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Effects of Childbearing On Maternal Health

SUMMARY

The International Woman's Year—1975—is an especially appropriate time to examine the implications of the United Nations declaration that:

The right to decide freely and responsibly on the number and spacing of children (if any), and the right to adequate information, education, and services are fundamental human rights to be granted to all persons . . . (133)

Yet the decision to have a child—or many children—is not free and responsible if that decision 1) threatens the life and health of the mother and child, 2) is made in ignorance of the risks of childbearing, and 3) is made without knowledge of ways to space and limit births.

Childbearing, the aspect of human reproduction unique to women, requires optimal age (20-30), good health, and a high standard of medical care to minimize maternal risks (125,126). Factors which increase these risks include: high parity (large number of births), short interpregnancy intervals, and pregnancy at both extremes of reproductive life. In developing countries the risks are heightened further by chronic malnutrition, little or no prenatal and obstetric care, excessive work, infections and other diseases, and poor environmental conditions (16,19,24,56,76,89,90,117).

Although in recent years maternal mortality rates have declined dramatically in many countries throughout the world, death rates associated with childbearing remain appallingly high in developing countries, in some countries as high as 740 per 100,000 live births—a figure almost 50 times higher than in developed countries. Differing definitions of maternal mortality and incomplete and unreliable statistics make exact measurements and comparisons of maternal mortality almost impossible but there is no doubt that even today in some developing countries mortality associated with pregnancy and childbearing is one of the leading causes of death among women in their reproductive years (ages 15-44) (146,150,154). Adequate nutrition and preventive and curative medical care can prevent most of these deaths, as they do in developed countries (see Fig. 2) (16,83,90,119,132,152).

About 40 percent of the women in developing countries, compared with only 6 or 7 percent in developed countries, have four or more children. The primary reason for this is

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that both women and men lack the knowledge and the means to control their reproduction. Furthermore, many of the women are chronically malnourished, perform hard physical labor, and have little or no access to medical care. They are often unaware of the risks of excessive childbearing to either their own lives and health or to that of their families. Although about 70 percent of women surveyed in developing countries indicated that they wanted to limit their family size, in many countries less than 10 percent have the knowledge and means to do so (10,11). Even fewer have the most effective means of fertility control available. This situation is most acute in rural areas where the majority of the world's population lives and where there are few physicians and hospitals, resulting in only about 20 percent of rural populations having access to modern health services (57,90,104,122,124,142,143,144, 145).

In desperation, many women turn to illegal abortions—estimated at 20 to 30 million annually throughout the world—many of which are done under conditions which often lead to maternal deaths.

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Most of the studies on the effects of childbearing on maternal health were done in developed countries from the 1940s through the 1960s. A small number of more recent studies have concentrated on nutritional aspects of pregnancy. In general, however, investigators have not studied the health of the mother as much as the health of the offspring, a point demonstrated by the far greater number of reports published on fetal, infant, and child health than on maternal health (see Fig. 3). The unreliability—and in some cases, the complete absence—of vital statistics from developing countries, especially the rural areas, means that the magnitude of maternal health problems has probably been underestimated.

Because a clear association exists between childbearing and a woman's health, women will not be able to improve their status significantly until they have total reproductive freedom (4). For this reason, family planning programs should incorporate measures which will encourage limitation of the number of children born and permit adequate spacing between births—two factors which at the same time will improve the health and nutrition of both women and children.

AGE, BIRTH INTERVAL, AND PARITY

Three major demographic factors influencing maternal morbidity and mortality rates are (35,60,87,94,95,102,103,107,135,160):

- woman's age
- length of the interval between births
- woman's parity (number of children she has borne).

Effects of Woman's Age

The optimal childbearing years are between the ages of 20 and 30. The further away from an optimal age a woman is, the greater the risks of her dying from pregnancy or childbirth. The increased risk ranges from two to six times that of the minimum risk (95). Although good nutrition and medical care can effectively reduce the age-related mortality of childbearing, they cannot eliminate it entirely. In the USA the death rate associated with pregnancy and childbirth climbs at a rate of 10 to 12 percent for each year the mother is past the optimum age range (95).

Age-related morbidity and mortality in both developed and less developed countries are higher for women over 35 (see Fig. 2). Compared with women 20 to 30, women over 35 are two to three times more likely to develop complications of pregnancy and childbirth, especially hemorrhage, toxemia, and difficult or prolonged labor (7,35,53,54,95,102,103,111). Even though the absolute risk of mortality in

developing countries for a woman of any parity over 35 is much greater than in developed countries, the contrast between the low risk of a woman in her 20s and the higher risk of a woman over 35 is more pronounced in developed countries (95). Nortman has suggested that this situation may be related to the difference in medical care between developed and developing countries. In developed countries improved medical care reduces deaths due to obstetric causes at younger ages but not at older ages because maternal deaths in women over 35 are often caused by complications arising from constitutional conditions which are less likely to respond to medical care. The contrast between maternal mortality at younger and older age groups in developing countries is less apparent, probably because a larger proportion of women die from obstetric causes at younger ages (95).

Effects of Birth Interval

A woman needs two to three years between births to fully recover physiologically from one pregnancy and prepare for another (35,157,158,159). The shorter the birth interval, the greater the risk of mortality for both mother and child. In fact, even good nutrition and medical care, optimal childbearing age and low parity cannot compensate for the health hazards of pregnancies spaced less than two years apart (140). Short birth intervals are associated with increased incidence of severe anemia (2,21) and complications resulting from pregnancy and childbirth. Also, short birth intervals are associated with an increased incidence of premature births and perinatal mortality (158,159).

Currently, two factors contributing to shorter birth intervals are the worldwide decline in prolonged breast-feeding, a natural way of extending birth intervals in noncontracepting populations (see **Population Report J-4**), and the inadequate availability of effective contraceptives for mothers who want to limit or space births (see **Population Report J-5**).

Effects of Parity

The likelihood of a woman dying from the first pregnancy or childbirth is slightly greater than from the second and third births. It then rises gradually with each subsequent pregnancy until the fifth, after which there is an even more marked increase (see Fig. 4) (95,97). In developing countries, where women commonly have more than five births (see Table 1), high parity contributes to high maternal and infant mortality rates.

The incidence of toxemia and other complications of pregnancy—difficult labor, ruptured uterus, hypertension, and kidney disease—is higher for women who have given birth to five or more children (7,106). The severity of these complications increases at higher ages, with inadequate prenatal and obstetric care, and with poor nutrition. Even in developed countries where improved obstetrical care has greatly reduced deaths in women of high parity, the incidence of these diseases and complications remains high in women of high parity (106,111,160).

