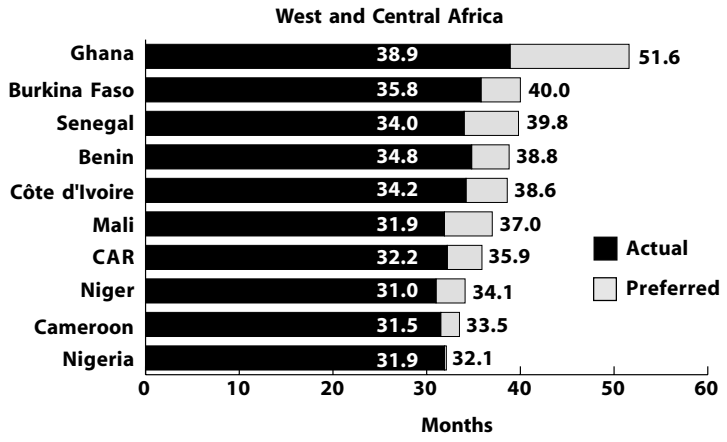
Promotion of increased birth spacing through support of optimal breastfeeding and family planning can have a major positive impact on maternal nutrition and child survival. Birth spacing can be promoted as a health intervention by maternal and child health programs as well as family planning programs.

Essential Health Sector Actions

Promote optimal breastfeeding practices

Breastfeeding patterns greatly affect the length of postpartum amenorrhea, thus prolonging protection against pregnancy. A DHS comparative study on the postpartum effects of breastfeeding found that the median duration of postpartum amenorrhea (by current feeding pattern) for mothers who do not breastfeed their children is three months on average and 14 months for those who exclusively or fully breastfeed. Those who supplement breastmilk with other milks or use a bottle experience, on average, eight months of

Figure 9. Median Duration of Actual and Preferred Birth Intervals in Africa



Source: DHS (Rutstein), 1999

postpartum amenorrhea (Haggerty and Rutstein, 1999). The median duration of postpartum amenorrhea for most countries in Africa is over a year, and for some countries—Chad, Niger, Rwanda, and Burkina Faso—the median duration is 15 months or more (Table 12). Contraceptive use, in contrast, is low in many African countries at 12 months postpartum (Figure 10).

Optimal breastfeeding practices support child spacing as well as child survival and women's health. Optimal practices include early initiation of breastfeeding, exclusive breastfeeding for about six months, and continued breastfeeding through two years or more (LINKAGES, 1999; UNICEF, 1999). Many African countries report low rates of early initiation and exclusive breastfeeding (Table 12).

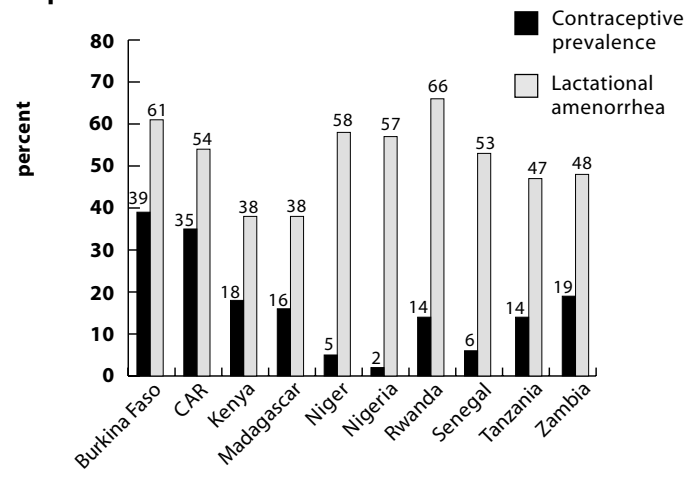
Early initiation of breastfeeding and exclusive breastfeeding for the first six months provide benefits to both the mother and child.

- Putting the baby to the breast immediately after delivery may reduce a mother's risk of postpartum hemorrhage since suckling stimulates the release of oxytocin, which helps to trigger uterine contractions (McNeilly et al., 1983). Early initiation of breastfeeding also reduces the risk of hypothermia in infants, provides infants with the immunologic benefits of colostrum, and enhances mother-infant bonding.
- Exclusive breastfeeding greatly reduces rates of diarrhea, acute respiratory and other infections, and associated mortality in infants.
- The savings in blood loss during amenorrhea help the woman recover her iron stores lost in pregnancy. In contrast to pregnancy, iron loss due to lactation is very low (around .23 mg per day in amenorrheic women). This is even less than the .44 mg of iron lost per day during menstruation. Thus, extending the period of lactational amenorrhea would have a net positive effect on iron status (Stoltzfus, 1994).
- There is evidence that breastfeeding has a protective effect against breast cancer (Newcomb et al., 1999; Lipworth et al., 2000).

Promote family planning as a health and nutrition intervention

To attain longer birth intervals, women need to have access to family planning methods. Health workers should discuss with women different family planning options and refer them to appropriate services during various contact points: antenatal, delivery and immediate postpartum, postnatal, and well baby (growth monitoring and immunization). Women

Figure 10. Contraceptive Use and Amenorrhea at 12 Months Postpartum



Source: Amenorrhea, DHS; Contraceptive Prevalence, Labbok et al., 1997a

Table 12. Breastfeeding Practices, Amenorrhea, and Fertility Rates in Africa

Country	% Ever Breastfed	% Breastfed < 1 hr.	% Breastfed < 24 hrs	% Exclusive Breastfed 0 to 5.9 months (a = 0 to 3.9 mo)	Median Breast-feeding (months)	Total Fertility Rate	Median Postpartum Amenorrhea (months)
Benin	97	24	63	10	23	6.3	13
Botswana				39 (a)		4.1	
Burkina Faso	99	30		5	25	6.7	15
Cameroon	97	38	59	12	18	5.2	11
Cape Verde				18 (a)		5.3	
C.A.R.	97	34	63	3	21	5.1	14
Chad	98	24		2	21	6.6	16
Comoros	96	25		3	20	5.1	7
Congo				32 (a)		6.6	
Côte d'Ivoire	100	44		2	20	6.1	12
Eritrea	98	48	69	59	22	6.1	14
Ethiopia				74 (a)		7.0	
Gabon				57 (a)		5.4	
Ghana	99	16		31		5.4	
Guinea				52 (a)		5.7	
Kenya	98	58	84	12	21	4.7	9
Lesotho				54 (a)		4.3	
Liberia						6.2	
Madagascar	97	34	79	48	21	6.0	11
Malawi	97	59		2	21	5.9	12
Mali	95	10	65	8	22	6.7	14
Mauritania	95	5		10	21	4.9	
Mauritius	72	20				2.0	2 (mean)
Mozambique	95	81	95	30	22	5.6	14
Namibia	95	55		14	17	5.1	8
Niger	97	28		1	21	7.5	16
Nigeria	97	33	50	1	20	6.2	15
Rwanda	97	20		90	28	6.0	17
Senegal	97	16	56	13	21	5.7	13
Sierra Leone						6.3	
Sudan	96	60		1	19	4.6	
Swaziland				37 (a)		5.2	
Tanzania	97	59	88	29	22	5.7	12
Togo	97	19		10	24	5.4	14
Uganda	98	49		57	20	6.9	13
Zambia	98	58	91	19	20	6.1	12
Zimbabwe	99	40	91	11	19	4.0	13

Source: Population Reference Bureau, 1999, DHS Surveys

and their partners should be provided with a full range of safe and effective contraceptive methods from which to choose. Modern methods for birth spacing include: condoms, spermicides, sterilization, oral contraceptives, vaginal barrier options, intrauterine devices, Natural Family Planning, the Lactational Amenorrhea Method, as well as implants, injections, and other progestin-only contraceptives.

Of particular importance to breastfeeding women is the Lactational Amenorrhea Method (LAM), a highly effective method for contraception that health programs can easily integrate into both maternal and child health services. Three criteria are required for LAM use:

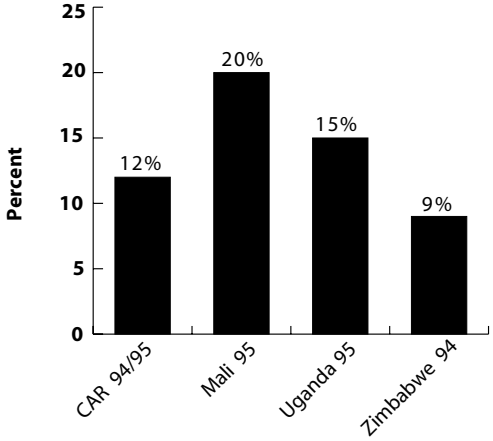
1. The woman's menstrual periods have not resumed, AND
2. The baby is fully or nearly fully breastfed,[15] AND
3. The baby is less than six months old.

If all three criteria are met, a woman is more than 98 percent protected against an unplanned pregnancy. LAM encourages the woman to switch to another family planning method for continued protection once any of the three criteria is no longer met (Labbok et al., 1994).