Although a woman's age, parity, and the length of the birth interval affect maternal morbidity and mortality, this is not a simple cause and effect relationship (45,116). Not only

are the three variables interrelated but other factors are also involved; for example, economic circumstances, cultural practices and beliefs, genetic predisposition, health and nutritional status, environmental conditions, and medical care (95). Many of these factors have not yet been thoroughly investigated, particularly in developing countries. Although most of the reports cited in the following sections were carried out in developed countries, many of the findings can probably be extrapolated to developing countries, where the special nutritional needs and the increased risks of morbidity and mortality which childbearing imposes on women are most severe (98).

MATERNAL MORTALITY

Even though more boys than girls are born, women usually live longer and outnumber men at every age group after about age 25 in developed countries (131,150). But in some developing countries the death rate for women during their reproductive years is much higher than for men of the same age. For example, in India in 1963 the female death rate for the 15-44 age group was 38 percent higher than for males; in Pakistan the rate was 75 percent higher (37). This increased mortality results primarily from the large numbers of women who die from pregnancy and childbirth-related causes (37). In Matlab thana, a rural area of Bangladesh, for

example, the overall maternal death rate in 1968-1970 was 570 per 100,000 live births but reached even higher levels in the 15-19 age group (740 per 100,000 live births), a rate almost 50 times greater than in developed countries (22).

The adverse effect of childbearing on female mortality rates, even in populations with good medical care, proper nutrition, and sanitary environmental conditions, is suggested by a study done among the Hutterites, a religious sect in rural areas of North America (36). Probably the fastest growing population in the world, the Hutterites have an unusually high birth rate (46 per 1000 in 1967) (138). Although the overall adult mortality rate is low compared to those in most developed and developing countries, Hutterite women between the ages of 15 and 60 have a higher mortality rate (25.86 per 1000) than do Hutterite men in the same age group (19.56 per 1000), thus suggesting excessive childbearing (10.9 children per woman) as the indictable factor (36).

Inadequate Statistics

In many developing countries maternal deaths rank among the ten leading causes of mortality (see Table 2). Lack of a standard definition of maternal mortality, however, and a scarcity of reliable data make comparisons of mortality figures from country to country virtually impossible. The Committee on Maternal Mortality of the International Fed-

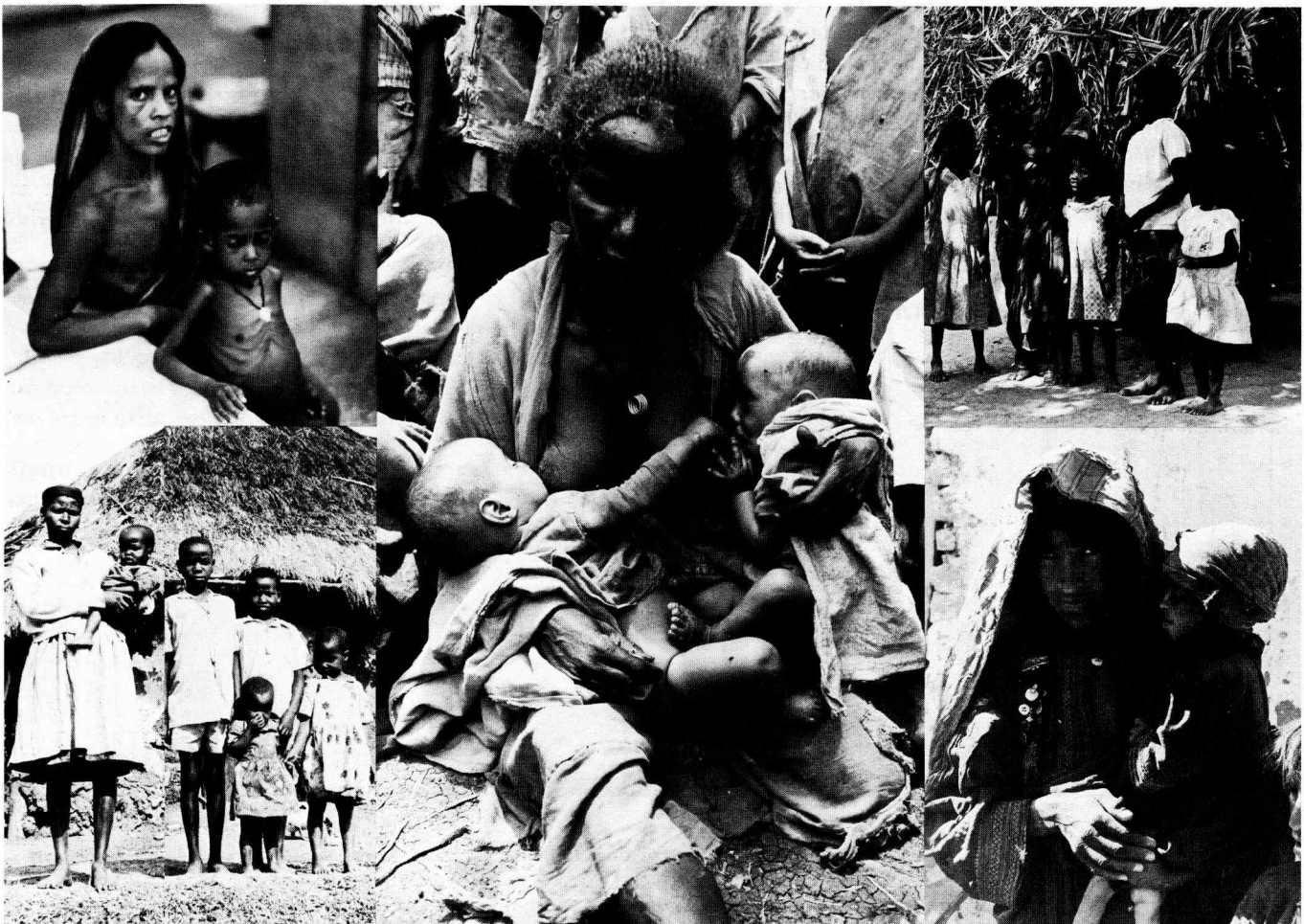


Fig. 1. Throughout the world excessive childbearing affects maternal health adversely. Upper left: mother and child in Bangladesh (courtesy of Douglas Huber); lower left: East African mother and children (courtesy of United Nations/FAO); center: Ethiopian mother and children (courtesy of UNICEF/Bill Campbell); upper right: Indian mother and children (courtesy of United Nations/ILO); lower right: Afghan mother and children (courtesy of UNICEF, photo by John Balcomb ICF Series 6606-6615).

erations of Obstetricians and Gynecologists (FIGO) defines a maternal death as:

Death of any woman dying of any cause while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy (22).