In some countries, a significant proportion of women currently meets the LAM criteria (Figure 11). These women are protected against pregnancy and experience the benefits listed above. However, they may or may not be aware that if any one of the three criteria is no longer met, they are at increased risk of pregnancy. In other words, in most cases these women may not be *consciously* using LAM as a method.

Many women report that they rely on breastfeeding—which is not a birth spacing method—to avoid pregnancy even though they may or may not meet the LAM criteria (Figure 12). For example, 78 percent of breastfeeding women in Uganda and 94 percent in Mali report that they rely on breastfeeding to avoid pregnancy. Those women who meet the LAM criteria should be made aware that they are currently protected against pregnancy but will need to switch to another method when any of

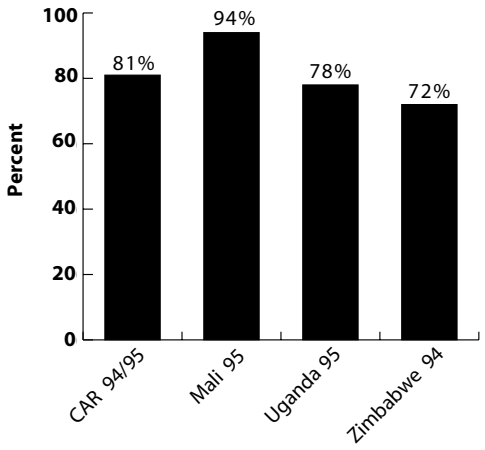
Figure 11. Percent of Breastfeeding Mothers in Africa Who Meet LAM Criteria



Source: Haggerty and Rutstein, 1999

15 Full breastfeeding is the term applied to both exclusive breastfeeding and almost exclusive breastfeeding (vitamins, water, juice, or ritualistic feeds given infrequently in addition to breastfeeds). Nearly full breastfeeding means that the vast majority of feeds given to infants are breastfeeds. While exclusive breastfeeding is not necessary for LAM to be effective, the closer the pattern is to exclusive, the better for mother and baby (LINKAGES, 2000).

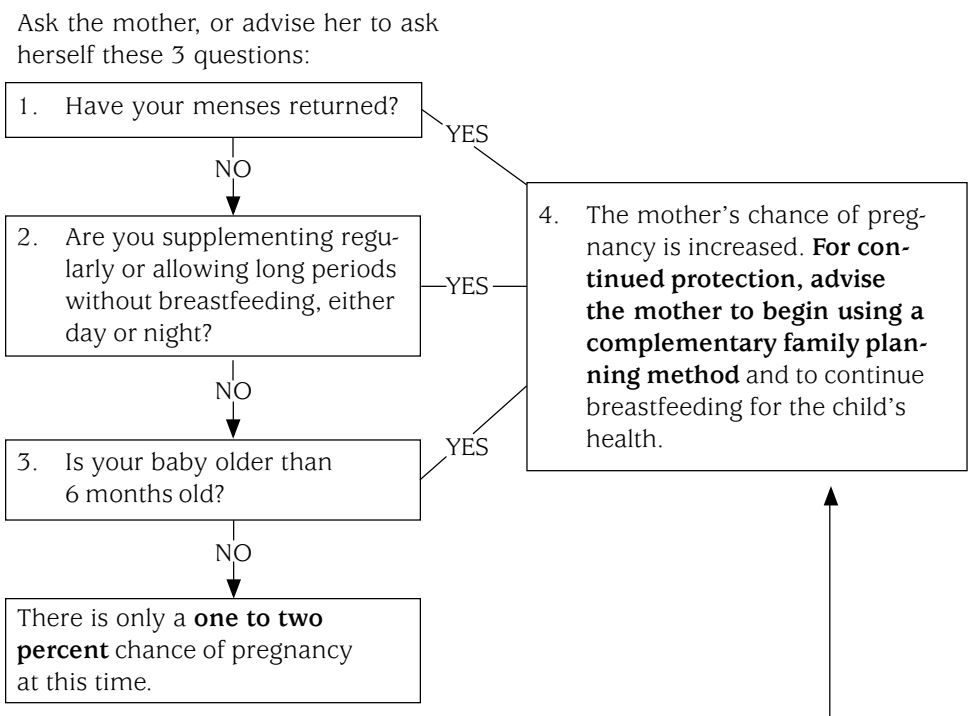
Figure 12. Percent of Breastfeeding Mothers in Africa Who Rely on Breastfeeding to Avoid Pregnancy



Source: Haggerty and Rutstein, 1999

the criteria no longer applies. Those who do not meet the LAM criteria need to be advised that they are at risk and should use an available method of contraception to avoid pregnancy. Figure 13 provides guidelines that health programs can use to counsel women on LAM at antenatal, delivery and immediate postpartum, postnatal, well-baby and family planning contacts.

Figure 13. Lactational Amenorrhea Method Algorithm



Source: Institute for Reproductive Health, 1994

Consider breastfeeding status when prescribing contraception

Breastfeeding women have special reproductive health needs that need to be addressed when choosing a family planning method. Situation analyses have shown that women seeking family planning services are not routinely asked about their breastfeeding status. Many providers are unaware that initiation of some methods, in particular combined hormonal pills and injectables, should be delayed during breastfeeding (Measham et al., 1996). In addition to including LAM in the contraceptive method mix, family planning providers should be aware of these special needs.

In some countries, when pregnancy tests are unavailable, modern contraception is often denied to non-menstruating clients for fear of harming the fetus. This puts women at risk for an unwanted pregnancy and a shortened birth interval. A checklist for ruling out pregnancy based in part on LAM criteria can be used for non-menstruating clients who want to use modern methods of contraception, as was done in Kenya using the form shown in Box 8.

Box 8. Checklist for ruling out pregnancy among family planning clients in Kenya

1. Have you given birth in the past 4 weeks?	Y/N
2. Are you less than 6 months postpartum and fully breastfeeding and free from menstrual bleeding since you had your child?	Y/N
3. Did your last menstrual period start within the past 7 days?	Y/N
4. Have you had a miscarriage or abortion in the past 7 days?	Y/N
5. Have you abstained from sexual intercourse since your last menses?	Y/N
6. Have you been using a reliable contraceptive method consistently and correctly?	Y/N

If the client answered **NO** to all of the questions, pregnancy cannot be ruled out. Client should await menses or use pregnancy test.	If the client answered **YES** to any of the questions, **and** is free of signs or symptoms of pregnancy, provide her with desired method

Source: Stanback et al., 1999

Promote safer sex

To help reduce the risk of HIV infection in mothers and their infants, health workers should be trained to promote dual protection and to make condoms accessible to clients at all times: prior to the decision to become pregnant, during pregnancy, and postpartum. Dual protection refers to protection against pregnancy and HIV and other sexually-transmitted diseases. Dual protection can be achieved through the use of condoms (male or female) alone or along with another contraceptive method. Male latex condoms—when used consistently and correctly with every act of sexual intercourse—have proved to be highly effective for preventing STIs and pregnancy. Even though women will be protected from pregnancy and STIs with condoms, LAM will still provide additional benefits to the mother and her child.

Protecting women from STIs/HIV during pregnancy is especially important for their own health and that of their infants. However, promoting condom use during pregnancy may be more difficult because partners are not seeking the additional benefit of contraceptive protection. Information on dual protection, risks, and contraceptive options should be part of informed choice counseling. Concerns about the transmission of HIV through breastfeeding are addressed in the Annex.

Box 9. Actions to Ensure Birth Spacing of Three Years or Longer	
Essential Health Sector Actions	**Maternal Actions**
• Promote optimal breastfeeding practices	• Initiate breastfeeding in the first hour after birth, exclusively breastfeed for about six months, and continue breastfeeding for two years or more
• Promote family planning as a health and nutrition intervention; counsel on the need for a recuperative period to build energy and micronutrient stores	• Practice family planning to space births for at least three years; delay pregnancy so that there are at least six months between the period of breastfeeding and the subsequent pregnancy
• Consider breastfeeding status when prescribing contraception	• Use contraceptives that protect breastfeeding
• Promote safer sex	• Use condoms prior to the decision to become pregnant and during pregnancy and lactation

Box 9 summarizes key actions to ensure birth spacing of three years or longer and to help prevent HIV.

Program Experience

The health sector has been successful in improving breastfeeding practices throughout the world. Family planning programs have been more successful in lowering the total number of children that women deliver than in increasing birth spacing. Program experience in promoting modern contraceptives and safer sex has been described in detail elsewhere (JSI, 2000). The use of LAM within family planning programs is less well documented since LAM is often not integrated into the method mix of family planning programs. Because LAM is a relatively new family planning method and is strongly interrelated with optimal breastfeeding practices, it will be discussed in greater detail here.

Integration of LAM into family planning programs

The acceptability and efficacy of LAM has been tested in various sites in Africa. A multi-center prospective study found that the overall efficacy for the method was greater than 98 percent and overall satisfaction greater than 83 percent. Continuation with another method of family planning following use of LAM was 68 percent at nine months postpartum. In most cases, this rate exceeded the previous use of contraception prior to use of LAM. (That is, the proportion using contraception following LAM exceeded the prior level of "ever use" in the lifetime of the client.) (Labbok et al., 1997b, Hight-Laukaran et al., 1997)

The Lactational Amenorrhea Method has been incorporated into several family planning programs in Africa, such as the SEATS Program in Burkina Faso. Burkina Faso has a low contraceptive prevalence (four percent), but breastfeeding is widely practiced. More than 98 percent of mothers breastfeed their babies at 0 to 12 months. In 1993 the project trained physicians, nurses, and midwives; established a data collection system; and incorporated LAM as a method in selected sites. Program evaluation showed that the most successful centers were those where maternity and other maternal child health and family planning services were integrated. Features of the programs included early

education about LAM during the prenatal period, close follow-up of the mother throughout her prenatal care, and extension of counseling beyond the delivery of her child to her postnatal care. In some centers with maternity wards, up to 50 percent of women who gave birth adopted LAM (Kagone, 1999).

Promotion of Optimal Breastfeeding Practices

The health sector has contributed to improved breastfeeding practices in a number of ways.

- *Changes in hospital policies and delivery routines*. In hospitals, changing policies and delivery routines to promote immediate mother-infant contact and suckling after birth has helped to reduce delays in breastfeeding initiation and encourage exclusive breastfeeding. Increases in the duration of exclusive breastfeeding, especially in the first few weeks postpartum, are associated with prenatal education about exclusive breastfeeding as well as hospital policies that encourage rooming-in and early contact and suckling during the first hour after birth. Training hospital staff in lactation management and restricting use of bottles in the hospital also contribute to improved breastfeeding practices (WHO, 1998). A cost-effectiveness study of breastfeeding promotion showed the clear benefits of hospital interventions in Brazil, Honduras, and Mexico (Sanghvi, 1995).
- *Training of health workers*. The training of health workers for as little as 40 hours (WHO/UNICEF course) has been shown to increase health workers' knowledge as well as their clinical and counseling skills for the support of breastfeeding (Rea et al., 1999).
- *Community-based interventions*. Community-based interventions, including peer counselors, mass media, and women's groups, have been effective in increasing rates of early initiation and use of colostrum and in maintaining breastfeeding (Green, 1999a and b). In Ghana, self-managed credit associations for rural women held education sessions on breastfeeding. Use of colostrum among program participants rose from 60 to 96 percent compared to an increase from 61 to 71 percent among controls (MkNelly, 1997). In Mali, after an intervention that included individual counseling, group education, and radio messages, 58 percent of women in the program villages had fed colostrum compared with 42 percent of those in control villages (NCP, 1995b).

A 1995 to 1996 study in Mexico, conducted by the National Institute of Nutrition and La Leche League of Mexico, found a dose-response effect between the number of home visits by a peer counselor and the duration of exclusive breastfeeding (Morrow et al., 1999). At three months postpartum, 72 percent of the mothers visited six times by a peer counselor—twice during pregnancy, immediately after delivery, and at two, four, and eight weeks postpartum—were exclusively breastfeeding during the previous week. Fifty percent of mothers visited three times—at the end of pregnancy, immediately after delivery, and at two weeks postpartum—were exclusively breastfeeding. Only seven percent of mothers in the control group—who received no visits—reported exclusively breastfeeding. This study is especially important because large improvements in exclusive breastfeeding were achieved in a country where exclusive breastfeeding is not commonly practiced.

A study assessing the impact of a breastfeeding counseling program on the prevalence of exclusive breastfeeding was also carried out in rural communities in Nigeria. Mothers attending primary care facilities with infants who had acute diarrhea were randomized into two groups. The intervention group received individual, focused breastfeeding counseling; the control group received routine advice

for diarrhea. Results showed marked increases in exclusive breastfeeding for the intervention group. On day seven, forty-nine percent were exclusively breastfeeding compared with six percent among the controls. On day 21, forty-six percent were still exclusively breastfeeding compared with eight percent among the controls. In addition, diarrhea reoccurrence was lower in the intervention group (Davies-Adetugbo et al., 1997).

- *Integrated program*. In Madagascar, the BASICS Project, the Ministry of Health, and various partners carried out a nutrition and child health project that brought about improved breastfeeding practices. Activities included development and revision of nutrition policies, training to reinforce district manager and health worker competence in the use of key nutrition interventions, and behavior change communication at the health center, community, and household levels. Baseline and follow-up surveys revealed major improvements in breastfeeding knowledge and practices, as well as improvements in quality of care. Exclusive breastfeeding rates within the first six months rose from less than 50 percent in 1996 to more than 60 percent in non-intensive intervention areas and over 70 percent in intensive intervention areas (Guyon et al., 1998).

Conclusion

The essential actions outlined in this paper should be integrated within existing health care systems. These actions foster the empowerment of women through the promotion of self-care. For health workers to implement the actions, they need:

- a basic understanding of the technical basis for the recommended actions,
- awareness of the factors that motivate or inhibit adoption of behaviors,
- effective counseling skills, and
- reliable supplies of micronutrient supplements, anti-malarial drugs, hookworm medication, and contraceptives.

Counseling cards, flip charts, health cards and booklets, and job aids[16] can assist providers in communication and counseling. Effective counseling is crucial for program success. Clients need to be treated with understanding, respect, and honesty. They need information that is clear, accurate, and relevant to their circumstances. Messages need to be locally developed and tested to ensure that they address women's specific fears, concerns, and constraints and offer locally appropriate solutions.

The health sector should coordinate with other sectors—such as education and agriculture—and with community-based organizations that address behavioral, social, and economic factors that influence nutrition.[17] Complementary interventions to improve maternal health include those that increase educational opportunities, income, and the status of women. The essential actions identified in this paper need to be supported by actions that address food insecurity, resource allocation, and gender inequities.

16 The LINKAGES Project developed job aids and a wall chart for health care providers to guide them on the essential actions. These actions include those outlined in this paper as well as ones to improve infant and young child nutrition. The outcomes of the essential actions focused on infants and young children are: 1) exclusive breastfeeding for about the first six months; 2) adequate complementary feeding starting at about six months, along with continued breastfeeding to 24 months and beyond; 3) adequate intake of iodine (iodized salt) by all members of the household; 4) adequate intake of vitamin A by all women, infants, and young children; and 5) appropriate nutritional care of sick and malnourished children. Six orientation sessions, each 2-2 ½ days in duration, are designed to inform, prepare, and motivate health workers to implement the essential actions at six service delivery contact points (antenatal, delivery and immediate postpartum, postnatal, well-baby, sick child, and family planning).

17 The 'better practices' of community-based organizations in Kenya, Uganda, and Tanzania in improving maternal and child nutrition are discussed in a forthcoming LINKAGES publication.

References

Adair L, Popkin B. Special policies are needed to promote breastfeeding among low birthweight infants. In: Wellstart International. Exclusive breastfeeding promotion: a summary of findings from EPB's applied research program (1992–1996). Washington: Wellstart International; July 1996.

Albonico M, Smith P, Hall A, Chwaya H, Alawi K, Savioli L. A randomized controlled trial comparing mebendazole and albendazole against Ascaris, Trichuris and hookworm infections. Trans R Soc Trop Med Hyg 1994 Sep–Oct;88(5):585–9.

Allen LH. Maternal micronutrients malnutrition: effects on breast milk and infant nutrition, and priorities for intervention. SCN News Mid-1994;11:21–4.

Allen LH. The Nutrition CRSP: What is marginal malnutrition, and does it affect human function? Nutr Rev 1993;51(9):255–67.

Anderson PO, Knoben JE, Troutman WG, editors. Handbook of clinical drug data, 9th ed. Stamford (CT): Appleton and Lange; 1999.

Arnaud JP, Preioai P, Mashako, et al. Serum trace elements in Zairian mothers and their newborns. Eur J Clin Nutr 1994;48:341–8.

Ashworth A. Effects of intrauterine growth retardation on mortality and morbidity in infants and young children. Eur J Clin Nutr 1998 Jan;52 Suppl 1:S34–41; discussion S41–2.

Atukorala STM, et al. Evaluation of effectiveness of iron-folate supplementation and anthelminthic therapy against anemia in pregnancy – a study in the plantation sector of Sri Lanka. Am J Clin Nutr 1994;60:286–92.

Baker J, Martin L, Piwoz E. The time to act: women's nutrition and its consequences for child survival and reproductive health in Africa. Washington: Academy for Educational Development; Dec 1996.

Barker DJP. Fetal origins of coronary heart disease. BMJ 1995 Jul 15;311:171–4.

Barker, DJP. Fetal origins of cardiovascular disease. Ann Med 1999;31(Suppl 1):3–6.

Barros F, Victora C, Vaughan J, et al. Perinatal mortality in southern Brazil: a population-based study of 7392 births. Bull World Health Organ 1987;65:95–105.

Baynes RD, Meriwether WD, Bothwell TH, et al. Iron and folate status of pregnant black women in Gazankulu. S Afr Med J 1986;70:148–51.

Beaton G, McCabe G. Efficacy of intermittent iron supplementation in the control of iron deficiency anemia in developing countries: an analysis of experience. Ottawa: The Micronutrient Initiative; Dec 1999.