The American Medical Association's (AMA) Committee on Maternal and Child Care, on the other hand, defines maternal death as:

... death that occurs while the woman was pregnant or within 90 days of the termination of the pregnancy irrespective of the duration of the pregnancy, the time of termination or the method by which it was terminated (22).

These definitions can be further categorized as 1) direct obstetric causes of death, 2) indirect obstetric causes of death (diseases aggravated by pregnancy), or 3) unrelated causes of death (accidents, for example). In a study of maternal mortality in Bangladesh, Chen and his associates found that 80 percent of maternal deaths classified according to the AMA's definition were direct obstetric causes, 10 percent were indirect obstetric causes, and only 10 percent were unrelated causes, thereby validating the usefulness of the definition (22).

About two-thirds of the world's population live in areas with unsatisfactory registration of vital statistics (149) and in many countries such statistics from rural areas are simply not available (8,152) or are grossly underestimated. In the Dominican Republic and Nicaragua, for example, an estimated 50 percent of all deaths are not reported and about 73 percent of those that are reported lack medical certification (57,72). In other countries, maternal mortality rates are often estimated on the basis of hospital deaths, but only about 15 percent of women in developing countries are delivered in hospitals (31). In order to accurately assess the incidence and causes of maternal deaths, FIGO has called for new maternal mortality studies (2,70,81,82).

NUTRITION AND MATERNAL VULNERABILITY

Although pregnant and lactating women are, from a nutritional standpoint, the most vulnerable adult group, especially in developing countries, their special nutritional needs require further definition (64,65,66). Physiological requirements of pregnancy, until recently regarded as a depletion of maternal resources by the developing fetus, are now thought to be an adjustment of a woman's physiology involving herself, the fetus, labor, and subsequent lactation since most of these physiological changes begin before the fetus is large enough to be a problem "parasite" (27,58,78, 85,104,106,140,141,153). Nevertheless, the physiologic changes often seem to anticipate the needs of the developing fetus: increased buildup of body fat as an energy reserve, increased rate of metabolism, changes in the blood and other body fluids to facilitate transport of nutrients and removal of wastes (104,58), and changes in the concentrations of vitamins (78).

Nutritional Requirements of Pregnancy

The nutritional requirements of a healthy woman who has a 280-day pregnancy and lactates for six months are greatly increased over the needs of a nonpregnant, nonlactating woman (see Table 3) (23,104,158). These increases in nutritional requirements represent the physiological needs of each pregnancy (104). Part of the nutritional needs of the pregnancy are derived from maternal tissues, but the effects on the woman of this nutrient depletion vary greatly due to differences in prepregnant nutritional status, amount of physical labor performed, diseases, and infestation with parasites.

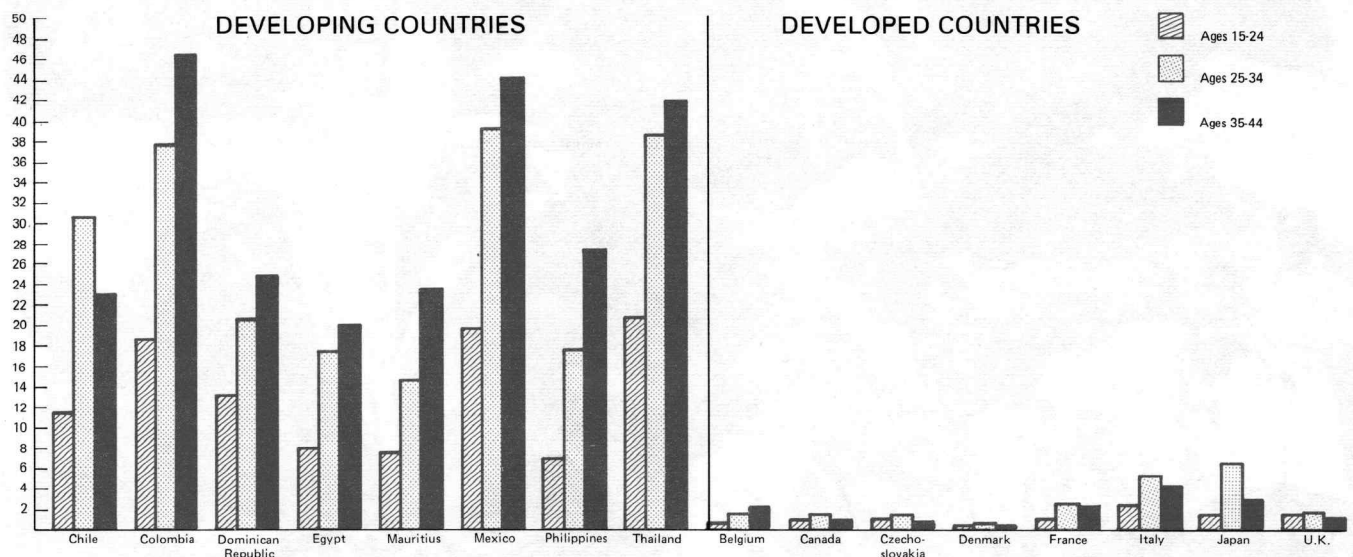


Fig. 2. Comparison of mortality rates per 100,000 women during their reproductive years, in developing countries and developed countries, for deaths due to pregnancy and childbirth*

*The category "due to pregnancy and childbirth" includes numbers 112-118 from the "A" List of the International Classification of Diseases: toxemias of pregnancy and the puerperium, hemorrhage of pregnancy and childbirth, abortion induced for legal reasons, other, and unspecified abortion, sepsis of childbirth and the puerperium, other complications of pregnancy, childbirth and puerperium, delivery without mention of complication.

SOURCE: Data from World Health Statistics Annual (150)

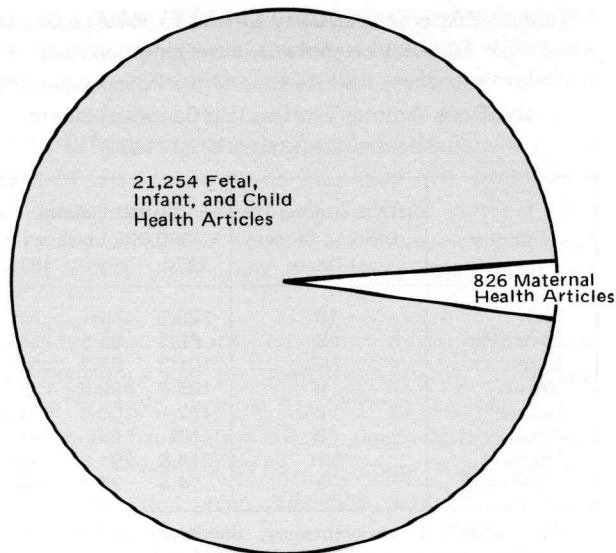


Fig. 3. Number of articles on maternal health compared with number on fetal, infant, and child health, in 1200 international medical journals, 1973-1975.