Bennett PN, editor. Drugs and human lactation, 2nd ed. Amsterdam: Elsevier; 1996.

Black R. Reducing perinatal and neonatal mortality. In: Child Health Research Project Special Report 3(1). Report of a meeting. Baltimore, MD. 1999 May 10–12. Baltimore: Johns Hopkins University; Oct 1999.

Bloland P, et al. Rates and risk factors for mortality during the first two years of life in rural Malawi. Am J Trop Med Hyg 1996;55 Suppl 1:82–6.

Boerma JT, Bicego G. Preceding birth intervals and child survival: searching for pathways of influence. Stud Fam Plan. 1992 Jul/Aug 23(4):243–56.

Bundy D, Chan M, Savioli L. Hookworm infection in pregnancy. Trans R Soc Trop Med Hyg 1995; 89: 521–2.

Calloway D, et al. Food intake and human function: a cross-project perspective. University of California, Berkeley: CRSP Collaborating Institutions; 1988.

Caulfield LE, Zavaleta N, Figueroa A. Adding zinc to prenatal iron and folate supplements improves maternal and neonatal zinc status in a Peruvian population. Am J Clin Nutr 1999;69:1257–63.

Caulfield L, et al. Potential contribution of maternal zinc supplementation during pregnancy to maternal and child survival. Am J Clin Nutr 1998 Aug;68 Suppl 2:499S–508S.

Ceesay SM, et al. Effects on birth weight and perinatal mortality of maternal dietary supplements in rural Gambia: 5 year randomised controlled trial. BMJ 1997 Jul;315:786–90.

Christian P. Antenatal iron supplementation as a child survival strategy. Am J Clin Nutr 1998; 68(2):404–5.

Christian P, West KP, Khatry SK, Katz J, Le Clerq SC, Kimbrough-Pradhan E, Dali SM, Shrestha SR. Vitamin A or B-carotene supplementation reduces symptoms of illness in pregnant and lactating women. J Nutr 2000;130:2675–82.

Christian P, West KP, Katz J, Khatry SK, Kimbrough-Pradhan E, Shrestha SR, Pokhrel PB. The impact of vitamin A or beta-carotene supplementation on the incidence of night blindness during pregnancy. J Nutr 1998;128:1458–63.

Czeizel A, Dudás I. Prevention of the first occurrence of neural-tube defects by periconceptional vitamin supplementation. N Engl J Med 1992;327(26):1832–5.

Dali R, Khatry SK, Katz J, et al. Impact of maternal vitamin A or beta-carotene supplementation on morbidity during pregnancy and lactation. International Vitamin A Consultative Group (IVACG) Abstracts. 1997, p. 103.

Davies-Adetugbo A, Adetugbo K, Orewole Y, Fabiyi A. Breastfeeding promotion in a diarrhoea programme in rural communities. J Diarrhoeal Dis Res 1997 Sep 15;(3):161–6.

de Silva NR, et al. Effect of mebendazole therapy during pregnancy on birth outcome. Lancet. 1999 Apr 3;353(9159):1145–9.

Demographic and Health Surveys. Comparative Studies No. 25. Maternal Health Care. (Stewart M, Stanton C, Ahmed O). Calverton (MD): Macro International Inc.; Sept 1997.

DHS Country Reports. Calverton (MD): Macro International Inc.; various years.

Durnin, J. Energy requirements of pregnancy: an integration of the longitudinal data from the five country study. Lancet 1987 Nov 14;2(8568):1131–3.

Elder L. Issues in programming for maternal nutrition. MotherCare Project. Arlington (VA): John Snow Inc.; Sept 2000.

FAO. Women, agriculture and rural development: a synthesis report of the Africa region. Rome: FAO, 1995.

FAO/WHO/UNU. Report of a Joint FAO/WHO/UNU Expert Consultation. Energy and protein requirements. WHO Technical Report Series 1985;724:1–206.

Fawzi W. Msamanga G. Hunter D, Urassa E, Renjifo B, Mwakagile D, Hertzmark E, Coley J, Garland M, Kapiga S, Antelman G, Essex M, Spiegelman D. Randomized trial of vitamin supplements in relation to vertical transmission of HIV-1 in Tanzania. J Acquir Immune Defic Syndr 2000;23:246–54.

Fleming AF. The aetiology of severe anaemia in pregnancy in Ndola, Zambia. Ann Trop Med Parasitol 1989;83:37–49.

Friss HP, Michaelsen KF. Micronutrients and HIV infection. Eur J Clin Nutr 1998;52:157–63.

Galloway R, McGuire J. Determinants of compliance with iron supplementation: supplies, side effects or psychology? Soc Sci Med 1994;39(3)381–90.

Garner P, Gulmezoglu AM. Prevention versus treatment for malaria in pregnant women. Cochrane Library, 1999.

Garner P, Kramer MS, Chalmers I. Might efforts to increase birthweight in undernourished women do more harm than good? Lancet 1992;340:1021–3.

Gibson R, Huddle JM. Suboptimal zinc status in pregnant Malawian women: its association with low intakes of poorly available zinc, frequent reproductive cycling, and malaria. Am J Clin Nutr 1998;68: 702–9.

Gillespie S. Improving adolescent and maternal nutrition: an overview of benefits and options. UNICEF Staff Working Papers. Nutrition Series Number 97-002. New York: UNICEF; 1999.

Gillespie S. Major issues in iron. Ottawa: Micronutrient Initiative; 1998.

González-Cossío T, Habicht J-P, Rasmussen KM, Delgado H. Impact of food supplementation during lactation on infant breast milk intake and on the proportion of infants exclusively breastfed. J Nutr 1998 Oct;128(10):1692–702.

Goodman CA, Coleman PG, Mills AJ. Cost-effectiveness of malaria control in Sub-Sahara Africa. Lancet 1999;354:378–85.

Green C 1999a. Improving breastfeeding behaviors: evidence from two decades of intervention research. LINKAGES Project. Washington: Academy for Educational Development; 1999.

Green C. 1999b. Interventions to improve breastfeeding behaviors: detailed summaries of 51 studies. LINKAGES Project. Washington: Academy for Educational Development; 1999.

Greenwood B. Malaria mortality and morbidity in Africa. Bull World Health Organ 1999;77(8):617–8.

Guerrant R, Walker D, Weller P, editors. Tropical infectious diseases: principles, pathogens and practice. Philadelphia: Churchill Livingstone; 1999.

Guyon A, Raharison S, Ravelojaona V, Andriantsalama N. Essential nutrition actions. Madagascar, 1996–1998. Arlington (VA): BASICS Project, 1998.

Haggerty P, Rutstein S. Breastfeeding and complementary infant feeding, and the postpartum effects of breastfeeding. DHS Comparative Studies No. 30. Calverton (MD): Macro International; 1999.

Hetzel B, Clugston G. Iodine. In: Modern nutrition in health and disease. 9th Edition. Baltimore: Williams and Wikins; 1999.

Hight-Laukaran V, Labbok M, Peterson A, Fletcher V, von Hertzen H, VanLook P. Multicenter study of the Lactational Amenorrhea Method (LAM): II. Acceptability, utility, and policy implications. Contraception 1997;55:337–46.

Hobcraft J, McDonald J, Rutstein S. Demographic determinants of infant and early child mortality: a comparative analysis. Popul Studies 1985;39:363–85.

Huddle JM, Gibson RS, Cullinate TR. The impact of malarial infection and diet on the anaemia status of rural pregnant Malawian women. Eur J Clin Nutr 1999 Oct;53(10):792–801.

Hytten FE, Leitch I. The physiology of human pregnancy. Oxford: Blackwell; 1971. p. 163–299.

INACG (International Nutritional Anemia Consultative Group) Secretariat. Safety of iron supplementation programs in malaria-endemic regions. Washington: International Life Sciences Institute (ILSI); Dec 1999. (www.ilsi.org/hnireports2.html).

INACG. Guidelines for the use of iron supplements to prevent and treat iron deficiency anemia. Washington: ILSI; 1998.

Institute for Reproductive Health. Guidelines: breastfeeding, family planning, and the Lactational Amenorrhea Method-LAM. Washington: IRH; 1994.

Institute of Medicine. Dietary reference intakes for vitamin C, vitamin E, selenium, and carotenoids. National Academy of Sciences. Washington: National Academy Press; 2000.

Institute of Medicine. Dietary reference intakes for thiamin, riboflavin, niacin, vitamin B_6, folate, vitamin B_6, pantothenic acid, biotin, and choline. National Academy of Sciences. Washington: National Academy Press; 1998.

Institute of Medicine. Dietary reference intakes for calcium, phosphorus, magnesium, vitamin D, and fluoride. National Academy of Sciences. Washington: National Academy Press; 1997.

Institute of Nutrition and Food Science (INFS). Bangladesh Integrated Nutrition Project. Midterm Evaluation. Final Report. Dhaka University, Dhaka, Bangladesh: Institute of Nutrition and Food Science; March 1999.

International Vitamin A Consultative Group (IVACG). Safe doses of vitamin A during pregnancy and lactation. Washington: ILSI; 1998. (http://www.ilsi.org/pregnancy.pdf)

Jansen A, Kusin J, Thiuri B, Lakhani S, Mannetje W. Machakos project studies No. XXIV. Anthropometric changes during pregnancy in rural African women. Trop Geogr Med 1984 Mar;36(1):91–7.

John Snow [JSI]. Family Planning Service Expansion and Technical Support [SEATS]. Proven approaches, new strategies: innovations, best practices, and lessons learned from the SEATS II Project. Arlington (VA): JSI; Jan 2000.

Joint WHO/UNICEF/ICCIDD Consultation. Review of findings from 7-country study in Africa on levels of salt iodization in relation to iodine deficiency disorders including iodine-induced hyperthyroidism. WHO/AFRO/NUT/97.2 and WHO/NUT/97.5. Geneva: WHO; 1997.

Kagone M. The introduction of LAM into SEATS/Burkina Faso. Presented at LINKAGES Project LAM Round Table. Washington, DC; June 9, 1999.

Keating J, Bjarnason I, Somasundaram S, et al. Intestinal absorptive capacity, intestinal permeability, and jejunal histology in HIV and their relation to diarrhea. Gut 1995;37:623–9.

Khan K, Chien P, Khan N. Nutritional stress of reproduction: a cohort study over two consecutive pregnancies. Acta Obstet Gynecol Scand 1998;77:395–401.

Khin-Maung N, Oo-Tin-Tin. Effect of dietary supplementation on lactation performance of undernourished Burmese mothers. Food Nutr Bull 1987;9:59–61

Kramer MS. Balanced protein/energy supplementation in pregnancy. Cochran 3 Library 1999. Issue 3, 1997.

Krasovec K. The implications of poor nutritional status during pregnancy for future lactational performance. J Trop Pediatr 1991 Oct;37 Suppl 1:3–10.

Krasovec K. Measurement of pregnancy weight gain and usefulness for targeting. Presentation made at Conference on Low Birth Weight: Epidemiology, Causes and Interventions. International Centre for Diarrhoeal Disease Research, Bangladesh 1999 June 14–17. Bethesda (MD): Abt Associates, 1999.

Kusin JA, Kardjati S, Renqvist U. Maternal body mass index: the functional significance during reproduction. Eur J Clin Nutr 1994 Nov;48 Suppl 3:S56–67

Kynast G, Saling E. Effect of oral zinc application during pregnancy. Gynecol Obstet Invest 1986; 21(3):117–23.

Labbok M, Perez-Escamilla R, Peterson A, Coly S. 1997a. Breastfeeding and child spacing country profiles. Washington: Institute for Reproductive Health; 1997.

Labbok M, Hight-Laukaran V, Peterson A, Fletcher V, von Hertzen H, VanLook P. 1997b. Multicenter study of the Lactational Amenorrhea Method (LAM): I. Efficacy, duration, and implications for clinical application. Contraception 1997;55:327–36.

Labbok M. Breastfeeding: whys, wherefores, and "what-to-do"s. Presentation. USAID/G/PHN/HN/NMH. Feb 29, 2000.

Labbok M, Cooney K, Coly S. Guidelines: Breastfeeding, family planning, and the Lactational Amenorrhea Method-LAM. Washington: Institute for Reproductive Health; 1994.

Levine B. Nutrition recommendations and practices of obstetrician-gynecologists before conception and during pregnancy. In: Keen CL, Bendich A, White CC, editors. Ann NY Acad Sci 1993;678:353–5.

Li DK, Daling JR, Mueller BA, et al. Periconceptional multivitamin use in relation to the risk of congenital urinary tract anomalies. Epidemiology 1995;6:212–8.

Lindsay S, Ansell J, Selman C, Cox V, Hamilton K, Walraven, G. Effect on pregnancy of exposure to malaria mosquitoes. Lancet 2000 Jun 3;355(9219):1972.

LINKAGES Project. Recommended feeding and dietary practices to improve infant and maternal nutrition. Washington: Academy for Educational Development; 1999.

LINKAGES Project. FAQ Sheet 1 (Revised). Frequently asked questions on: Breastfeeding and HIV/AIDS. Washington: Academy for Educational Development; Oct 1998.

LINKAGES Project. FAQ Sheet 4. Frequently asked questions on: Breastfeeding and maternal nutrition. Washington: Academy for Educational Development; 2000.

Lipworth L, Bailey LR, Trichopoulos D. History of breast-feeding in relation to breast cancer risk: a review of the epidemiologic literature. J Natl Cancer Inst 2000 Feb 16;92:302–12.

Luo C, Mwela CM. National survey on vitamin A deficiency in Zambia: a random cluster study for children (0–5 years) and mothers attending national immunization days in August 1997. Lusaka (Zambia): National Food and Nutrition Commission; 1997.

Luo C, Mwela CM, Campbell JA. Baseline anemia survey preliminary laboratory report. Lusaka (Zambia): National Food and Nutrition Commission; 1999.

Macallan D. Dietary intake and weight loss patterns in HIV infection. In: Miller TI, Gorbach SL, editors, Nutritional aspects of HIV infection. New York: Oxford University Press; 1999.

Management Sciences for Health. International drug price indicator guide. Arlington (VA): Management Sciences for Health; 1999.

Mazengo M, et al. Food consumption in rural and urban Tanzania. Acta Trop 1997 Dec;68(3):313–26.

McCullough AL, Kirksey A, Wachs TD, McCabe GP, Bassily NS, Bishry Z, Galal OM, Harrison GG, Jerome N. Vitamin B_6 status of Egyptian mothers: relation to infant behavior and maternal-infant interactions. Am J Clin Nutr 1990;51:1067–74.

McGuire J, Popkin B. Beating the zero sum game: women and nutrition in the third world. In: Women and nutrition. ACC/SCN Symposium Report Nutrition Policy Discussion Paper. No. 6. Geneva: United Nations; 1990.

McNeilly A, Robinson I, Houston M, Howie P. Release of oxytocin and prolactin in response to suckling. BMJ 1983 Jan 22;286:257–9.

McNeilly A, Tay C, Glasier A. Physiological mechanisms underlying lactational amenorrhea. Ann NY Acad Sci 1994 Feb 18;709:145–55.

Measham D, Stein K, Winikoff B. The unmet family planning needs of breastfeeding women. Washington: Wellstart International; July 1996.

Menendez C. Malaria during pregnancy: a priority area of malaria research and control. Parasitol Today 1995;11(5):178–83.

Merchant K, Martorell R, Haas J. 1990a. Consequences for maternal nutrition of reproductive stress across consecutive pregnancies. Am J Clin Nutr 1990;52:616–20.

Merchant K, Martorell R, Haas J. 1990b. Maternal and fetal responses to the stresses of lactation concurrent with pregnancy and of short recuperative intervals. Am J Clin Nutr 1990;52:280–8.

Merialdi M, Caulfield LE, Zavaleta N, Figueroa A, Pietro JA. Adding zinc to prenatal iron and folate tablets improves fetal neurobehavioral development. Am J Obst Gynecol 1998;180:483–90.

Metz, J. Folate deficiency conditioned by lactation. Am J Clin Nutr 1970;23:843–7.

MkNelly B. Freedom from Hunger's credit with education strategy for improving nutrition security: impact evaluation results from Ghana. Paper presented at XXII International Conference of Agricultural Economists. Sacramento, CA, Aug 11–14, 1997.

Moller B, Gebre-Medhin M, Lindmark G. Maternal weight gain and birthweight at term in the rural Tanzanian village of Ilula. Br J Obstet Gynaecol 1989 Feb; 96(2):158–66.

Morrow AL, Guerrero ML, Shults J, Calva JJ, Lutter C, Bravo J, Ruiz-Palacios G, Morrow RC, Butterfoss FD. Efficacy of home-based peer counselling to promote exclusive breastfeeding: a randomised controlled trial. Lancet 1999 Apr 10;353(9160):1226–31.

MotherCare. Malawi Maternal Anemia Program. Technical Working Paper #10. Arlington (VA): John Snow, Inc.; 1999.

MRC (Medical Research Council) Vitamin Study Research Group. Prevention of neural tube defects: results of the Medical Research Council vitamin study. Lancet 1991;338:131–7.

NCP (Nutrition Communication Project). 1995a. Burkina Faso Nutrition Communication Project 1989–1995: final report. Washington: Academy for Educational Development, June 1995.

NCP (Nutrition Communication Project). 1995b. Mali Nutrition Communication Project 1989–1995: final report. Washington: Academy for Educational Development, May 1995.

NCP (Nutrition Communication Project). 1995c. Niger Vitamin A Promotion Project 1991–1995: final report. Washington: Academy for Educational Development, Aug 1995.

Ndossi G, Taylor A. Multiple micronutrient supplementation in Tanzania. New York: UNICEF, May 1999. p. 104.

Newcomb P, Egan K, Titus-Ernstoff L, Trentham A, Greenberg E, Baron J, Willett W, Stampfer M. Lactation in relation to postmenopausal breast cancer. Amer J Epidemiol 1999;150(2):174–82.