SOURCE: Search made on August 28, 1975 of the National Library of Medicine's (USA) MEDLINE (computerized information retrieval system), using *Index Medicus* terms relating to maternal, fetal, infant, and child health (maternal health services; maternal welfare; maternal mortality; infant care; infant nutrition; infant, newborn diseases; infant, premature diseases; infanticide; all infant diseases; fetal disease; child health services).

Nutrition and the Birth Interval

The interaction of nutrition and interpregnancy interval is often critical in determining the survival of the mother and the child as well as the success of subsequent pregnancies. After delivery the mother's body needs a minimum of two years' time and adequate nutrition to replenish its nutrients and to adjust to its prepregnant state. The more poorly nourished a woman is, the longer the interpregnancy interval needs to be (104,140). If another pregnancy follows too rapidly, her body is still nutritionally deficient, resulting in low weight gain during pregnancy, severe anemia, high rates of both maternal and perinatal mortality, and low birth weight of offspring (92,120,158,159).

Nutritional needs are particularly critical for women of high parity in developing countries who are often either preg-

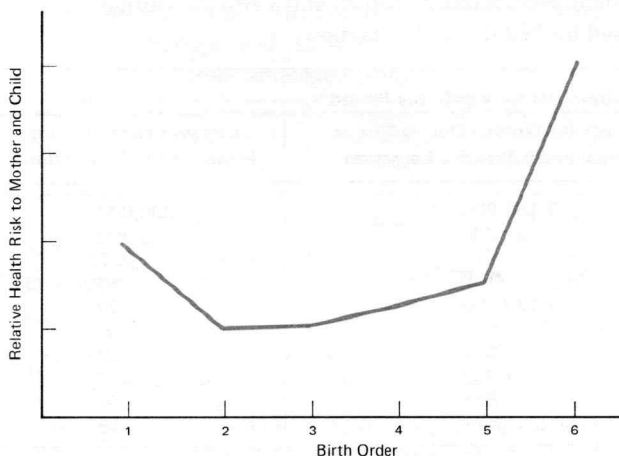


Fig. 4. Relative maternal health risks at different parities.

SOURCE: adapted from Omran (97).

nant or breast-feeding throughout their reproductive lives (16,63,64,90), are infested with parasites (155), and subsist on inadequate diets (148,149).

Because chronic malnutrition is widespread in the developing countries, and because many women undergo a constant and cumulative nutritional drain from repeated pregnancies and lactation, they develop a "maternal depletion syndrome" (63,64), which can include protein-calorie malnutrition, osteomalacia (softening of the bones due to calcium and vitamin D deficiency), iodine-deficiency goiter, and anemias (64).

NUTRITIONAL ANEMIAS

Nutritional anemia, an abnormally low hemoglobin content in the blood resulting from a deficiency of iron, vitamin B₁₂, or folic acid, is one of the most common of the serious diseases which affect women. Together with protein-calorie malnutrition (PCM), xerophthalmia (dryness of the cornea and tissues surrounding the eye caused by vitamin A deficiency), and endemic goiter, anemia ranks among the four most prevalent serious nutritional diseases in the world (148). In contrast to PCM and xerophthalmia which are more likely to affect infants and children, or goiter which affects people of all ages, anemia is a particular scourge of women. It occurs two to three times more frequently in nonpregnant women than in men and up to 20 times more frequently in pregnant women (see Table 4) (9,

Table 1—Total Number of Live Births to Women During Their Reproductive Years (Ages 15-49), in Selected Developing Countries, 1960-1970

Country	Year	Number of Children per Woman ^a
AFRICA		
Kenya ^b	1969	6.6
Senegal ^b	1960-61	5.4
Tanganyika	1967	5.0
ASIA		
Indonesia ^{c,d}	1965	4.8
Jordan ^c	1961	7.7
Republic of Korea	1966	5.7
Malaysia ^c	1960	5.4
Thailand ^c	1960	6.0
AMERICAS		
Brazil	1970	5.3
Nicaragua	1963	5.8
Paraguay ^e	1962	4.2
Peru ^e	1961	5.6
OCEANIA		
Fiji	1966	6.3
Tonga	1966	6.7
Western Samoa	1966	7.8

^aBased on total fertility rate (TFR), total number of births during reproductive life per 1,000 women

^bAfrican population only

^cChildren born to married, widowed, and divorced women only

^dEstimated from Second Round of National Sample Survey

^eExcluding aboriginal jungle population

SOURCE: United Nations (130)

29,112,148,155). The disease, which in its severe form is characterized by debility and edema, is so common in some areas of the world that women in those regions accept the symptoms as a normal condition of pregnancy (29). Although anemia in pregnancy occurs to some degree in women in developed countries (67,88,155), its effects are most severe in developing countries where it is the underlying cause of 40 to 50 percent of maternal deaths, as opposed to virtually none in developed countries (9,31,50, 51).

Types of Anemia

Three types of nutritional anemia are recognized, based on whatever nutrient deficiency is causing the diminished hemoglobin: iron deficiency, vitamin B₁₂ deficiency, and folate (folic acid) deficiency. Iron deficiency anemia, the most common anemia, affects an estimated 80 to 90 percent of pregnant women in developing countries (29,155). Precise data are not available on the incidence of other nutritional anemias. Folate deficiency anemia, thought to be common in pregnant women because of the greatly increased folate requirements of pregnancy, often occurs together with iron deficiency anemia and goes undetected. One report from India indicates that 20 to 50 percent of pregnant women had folate deficiency anemia and similar results have been reported from South America (21,112, 134,148). Few cases of vitamin B₁₂ anemia in pregnant women have been reported, but this may be because of lack of detection rather than lack of occurrence.

Causes of Anemia

The high incidence of anemia among women in developing countries results from the combined—and additive—effects of:

- inadequate diet
- recurrent infections and diseases
- great nutritional demands of childbearing.

Multiparity and short birth intervals are associated with severe anemia in women in developing countries (21,42,99). A study in Malaysia indicated that among anemic obstetric patients only 10 percent were primigravidas (first pregnancy), but 55 percent were women of parity five or more

Table 2—Maternal Mortality Rates (15 - 44 Age Group) per 100,000 Liveborn Due to Complications of Pregnancy, Childbirth, and the Puerperium, and Rank Among Ten Leading Causes of Death, in Selected Countries, 1970 - 1972^a

Country	Rank Among 10 Leading Causes of Death	Mortality Rates/ 100,000 Liveborn		
		1970	1971	1972
Chile	10	125.7	NR	NR
Costa Rica	8	88.3	90.5	NR
Egypt	NR	101.3	89.2	NR
Mexico	6	135.3	138.6	122.5
Panama ^b	6	122.1	105.6	103.4
Paraguay	5	NR	NR	NR
Thailand	NR	214.8	201.8	NR
Venezuela ^b	6	74.4	74.5	NR

^aComplications of pregnancy, childbirth and the puerperium in this table are numbers 112-118 in the "A" List of the International Classification of Diseases, 8th edition, Geneva, World Health Organization, 1967.

^bExcluding tribal Indians

NR=Not Reported

SOURCE: World Health Organization (145).

(99). The need for iron, as well as folic acid, is six times greater for a woman in the last trimester of pregnancy than for a nonpregnant woman (2). This great need for iron—ranging from about 1000 to 1300 mg per pregnancy (see Table 5)—cannot be met by diet alone but is derived partly from maternal reserves. Since maternal reserves of iron are usually increased only during periods of nonpregnancy, women who experience closely spaced births suffer chronic and progressively more severe anemia (21,29,31,39,42,48, 51,71,112). When a pregnant woman's level of body iron is reduced to the point of morbidity, her body is not able to produce hemoglobin. The World Health Organization considers a pregnant woman whose hemoglobin is less than 11g/100 ml to be anemic (155). Defining the level of hemoglobin which separates normality from anemia is still somewhat inexact, however, since a slight decrease in hemoglobin level is probably normal in pregnancy.

Poor nutrition, resulting from inadequate dietary intake of both proteins and iron, is a major cause of anemia in the

Table 3—Comparison of Nutritional Needs of a Nonpregnant, Nonlactating Woman and a Woman During a Normal 280-Day Pregnancy Followed by 180 Days of Lactation

Nutrient	Total Requirements for a 460 Day Period*		
	Nonpregnant, Nonlactating Woman**	Total Needs for Woman During Normal Pregnancy and 6 Months' Lactation	Increased Needs During Pregnancy and Lactation
calories	920,000	1,156,000	236,000
protein (g)	25,300	31,700	6,400
calcium (g)	368	570	202
iodine (g)	46	62	16
vitamin A (I.U.)	2,300,000	3,120,000	820,000
ascorbic acid (mg)	25,300	27,600	2,300
folacin (mg)	184	314	130
niacin equivalent (mg)	5,980	7,800	1,820
riboflavin (mg)	690	864	174
thiamin (mg)	460	578	118

*280 days of pregnancy and 180 days of lactation

**based on the needs of a woman 22 years old, weighing 58 kg (128 lbs.), engaged in light activity

SOURCE: Adapted from PAHO, Maternal nutrition and family planning in the Americas (104)

developing countries. Protein malnutrition interferes with the utilization of iron: in some cases of iron deficiency, anemia will not respond to iron therapy unless protein is ingested, particularly protein from animal sources. Iron in plant foods is poorly absorbed because it contains a large amount of phytic acid which interferes with iron absorption. Animal protein—meat, fish, and eggs—not only provides readily absorbable iron but also increases the absorbability of iron in plant foods at the same time (1,44,47,67, 121).

Sometimes food taboos, especially those which apply during pregnancy and the puerperium, hinder good nutrition. For example, in some East African societies, women are prohibited from eating chicken, eggs, mutton, and certain types of fish (38,63,64). In some Asian societies, women believe that green vegetables, legumes, and grains are "too heavy" and will cause flatulence (49,64). Therefore, they avoid these foods, especially during pregnancy.

Overcooking vegetables, thus destroying folic acid, also contributes to folate deficiency anemia (42). Unsupervised weight-reducing regimens, which exclude necessary iron and proteins, sometimes undertaken with the mistaken notion that it will minimize the difficulties of labor by producing a small infant, is still another important cause of anemia (42,67).

Malaria, Parasitism, and Anemia

Beginning with the second trimester, pregnant women have a markedly decreased resistance to malaria, but the cause of this phenomenon is unknown (42,148). Malaria destroys red blood cells, increases the folic acid requirements of the body, and may result in severe folate deficiency anemia (42).

Worm infestation (roundworm, hookworm, and tapeworm) is a common cause of anemia in developing countries (12, 42,32,99,149,155). Iron therapy or nutritional supplementation may not be effective unless worm infestation in the body is eliminated (32). Hookworm infestation, for example, may cause blood losses ranging from 2 to 100 ml daily (155).

Consequences of Anemia

Anemia reduces a woman's resistance to infections, increases the frequency of complications of pregnancy and

Table 4—Percent of Total Population in Africa, Asia, Europe, and the Americas with Iron-deficiency Anemia

Region	Percent of Men	Percent of Women	Percent of Pregnant Women
Africa	6-17	15-50	20-90 ^a
Asia	10	20	40-50 ^b
Europe	3-6	10-25	NR
Americas	5-15	10-35 ^d	38 ^e

^aExcluding Bantus from South Africa (2,9,111,147).

^bUp to 100 percent of pregnant women in India.

^cIn Scandinavia (148).

^dData for South America; in North America incidence of anemia in total population estimated at 20 percent, with a higher incidence in women than in men.

^eIn Venezuela (32).

NR=Not Reported

Table 5—Amount of Iron Required During a Normal Pregnancy

Source of Bodily Need	Amount of Iron Required (in mg)
Loss through excretion	180-300
Demands of fetus	250-300
Demands of placenta	75
Blood loss at delivery	200
Increased production of red blood cells during pregnancy	<u>300-400</u>
Total to term	1005-1275

SOURCE: Adapted from Alvarez-Bravo (2).

childbirth from two to three times the normal rate and, in addition, increases the risk of maternal mortality (20,29,30, 39,51). In a study of maternal mortality in Bombay, anemia was the single most important factor contributing to death. The death rate from anemia-related deaths among grand multiparas (women bearing six or more children) was almost twice that of primiparas (women bearing their first child) (39). Anemic women suffer more frequent and dangerous infections of the respiratory tract, especially staphylococcal pneumonia; latent tuberculosis lesions often become active and already active ones are dangerously exacerbated; even relatively benign infections of the genital tract often worsen and sometimes become fatal with anemia. A report in 1960 from South America showed that maternal mortality due to puerperal sepsis was 34.4 percent in patients with chronic anemia compared to an overall rate of 1.3 percent (20). In Latin America anemic women have almost three times more premature births and twice as many perinatal losses as nonanemic women (20). Antepartum and postpartum hemorrhages are not only more frequent in anemic women but are more often fatal because an anemic woman cannot afford to lose any blood (39, 139).