Newmann C, Bwimbo N, Sigman M. Functional implications of malnutrition. Kenya Project, Final Report. UCLA: Human Nutrition Collaborative Research Program, 1992.

Newmann CG, Harrison GG. Onset and evaluation of stunting in infants and children: ex-

amples from the Human Nutrition Collaborative Research Support Program, Kenya and Egypt studies. Eur J Clin Nutr 1994;48 Suppl 1 S90–S102.
Oakley G, Erikson J, Adams M. Urgent need to increase folic acid consumption. JAMA 1998; 274(21):1717–8.
Pardede LVH, Hardjowasito W, Gross R, Dillon DHS, Totoprajogo OS, Yosoprawoto M, Waskito L, Untaro J. Urinary iodine excretion is the most appropriate outcome indicator for iodine deficiency at field conditions at district level. J Nutr 1998;128:1122–6.
Parlato M, Gottert P. Promoting vitamin A in rural Niger: strategies for adverse conditions. In: Seidel R, editor. Strategies for promoting vitamin A production, consumption, and supplementation: four case studies. Washington: Academy for Educational Development; Feb 1996.
Parise ME, et al. Efficacy of sulfadoxine-pyrimethamine for prevention of placental malaria in an area of Kenya with a high prevalence of malaria and human immunodeficiency virus infection. Am J Trop Med Hyg 1998 Nov;59(5):813–22.
Parise ME. Control and prevention of malaria in pregnant women: where we are and where we need to be. Presentation made at ASTMH meetings on malaria in pregnancy. 1999.
Pawlowski ZS, et al. Hookworm infection and anaemia: approaches to prevention and control. Geneva: World Health Organization; 1991.
Piwoz EG, Preble EA. HIV/AIDS and nutrition: a review of the literature and recommendations for nutritional care and support in sub-Saharan Africa. SARA Project. Washington: Academy for Educational Development; Nov 2000.
Population Action International. Reproductive risk: a worldwide assessment of women's sexual and maternal health. Washington: PAI; 1995.
Population Reference Bureau. Breastfeeding patterns in the developing world. Measure Communication Project. Washington: PRB; 1999.
Powers H. Effects of riboflavin deficiency on the handling of iron. Micronutrient interactions: impact on child health. Washington: International Life Sciences Institute; 1998.
Prentice A, Goldberg G. Energy adaptations in human pregnancy: limits and long-term consequences. Am J Clin Nutr 2000:71 (Suppl):1226S–32S.
Prentice AM, Landing MA, Cole TJ, Stirling DM, Dibba B, Fiarweathter-Tait S. Calcium requirements of lactating Gambian women and effects of a calcium supplement on breastmilk-calcium concentration, maternal bone mineral content and urinary calcium excretion. Am J Clin Nutr 1995;62:58–67.
Prentice AM, Cole TJ, Foord F, Lamb WH, Whitehead RG. Increased birthweight after prenatal dietary supplementation of rural African women. Am J Clin Nutr 1987;46:912–25.
Prentice AM. Food supplementation in pregnant women. Eur J Clin Nutr 1988;42:87–91.
Prentice AM. Presentation made at ICDDRB. Meeting on Prevention of Low Birthweight. Dhaka, Bangladesh. Aug 1999.
Prentice A. Can maternal dietary supplements help in preventing infant malnutrition? Acta Paediatr Scand Suppl 1991;374:67–77.
Preziosi P, Prual A, Galan P, Daouda H, Boureima H, Hercberg S. Effect of iron supplementation on the iron status of pregnant women: consequences for newborns. Am J Clin Nutr 1997;66(5):1178–82.
Ramakrishnan U. Functional consequences of nutritional anemia during pregnancy and lactation. In: Ramakrishnan U, editor. Nutritional Anemias. CRC Series in Modern Nutrition. Boca Raton (LA): CRC; 2000.
Ramakrishnan U, Martorell R, Schroeder D, Flores R. 1999a. Role of intergenerational effects on linear growth. J Nutr 1999 Feb;129 Suppl 2S:544S–549S.
Ramakrishnan U, Manjrekar R, Rivera J, Gonzalez T, Martorell R. 1999b. Micronutrients and pregnancy outcome. Nutr Res 1999;19:103–59.
Rasmussen K. Benefits to mother and child of maternal food supplementation during the reproductive cycle. Unpublished paper. LINKAGES Project, Washington: Academy for Educational Development, 1998.
Rea M, Venancio S, Martines J, Savage F. Counselling on breastfeeding: assessing knowledge and skills. Bull World Health Organ 1999;77(6):492–8.
Roesel C, Schaffter T, Durongdej S, Tokmoh L. Effects of improved weight monitoring feedback during pregnancy in a Khmer refugee camp in Thailand. Maternal Nutrition and Health Care Program Research Report Series. Report No. 16. Washington: International Center for Research on Women; March 1990.
Ross J, Thomas EL. Iron deficiency anemia and maternal mortality. Profiles Working Notes Series No. 3. Washington: Academy for Educational; 1996.
Rutstein S. Effect of birth intervals on mortality and health. Multivariate cross-country analyses. Measure/DHS + . Macro International. (Slide Show) 1999.
Sachs J. www.hiid.harvard.edu/about/people/sachs/jsachs.html. October, 1998.

Sanghvi T. Improving the cost-effectiveness of breastfeeding promotion in maternity services: summary of the USAID/LAC HNS study in Latin American (1992–1995). Washington: Wellstart International; 1995.

Schultz LJ, et al. Malaria and childbearing women in Malawi: knowledge, attitudes and practices. Trop Med Parasitol. 1994 Mar;45(1):65–9.

Schultz LJ, Steketee RW, Chitsulo L, Macheso A, Kazembe P, Wirima JJ. Evaluation of maternal practices, efficacy, and cost-effectiveness of alternative antimalarial regimens for use in pregnancy: chloroquine and sulfadoxine-pyrimethamine. Am J Trop Med Hyg 1996;55 Suppl 1:87–94.

Shankar AH, Prasad AS. Zinc and immune function: the biological basis of altered resistance to infection. Am J Clin Nutr 1998;68(2S):447S–463S.

Shaw GM, Lammer EJ, Wasserman CR, O'Malley CD, Olarvora MM. Risks of orefacial clefts in children born to women using multivitamins containing folic acid periconceptionally. Lancet 1995;346(8972):393–96.

Schieve LA, Cogswell ME, Scanlon KS, Perry G, Ferre C, Blackmore-Prince C, Yu SM, Rosenberg D. Prepregnancy body mass index and pregnancy weight gain: associations with preterm delivery. Obstet Gynecol 2000 Aug;96(2):194–200.

Shetty PS, James WPT. Body mass index: a measure of chronic energy deficiency in adults. FAO Food and Nutrition Paper 56. Rome: Food and Agriculture Organization; 1994.

Shulman CE, et al. Intermittent sulphadoxine-pyrimethamine to prevent severe anaemia secondary to malaria in pregnancy: a randomised placebo-controlled trial. Lancet 1999 Feb 20;353(9153):632–6.

Slesinski M, Subar A, Kahle L. Trends in use of vitamin and mineral supplements in the United States: the 1987 and 1992 National Interview Surveys. Am Diet Assoc 1995;(8):921–3.

Snow R, Craig M, Deichmann U, Marsh K. Estimating mortality, morbidity and disability due to malaria among Africa's non-pregnant population. Bull World Health Organ 1999;77(8):624–40.

Stanback J, Qureshi Z, Sekadde-Kigondu C, Gonzalez B, Nutley T. Lancet 1999 Aug 14;354(9178):566.

Sommer A, West KP Jr. Vitamin A deficiency: health, survival and vision. New York: Oxford Press; 1996.

Steketee RW, et al. 1996a. Malaria parasite infection during pregnancy and at delivery in mother, placenta, and newborn: efficacy of chloroquine and mefloquine in rural Malawi. Am J Trop Med Hyg 1996;55 Suppl 1:24–32.

Steketee RW, et al. 1996b. The effect of malaria and malaria prevention in pregnancy on offspring birthweight, prematurity, and intrauterine growth retardation in rural Malawi. Am J Trop Med Hyg 1996;55 Suppl 1:33–41.

Steketee RW, et al. 1996c. Developing effective strategies for malaria prevention programs for pregnant African women. Am J Trop Med Hyg 1996;55 Suppl 1:95–100.

Steketee RW, et al. 1996d.. Malaria treatment and prevention in pregnancy: indications for use and adverse events associated with use of chloroquine or mefloquine. Am J Trop Med Hyg 1996;55 Suppl 1:50–6.

Stoltzfus R, et al. Clinical pallor is useful to detect severe anemia in populations where anemia is prevalent and severe. J Nutr 1999 Sep;129(9):1675–81.

Stoltzfus RJ, et al. Hookworm control as a strategy to prevent iron deficiency. Nutr Rev 1997;55(6):223–32.

Stoltzfus R. Iron deficiency and strategies for its control. A report prepared for The Office of Nutrition, Agency for International Development. Baltimore: Johns Hopkins University; Jan 1994.