Preventing Anemia

Family planning and dietary supplementation are key factors in preventing anemia in women. Spacing births to allow at least a two-year interval reduces a woman's chances of becoming iron deficient by reducing the frequency with which her body must meet the great iron requirements of pregnancy and by allowing time for her body to build up adequate iron reserves for a planned pregnancy. Among undernourished women, a minimum interval of three years is necessary (140,159).

Oral contraceptives warrant special consideration as a method to prevent or delay pregnancy in chronically anemic women because, in addition to their high degree of effectiveness in preventing pregnancy, orals also usually reduce menstrual bleeding with its accompanying loss of iron although in some women they have also been associated with a decreased level of folic acid (69). The seven "spacer" tablets included with each cycle of oral contraceptives distributed by the United States Agency for International Development (USAID) each contain 75 mg of an iron salt, ferrous fumarate, which although below the usual thera-

peutic dose, should help to reduce chronic iron deficiency and anemia. The 1974 Report of the Royal College of General Practitioners in Britain concluded that:

Use of the Pill is associated with a highly significant protective effect against iron deficiency anemia and anemia of unspecified etiology. The majority of the latter are also undoubtedly of the iron deficiency type. This lower incidence of anemia in Pill users has long been recognized and is to be expected from the markedly reduced menstrual loss experienced by oral contraceptive users (46).

DIABETES MELLITUS AND PARITY

Although high parity has been implicated as a possible factor causing twice as many women as men to develop diabe-

tes after the age of 40 (41,79,84,86,91,109), the relationship has not been definitely established. It is well known that pregnancy does indeed worsen existing diabetes and that it causes biochemical symptoms to appear during gestation in a previously nondiabetic woman, but other etiologic factors such as age, obesity, genetic predisposition, and possibly diet, are considered by some investigators as more important than parity (14,43,61,135).

Middleton and Caird (86), having noted, as did Pyke and Fitzgerald (41,109), that the incidence of diabetes in women over 40 increases with increasing parity, calculated the excess maternal risk caused by childbearing from the three sets of data (see Table 6). They compared nulliparas

Table 6—Comparative Risk of Diabetes Mellitus in Men and Women and Effect of Parity on Incidence of Diabetes in Women, in Selected Studies, 1949-1972

Author, Date, & Country	Ref. No.	Study Population		Investigator's Conclusions
		Test Group*	Control Group	
Fitzgerald et al., 1961, England	40	3,260 women 2,181 men	7,608 married women	incidence of diabetes the same in men and women until age 40, then more frequent in women; in women with 3 children, twice as frequent as nullipara; with 6 children, six times more frequent
Florey et al., 1972, Jamaica	42	302 women 236 men	no controls	incidence of disease rose with age for both sexes: to 14.5% in men 45-54 and to 17.0% in women 55-64; no correlation between parity and incidence of diabetes
Jackson, 1961, South Africa	60	508 women 361 men	782 nondiabetic women	women over 35 more than twice as likely to develop diabetes; significant rise in incidence with parities above six but not at lower parities; pregnancy has a temporary diabetogenic effect; prediabetics may be more fertile than nondiabetics
Middleton & Caird, 1968, England	85	543 women 413 men	general population (Oxford and surrounding districts)	risk of diabetes greater in women over 40 than in men over 40; increased maternal risk of diabetes over nullipara: 20% for one child, 45% for two, 100% for three, 200% for four or five, 400% for six or more
Munro et al., 1949, Scotland	90	907 women 402 men	general population (Glasgow, Scotland)	incidence of diabetes the same for men and women until age 40; then more frequent among women, especially multiparas
Pyke, 1957, England	108	583 women 370 men	random sample from 1951 Census in England	risk of diabetes in women with 5 or more children is at least twice as great as in nullipara
Vinke et al., 1959, Netherlands	135	1,379 women 773 men	census data for Netherlands	slightly more male than female diabetics under age 40; over 40, two to three times more female diabetics; no correlation between parity and incidence of diabetes; obesity in women increased incidence of disease

* Diabetic patients

(women who have never borne a viable child) with women of varying parity and concluded that the likelihood of developing diabetes is about 20 percent greater for a woman with one child, 45 percent for two, 100 percent for three, 200 percent for four or five, and over 400 percent greater for six or more. The likelihood that a man over 40 will develop diabetes is about 50 percent greater than that of a

nullipara and about equal to that of a woman with two children. By contrast, Florey, Jackson, and Vinke, while confirming the higher female than male rate of diabetes after age 40, found no correlation between higher parity and increased incidence of the disease (43,61,135). They conclude that age (43,61) and obesity (135) were more important as causative factors (see Table 6).

Table 7—Cervical Cancer and Age, Marital Status, and Parity in Selected Studies, 1949-1974

Author, Date, & Country	Ref. No.	No. of Women in		Variables Studied	Investigator's Conclusions
		Test Group	Control Group		
Fernando, 1974, Sri Lanka	40	2,316	no control	race, age at first pregnancy, parity, traumatic delivery	Positive correlation of incidence of cervical cancer with: 44-60 age group; parity above 3 (88% of cancer patients had 3 or more children and parities 4 and 5 accounted for more than half of all cases); low socioeconomic status
Lundin et al., 1964, USA	77	517	2,472	race, age at first pregnancy, parity, socioeconomic status	1. Positive correlation of incidence of cervical cancer with: <ol style="list-style-type: none"> a) early marriage (under 20) in white women but not in black women; b) early age (less than 18) at first pregnancy in both black and white women; c) low socioeconomic status 2. No correlation between parity and incidence of cervical cancer
Maliphant, 1949, U.K.	80	1,200	302,485 (census for Glamorgan, Wales)	age, marital status, parity	1. Greatest risk is between ages 35 and 64; 2. Marriage (and intercourse) increase risk regardless of childbearing, but parity increases risk; risk for single woman, 1/21,000; childless married woman, 1/6,500; parous woman, 1/15,000
Rotkin & Cameron, 1968, USA	114	416	416	120 variables	Early sexual experience, especially age at first coitus, most closely linked factor with high incidence of cervical cancer
Wahi et al., 1969, India	137	693	39,587 (screened by Papanicolaou smear)	age, age at first marriage, age at first pregnancy, parity, socioeconomic status	1. Greatest risk is between ages 45 and 54; 2. First pregnancy before age 17 associated with significantly higher incidence of cervical cancer; 3. Early marriage associated with increased risk of cervical cancer (average age at first marriage for cancer patients was 13.6 compared with 15.6 for controls); 4. Incidence of cancer significantly higher among women with more than 4 deliveries
Wynder et al., 1954, USA & India	156	589 (USA) 303 (India)	1,311 (USA) 515 (India)	marital status, age at first coitus, parity	In both USA and Indian populations higher incidence of cervical cancer was associated with: marriage (single women had lower incidence), early age at first coitus (less than 19 in the USA). No correlation with parity.