Sullivan A, Nyirenda T, Cullinan T, Taylor T, Harlow S, James S, Meshnick S. Malaria infection during pregnancy: intrauterine growth retardation and preterm delivery in Malawi. J Infect Dis 1999;179:1580–3.

Sundqvist J, Wijetunga M, Assey V, Gebre-Medhim G, Peterson S. Salt iodization and risk of neonatal brain damage. Lancet 1998;352:34–45.

Swanson C, King J. Zinc and pregnancy outcome. Am J Clin Nutr 1987 Nov;46(5):763–71.

Tafari A, Naeye RL, Gobezie A. Effects of maternal undernutrition and heavy physical work during pregnancy on birth weight. Brit J Obstet Gynecol 1980;87:222–6.

Tang A, Graham N, Saah A. Effects of micronutrient intake on survival in human immunodeficiency virus type 1 infection. Am J Epidemiol 1996 Jun 15;143(12);1244–56.

ter Kuile F. Presentation at American Society of Tropical Medicine and Hygiene Meeting. Dec 1999.

Thacher TJ, Fischer PR, Pettifor JM, Lawson JO, Isichei CO, Reading JC, Chan GM. A comparison of calcium, vitmain D or both for nutritional rickets in Nigerian children. NEJM 1999;341(8):563–8.

Thapa S, Short RV, Potts M. Breastfeeding, birth spacing and their effects on child survival. Nature 1988; 335:679–82).

Truswell A, Ash S, Allen J. Energy intake during pregnancy. Lancet 1988 January 2–9;1(8575–6):49.

UNAIDS. Report on Global HIV/AIDS epidemic. Geneva: UNAIDS; June 2000.

UNICEF. State of the world's children 2000. New York: UNICEF; 2000.

UNICEF. Breastfeeding: foundation for a healthy future. New York: UNICEF; Aug 1999.

UNU/UNICEF/WHO/MI. Preventing iron deficiency in women and children. Consensus on key technical issues. Ottawa: Micronutrient Initiative; 1999.

U.S. Department of Health and Human Services. Public Health Service. Folic acid – healthy babies. Atlanta (GA): Centers for Disease Control and Prevention; Nov 1996.

Van Hensbroek MB, et al. Iron but not folic acid combined with effective antimalarial therapy promotes haematological recovery in African children after acute falciparum malaria. Trans R Soc Trop Med Hyg 1995;89:672–76.

Verhoeff FH, Brabin BJ, Chimsuku, et al. An evaluation of the effects of intermittent sulfadoxine-pyrimethamine treatment in pregnancy on parasite clearance and risk of low birth weight in rural Malawi. Ann Trop Med Parasitol 1998;92(2):141–50.

Villar J. Belizan J, Same nutrient, different hypothese: disparities in trials in calcium supplementation during pregnancy. Presented at the International Symposium on Maternal Nutrition: New Developments and Implications. Paris, France. June 10–11, 1998.

Vitamin A Global Initiative. A strategy for acceleration of progress in combating vitamin A deficiency: consensus of an informal technical consultation, New York, 18–19 December 1997. New York: UNICEF; 1998.

Viteri F. Prevention of iron deficiency. In: Prevention of micronutrient deficiencies: tools for policy makers and public health workers. Washington: National Academy of Sciences; 1998.

West KP, Katz J, Khatry SK, LeClerq SC, Pradhan EK, Shrestha SR, Conner PB, Dali S, Christian P, Pokhrel R, Sommer A on behalf of the NNIPS-2 Study Group. Double blind, cluster randomised trial of low dose supplementation with vitamin A or beta-carotene on mortality related to pregnancy in Nepal. BMJ 1999;318:570–5.

WHO Expert Committee on Malaria, Twentieth Report. WHO Technical Report Series. Geneva: World Health Organization; 2000.

WHO. Malaria. Fact Sheet No. 94. October, 1998. http://www.who.int/inf-fs/en/fact094.html.

WHO. 1996a. Report of the WHO informal consultation on the use of chemotherapy for the control of morbidity due to soil-transmitted nematodes in human. Geneva: WHO; May 1996.

WHO. 1996b. Mother-Baby Package: implementing safe motherhood in countries. WHO/FHE/MSM/94.11. Geneva: WHO; 1996.

WHO. Report of the WHO informal consultation on hookworm infection and anaemia in girls and women. WHO/CDS/IPI/95.1. Geneva: WHO; Dec 1994.

WHO/UNICEF. Management of childhood illnesses. Geneva: WHO; 1995.

Winkvist A, Habicht J-P, Rasmussen KM. Linking maternal and infant benefit of a nutritional supplement during pregnancy and lactation. Am J Clin Nutr 1998;68:656–61.

Winkvist A, Jalil F, Habicht J-P, Rasmussen K. Maternal energy depletion is buffered among malnourished women in Punjab, Pakistan. J Nutr 1994;124:2376–85.

Yan L, Prentice A, Dibba B, Jarajou LMA, Stirling DM, Fairweather-tait S. The effect of long-term calcium supplementation on indices of iron, zinc, and magnesium status in lactating Gambian women. J Nutr 1996;76:821–31.

Yang Q, Khoury MJ, Olney RS, Mulinare J. Does periconceptional multivitamin use reduce the risk for limb deficiency in offspring? Epidemiology 1997;8:157–61.

Yu S, et al. Preconceptional and prenatal multivitamin-mineral supplement use in the 1988 National Maternal and Infant Health Survey. Am J Public Health 1996 Feb;86(2):240–2.

Annex: Frequently Asked Questions on Breastfeeding and HIV/AIDS

HIV passes via breastfeeding to about 1 out of 7 infants born to HIV-infected women. But in many situations where there is a high prevalence of HIV, the lack of breastfeeding is also associated with a three- to five-fold increase in infant mortality. Infants can die from either the failure to appropriately breastfeed or from the transmission of HIV through breastfeeding.

Furthermore, less than five percent of adults have access to HIV testing. In many countries with high prevalence of HIV, uninfected women may think they have the virus. In the absence of breastfeeding promotion, the may stop breastfeeding even though breastfeeding remains one of the most effective strategies to improve the health and chances of survival of both mother and child.

How many infants are at risk of HIV?

Risk to infants of HIV-infected mothers. Analyses of data show that approximately 20 percent of infants of HIV-infected mothers are infected before or during delivery. If all HIV-infected mothers breastfeed, another 14 percent of their infants will be infected through breastfeeding. This means that about two-thirds of children of HIV-infected women *will not* become infected.

Risk to all infants in a community. Although the percentage of mothers infected with HIV approaches 40 percent in some African communities, it generally is much lower, rarely above 25 percent (one in four).

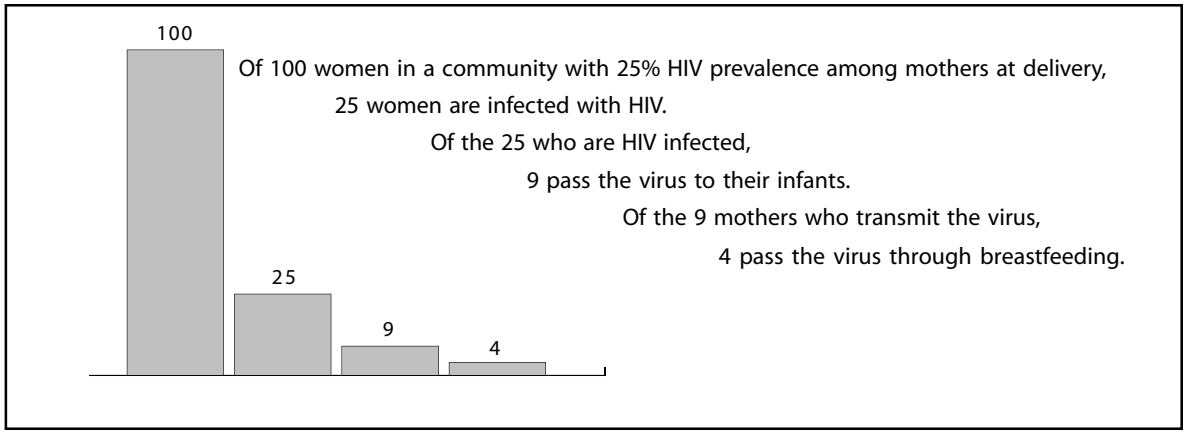
The risk of HIV transmission via breastfeeding can be calculated by multiplying the HIV prevalence rate among mothers at the time of delivery (25 percent in the example below) by 14 percent (25 percent at risk x 14 percent infected through breastfeeding = 3.5 percent, or rounded to 4 percent). In other words, even where 25 percent of women are infected with HIV and all of them breastfeed, less than 4 percent of all infants in the community will be infected through breastfeeding.

Should mothers with HIV be advised not to breastfeed?

IT DEPENDS . . .

IF a mother knows she is infected, and
IF breastmilk substitutes are affordable and can be fed safely with clean water, and
IF adequate health care is available and affordable,
THEN the infant's chances of survival are greater if fed artificially.