Table 8—Complications of Pregnancy and Childbirth among Multiparas, in Selected Studies, 1940-1968

Author and Date	Ref. No.	Population Studied	Country	Conditions Which Appeared with Above Average Frequency in Multiparas										Comments		
				Abruptio Placentae	Anemia	Diabetes Mellitus	Heart Disease	Hemorrhage: Antepartum & Postpartum	Hypertension	Kidney Disease	Malpresentation	Placenta Previa	Preeclampsia		Ruptured Uterus	Toxemia of Pregnancy
Eastman 1940	35	7,596 women para 5+	USA	a				X	X	X	X	X		X	X	Compared with 37,918 women of lower parity. Great increase in mortality occurs at eighth birth and continues to increase thereafter; most important causes of death were ruptured uterus, hypertension, and nephritis.
Israel & Blazar 1965	60	5,551 women para 7+	USA	X	X			X	X			X	X	X		Multiparas (para 7+) compared with 123,017 women of lower parity. Mortality no greater among high parity women due to better medical care; morbidity higher in multiparas.
Miller 1954	87	563 women para 6+	USA					X			X					Control group; data compared with other studies. Premature birth associated with both increasing parity and increasing age.
Nelson & Sandmeyer 1958	94	812 women para 8+	USA					X	X		X					Grand multiparas (8+) were compared with 18,402 women of lower parity.
O'Sullivan 1963	102	611 women para 6+	Ireland		X			X	X		X				X	No control group. Conclusions based on comparisons with other reports of grand multiparity.
Oxorn 1955	103	1,056 women para 8+	Canada	X			X	X			X	X		X	X	Multiparas (8+) compared with 29,000 women of lower parity. Age and parity more important than parity alone, but parity more important than old age.
Petry 1955	107	6,512 deliveries	USA	X					X		X	X		X	X	Grand multipara defined as 7 or more. Mortality twice as high for grand multiparas.

Table 8—Continued

Author and Date	Ref. No.	Population Studied	Country	Conditions Which Appeared with Above Average Frequency in Multiparas										Comments			
				Abruptio Placentae	Anemia	Diabetes Mellitus	Heart Disease	Hemorrhage: Antepartum & Postpartum	Hypertension	Kidney Disease	Malpresentation	Placenta Previa	Preeclampsia		Ruptured Uterus	Toxemia of Pregnancy	
Vehaskari 1968	135	1,567 women para 8+	Finland	X					X		X	X					Grand multiparas (8+) compared with 16,432 women of lower parity. Hypertension correlated with age; placental complications with age; placental complications with parity.
Ziel 1962	160	516 women para 6+	USA		X	X	X	X	X		X		X				Compared with 1,125 women of lower parity. Heart disease, hypertension, and diabetes significantly associated with maternal weight.

^aBlank spaces do not indicate condition did not occur with above average frequency, but that the investigator did not report on the frequency of the condition.

The identification of existing or potential diabetes in women is clinically important (101) because of the association of diabetes in pregnancy with increased maternal and perinatal morbidity and mortality (99,129), the large number of undetected diabetics, and the observed increase in the incidence of diabetes (14). Although a woman who develops gestational diabetes usually reverts to a nondiabetic status after parturition, her chances of developing permanent diabetes in later years are high, especially after repeated pregnancies (41,86,91,100,109). Women with latent diabetes—the so-called prediabetics—frequently give birth to large babies (often in excess of 10½ pounds), are over 25 years old, and, probably most important for diagnostic purposes, have abnormal glucose tolerance tests (GTTs) (100,101).

CERVICAL CANCER AND PARITY

Cervical cancer has been associated with high parity in some studies although no definite relationship has been confirmed (40,68,80,113,114,137,156). Maliphant, who studied cervical cancer patients in England, found that nulliparous married women developed cervical cancer two times more frequently and married women of any parity ten times more frequently than single women. Although Maliphant concluded that with each child a woman slightly increased her risk of cancer, other studies have failed to show that the relationship between parity and cervical cancer is as important as age at first marriage or at first intercourse, or a number of other sexual factors (see Table 7) (80).

Since cervical cancer is the most prevalent form of cancer among women in India and China, and appears very frequently in South America, additional studies of the relationship, if any, between parity and cervical cancer would be valuable (118).

COMPLICATIONS OF PREGNANCY AND CHILDBIRTH

Conditions which result in increased rates of maternal morbidity and mortality may be directly related to obstetric complications (other than normal changes that a woman undergoes during pregnancy, labor, and the puerperium) or to constitutional conditions (her illnesses or pathological state) which although not directly related to pregnancy may be worsened by it (6,13,17,18,52,53,54,55,62,95,109,127). Both categories of complications are directly influenced by a woman's parity, age, and interpregnancy interval. The risk of a woman developing one or more complications is lowest for women between the ages of 18 and 30 and from their second to fourth pregnancy. The risks increase progressively for women younger than 18 or older than 30. They are also higher during the first or fifth and subsequent pregnancies (see Table 8).

The three major groups of obstetrical complications which cause about half of all maternal deaths in the world are (see Table 9) (95):

- toxemia
- hemorrhage
- sepsis.

Additional obstetrical complications include ruptured uterus and malpresentation (a fetal position during labor which makes vaginal delivery either difficult or impossible.)

These complications which occur most often in older multiparas may reflect decreased elasticity of the uterus (125, 126).

Table 9—Characteristics and Consequences of the Three Major Obstetrical Complications: Toxemia, Hemorrhage, and Sepsis

Condition	Description	Clinical Characteristics and Management	Maternal Causes and Consequences
TOXEMIA OF PREGNANCY:			
Preeclampsia	a toxemia of pregnancy characterized by hypertension; may lead to eclampsia	warning signs are hypertension (diastolic pressure greater than 90 mm), sudden and excessive weight gain (more than two pounds a week), albuminuria (presence of serum albumin in urine), retention of fluids, and edema	almost exclusively a disease of the first pregnancy; closely related to lack of antenatal care
Eclampsia	convulsions and coma occurring in pregnant or recently delivered women, associated with hypertension, edema, and proteinuria (excess serum protein in urine); occurs almost exclusively during last trimester	characterized by intravascular coagulation leading to hypertension, hemorrhage, and necrosis of tissues, especially in the liver, kidneys, and brain; nearly all cases of postpartum eclampsia occur within 24 hours of delivery; requires immediate delivery after convulsions have been controlled; delivery frequently by cesarean section	occurs more frequently in nulliparas and older multiparas; mortality closely related to how soon medical care is received; genetic factor may be involved; the most serious and dangerous obstetrical complication
HEMORRHAGE:			
Placenta previa	a placenta which develops in lower portion of uterus adjoining or covering the cervix; most common symptom is hemorrhage during last trimester, especially in eighth month	requires hospitalization, preparation for massive transfusions, and usually cesarean section delivery	multiparity and advancing age favor occurrence, age probably being more important (half as frequent in primigravidas as multiparas, but women over 35 three and a half times more likely to have condition than those under 25 regardless of parity); death rate in developing countries may exceed 15 percent
Abruptio placenta	premature detachment of a normally located placenta between the 20th week of pregnancy and birth, often accompanied by maternal shock; most common symptom is hemorrhage during last trimester, especially in eighth month	vaginal bleeding may occur, but concealed internal bleeding is more important; uterus usually extremely rigid and tender; often accompanied by decreased urination and decreased amount of fibrinogen in blood; treatment involves multiple blood transfusions and delivery within about six hours of onset of symptoms either by inducing labor or by cesarean section	occurs three times as often in multiparas (para 5 or more) than in primigravidas; previous high death rate lowered in developed countries where swift hospitalization possible; lack of immediate care is fatal in severe cases
Postpartum hemorrhage	loss of blood in excess of 500 ml during the first 24 hours after delivery	amount of blood loss may be slight or great, even small amount dangerous for women already anemic; treatment involves blood transfusions	three major immediate causes: failure of uterus to contract (accounting for 90 percent of hemorrhages), vaginal or cervical lacerations, retention of placenta or placental fragments; predisposing factors: multiple pregnancy, high parity, prolonged and difficult labor, operative delivery; if delivery done in hospital with adequate blood for transfusions, fatality is low; in developing countries mortality rate for postpartum hemorrhage may be as high as 95 percent

Table 9—Continued

Condition	Description	Clinical Characteristics and Management	Maternal Causes and Consequences
SEPSIS: Puerperal infection, childbed fever	postpartum infection of the genital tract, accompanied by temperature of 100.4° F (38.0° C) or higher, on any two of the first ten days postpartum, exclusive of the first 24 hours	commonly affects endometrium; may extend into veins and cause thrombophlebitis (reason for almost half puerperal infection deaths; may also result in general peritonitis; prompt treatment with antimicrobial drugs essential	infection-causing organisms, usually <i>streptococcus</i> , <i>staphylococcus</i> , and <i>Escherichia coli</i> , may have been introduced into genital tract or be normal inhabitants of it; major predisposing factors: hemorrhage, anemia, prolonged and difficult labor; depending on causative organism and promptness of medical care, puerperal infection may be mild or fatal within a few hours

SOURCES: Dorland's Illustrated Medical Dictionary, 25th edition. Philadelphia, Saunders, 1974. 1748 p.; Hellman and Pritchard (53,54,55); Nortman (95).

Constitutional conditions which can cause maternal complications include anemia, cardiovascular disease and kidney disease.

Toxemia of pregnancy, either preeclampsia or its more serious form, eclampsia, is a pathological condition of unknown etiology which usually occurs during the last month or two of pregnancy, most commonly in primigravidas (women pregnant for the first time) or multiparas over 35.

The condition is characterized by hypertension, rapid weight gain, edema, and high levels of sodium. It may be controlled with timely antenatal medical care. Lack or delay of treatment may result in convulsions, coma, and death (see Table 9).

Hemorrhage associated with pregnancy and childbearing usually results from placental abnormalities or failure of the uterus to contract after delivery. Placental abnormalities causing antepartum hemorrhage are placenta previa (a placenta which adjoins or covers the cervix) and abruptio placenta (premature separation of a normally implanted placenta). Both of these abnormalities are two to three times more frequent in multiparas than in primiparas, but age becomes even more important than parity in increasing the risk of placenta previa (see Table 9). Failure of the uterus to contract accounts for 90 percent of the cases of postpartum hemorrhage. The remaining 10 percent is usually due to retention of the placenta or placental fragments. High parity is one of the most important factors contributing to postpartum hemorrhage (see Table 9) (52,53, 54,55).

Sepsis of the genital tract, sometimes referred to as puerperal infection or childbed fever, remains a frequent complication of childbirth in developing countries where births are often attended by untrained midwives working under septic conditions. Puerperal infection which may be caused by various organisms such as streptococcus, staphylococcus, and *Escherichia coli*, sometimes extends into the pelvic veins, resulting in thrombophlebitis, an important cause of maternal deaths. Hemorrhage, malnutrition, anemia, and difficult labor, all of which predispose a woman to puer-

peral sepsis, are also associated with multiparity (see Tables 8 and 9) (52,53,54,55).

Two other complications which frequently result from repetitive childbearing are varicosities and "pelvic relaxation". Although not life threatening, these complications may cause discomfort and sometimes require surgical repair. Varicosities (unnaturally distended veins) are common during and after pregnancy. They are usually veins in the legs, hemorrhoidal plexus, or vulva. Often the varicosities diminish after delivery, but in some cases are severe enough to require bedrest. If varicose veins in the vulva rupture, bleeding may be profuse, which can be dangerous for anemic women (26,53,54).

Pelvic relaxation (lengthening of the tissues and structures supporting the uterus, bladder, rectum, and upper posterior wall of the vagina) occurs to some extent in any woman who has delivered vaginally. Often, the symptoms of pelvic relaxation, a mass protruding from the vagina, do not appear until after menopause. The symptoms and the severity of the condition vary depending on the organs affected, but the condition frequently requires surgical repair (26).

ABORTION AND PREGNANCY

Induced abortion is being used increasingly throughout the world to terminate pregnancy (73). While legal abortion is becoming more available, illegal abortion, often done inexpertly and under poor hygienic conditions (98), remains a major threat to the life and health of women. Reliable data on the incidence of illegal abortion, usually performed clandestinely, are difficult to obtain but surveys indicate that probably 20 to 30 million illegal abortions are performed annually throughout the world (73). In some urban areas the number of abortions equals and even surpasses the number of live births (105). Illegal abortion may result in infection, hemorrhage, or mechanical injury which may cause death or impairment of the woman's health (98,147). In Chile, for example, an estimated 39 percent of all maternal deaths in 1963 resulted from complications of illegal

abortion (97,147). Tietze, using data from the USA, compared the risks of legal abortion performed in a hospital with illegal abortion performed outside a hospital by persons without medical training and concluded that the low

mortality rate associated with legal abortion (3 per 100,000 abortions) was in sharp contrast to the high mortality associated with illegal abortion (100 per 100,000 abortions) (128).

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