Figure 1. Risk of Mother-to-Child Transmission of HIV in Communities in Developing Countries with 25 Percent HIV Prevalence



HOWEVER,

IF infant mortality is high due to infectious diseases such as diarrhea and pneumonia, or
IF hygiene, sanitation, and access to clean water are poor, or
IF the cost of breastmilk substitutes is prohibitively high, or
IF access to adequate health care is limited,
THEN breastfeeding may be the safest feeding option even when the mother is HIV-positive.

Even where clean water is accessible, the cost of locally available formula exceeds the average household's income. Families cannot buy sufficient supplies of breastmilk substitutes and tend to:

- over-dilute the breastmilk substitute,
- under-feed their infant, or
- replace the breastmilk substitute with dangerous alternatives.

In the 50 poorest developing countries, infant mortality averages over 100 deaths per thousand live births. ***Artificial feeding can triple the risk of infant death.***

If a mother with HIV breastfeeds, how can she reduce the risk of transmission?

HIV-positive women may be able to reduce the risk of transmission by:

- ***Exclusively breastfeeding for the first six months.*** Many experts believe that the safest way to breastfeed in the first six months is to do so exclusively, without adding any other foods or fluids to the infant's diet. These additions are not needed and may cause gut infections that could increase the risk of HIV transmission. In South Africa, mothers who reported exclusively breastfeeding for at least three months *were less likely* to transmit the virus to their infants than mothers who introduced other foods or fluids before three months. Moreover, their risk of transmitting the virus was no greater than among mothers who never breastfed.
- ***Shortening the total duration of breastfeeding.*** There is evidence that the risk of transmission continues as long as the infant is breastfed. The risk of death due to replacement feeding is greatest in the first few months and becomes lower over time. Therefore, in some cases the best strategy may be for a mother to stop breastfeeding early and to introduce breastmilk substitutes as soon as an available replacement method becomes safer. The optimum time for introducing substitutes, however, is not known and varies with the situation.
- ***Preventing and promptly treating oral lesions and breast problems.*** If an infant has oral lesions (commonly caused by thrush) or if a mother has breast problems such as cracked nipples or mastitis, the risk of transmission is higher.
- ***Taking anti-retroviral drugs.*** In a recent clinical trial in Uganda, a single dose of nevirapine to a mother during labor and another to her infant after delivery reduced transmission in breastfed infants by 42 percent through six weeks and by 35 percent through 12 months. The simplicity and lower cost of the nevirapine regimen—compared with other regimens that are prohibitively expensive for most poor households—offers hope that it will become an important component of programs to reduce mother-to-child transmission. Studies are being conducted to find out if nevirapine used during the breastfeeding period can further reduce transmission.

What are the current international recommendations on breastfeeding and HIV?

In May 1997, a policy statement was issued by UNAIDS—the United Nations system's joint program on HIVAIDS—whose sponsors include the World Health Organization and UNICEF. The statement, which is supported by technical advisers within USAID and LINKAGES, emphasizes

supporting breastfeeding in all populations; improving access to HIV counseling and testing; providing information to empower parents to make fully informed decisions; reducing women's vulnerability to HIV infection; and preventing commercial pressures to provide artificial feeding. It also recommends weighing the rates of illness and death from infectious diseases and the availability of safe alternatives to breastfeeding, against the risk of HIV transmission when recommending feeding practices. The policy emphasizes the need for women to make their own choices based on the best available information.

Subsequently, in 1998, the UN agencies published guidelines for policy makers and for health care managers to help countries implement this policy. Pilot projects underway in many countries offer voluntary counseling and testing as a part of antenatal services. Pregnant women who test positive for HIV receive counseling on infant feeding options, among other things. To fully understand the positive and negative effects on feeding practices and infant health in the general population, it is important that these efforts are adequately monitored and evaluated.

The International Code of Marketing of Breastmilk Substitutes was introduced by the World Health Organization in 1981 to counter the negative effects of the introduction of breastmilk substitutes in developing countries. The Code's provisions should continue to be promoted and observed. The effects of a general reduction in breastfeeding practices would be disastrous for child health and survival.

How can an organization support breastfeeding while reducing mother-to-child transmission of HIV?

Promote safer sexual behavior. The best way of protecting children from HIV is to help women avoid HIV infection. Most infection is through unprotected sexual intercourse. The risk of infection can be decreased by the use of condoms. Methods of protection that women themselves can control are urgently needed. Treating and preventing other sexually transmitted diseases can also help decrease the risk of HIV transmission. Improving the economic and social conditions of women and girls also would reduce their vulnerability to coercive and other unsafe sexual situations.

Provide universal access to voluntary and confidential HIV testing and counseling for both men and women. At present, testing is not generally available. Many of the strategies proposed for reducing mother-to-child transmission assume that the mother's HIV status is known. Even where testing is available, mothers often do not want to know their status or cannot be assured that test results will be confidential.

Communicate the advantages of knowing one's HIV status. If a mother knows she is infected, she can try to minimize the risk of transmission to her partners and children and, if she chooses, avoid further pregnancies. As part of her counseling, she should be given information on the risks and benefits of infant feeding options. If she knows she is not infected, she should be counseled to breastfeed, knowing that there is no risk of infecting her child. She should also be motivated to protect herself from further risk of infection. Stimulating demand for testing by emphasizing these advantages along with ensuring the availability of confidential testing is essential.

Provide training to health workers and technical information to opinion makers. Health care providers and groups with public influence—such as the media, policy makers, and health advocates—need accurate technical information on this issue to prevent the spread of misinformation and to maintain the strength and credibility of breastfeeding promotion activities.

Provide counseling guidelines to health workers. UN agencies have developed counseling guidelines for health workers and policy makers that address the risks and benefits of available infant feeding methods and how to make the chosen

method of infant feeding as safe as possible. However, until testing programs that help women know their HIV status are available, such guidelines are of limited use.

Continue to promote, protect, and support breastfeeding. In the absence of breastfeeding promotion, there is a danger that information about HIV transmission during breastfeeding will result in inappropriate discontinuation of breastfeeding among both infected and uninfected mothers. Breastfeeding promotion should include continued efforts to monitor the observance of the provisions of the International Code of Marketing of Breastmilk Substitutes and the use and misuse of information on breastfeeding and HIV.

Support research. Policies and programs remain hampered by uncertainty. We need to know more about factors that influence transmission rates and about the risks associated with different feeding alternatives in poor environments. Currently, the stage of infection, breastfeeding patterns and duration, related lesions and illness, antiretroviral therapies, micronutrients, and nutritional status are all being explored as possible influences on transmission. In studies of infant feeding practices, there is a particular need to distinguish different patterns of breastfeeding using standard definitions. We also need to translate this information into knowledge that the mother can use to make the best infant feeding decision for herself, her baby, and her family.

What advice can health workers give to mothers?

Each situation is unique, and health workers must tailor their advice to the individual needs of each mother. Ultimately, the infant feeding choice is the mother's, but this decision should be based on the best information available. The role of the health worker is to provide this information and the support needed to make the mother's choice as safe as possible. Box 1 offers counseling guidelines for various situations.

For the woman who is not infected, breastfeeding is clearly the best choice. Breastfeeding remains one of the most effective strategies to improve the health and chances of survival of both the mother and child. It provides a complete and hygienic source of the infant's fluid and nutritional requirements through the first six months of life, as well as growth factors and antibacterial and anti-viral agents that protect the infant from disease for up to two years and more. Breastfeeding also contributes to child spacing and women's long-term health.

Does the same advise apply in emergency situations?

The same infant feeding guidelines apply in emergencies. The risk of death due to diarrhea and acute respiratory infections as well as malnutrition is likely to be even greater in emergencies than in normal circumstances.

Box 1. HIV and Infant Feeding Counseling Guidelines in Resource-Poor Communities

Situation	Health Worker Guidelines
Mother's HIV status is unknown	• Promote availability and use of confidential testing • Promote breastfeeding as safer than artificial feeding* • Teach mother how to avoid exposure to HIV
HIV-negative mother	• Promote breastfeeding as safest infant feeding method (exclusive breastfeeding for first 6 months, introduction of appropriate complementary foods at about 6 months, and continued breastfeeding to 24 months and beyond) • Teach mother how to avoid exposure to HIV
HIV-positive mother who is considering her feeding options	• Treat with anti-retroviral drugs, if feasible • Counsel mother on the safety, availability, and affordability of feasible infant feeding options • Help mother choose and provide safest available infant feeding method • Teach mother how to avoid sexual transmission of HIV
HIV-positive mother who chooses to breastfeed	• Promote safer breastfeeding (exclusive breastfeeding up to 6 months, prevention and treatment of breast problems of mothers and thrush in infants, and shortened total duration of breastfeeding when replacements are feasible)
HIV-positive mother who chooses to feed artificially	• Help mother choose the safest alternative infant feeding strategy (methods, timing, etc.) • Support her in her choice (provide education on hygienic preparation, health care, family planning services, etc.)

*Where testing is not available and where mothers' HIV status is not known, widespread use of artificial feeding would improve child survival only if the prevalence of HIV is high and if the risk of death due to artificial feeding is low, a combination of conditions that does not generally exist.

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