Research Needs in Maternal Morbidity

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I. Introduction

The improvement of maternal health is one of the Millenium Development Goals. To achieve this goal, states are called upon to undertake measures to reduce the maternal mortality ratio and increase the proportion of births attended by skilled persons. WHO estimates that more than 30 million women suffer ill health or death from pregnancy and childbirth (WHO, 2003a). Measures to improve maternal health in the form of increasing skilled attendance and emergency obstetric care are expected to contribute to a decline in the burden of maternal mortality as well as morbidity.

Going beyond the issue of maternal health, the issue of maternal morbidity intertwines with other millennium development goals. For example, goals related to achieving universal primary education (of girls) and promotion of gender quality in education would reduce the number of adolescent pregnancies and the accompanying higher levels of maternal morbidity. Women suffer chronic and residual conditions like anemia, infertility, fistula and prolapse silently over the years. These conditions (especially fistula) reduce their acceptance within the family and community, thereby inviting discriminatory treatment. In addition, women's mobility in seeking or migrating for work and their economic productivity are adversely affected by such conditions. A heavy burden of reproductive morbidity, including maternal morbidity, would therefore make it more difficult to attain the MDG on eradicating extreme poverty and hunger. Conversely, success in reducing the spread of HIV/AIDS, malaria and other diseases would reduce the burden of indirect maternal morbidity arising from these conditions. On another note, maternal morbidity during pregnancy leads to higher perinatal and neonatal mortality, thereby affecting attainment of the MDG on reducing child mortality. Thus while it is clear that addressing the issue of maternal morbidity derives squarely from the MDG on improving maternal health, it is in parallel related to most of the other goals.

According to DALY estimates in the 1990 Global Burden of Diseases (GBD) study, reproductive ill health accounted for 22% of the global disease burden among women of reproductive age (15-44) and 3% for men (WHO, 1998a). Maternal conditions dominated the burden of reproductive ill health, accounting for 14.5% of GBD, particularly in areas such as sub-Saharan Africa and India, where maternal ill health accounted for 24.4% and 10.2% of GBD respectively.

In the area of reproductive health, data on incidence and prevalence of specific conditions are far from universally available although much has changed in recent years. Knowledge about sexually transmitted diseases and HIV/AIDS has improved in several countries. However, the burden of disability resulting from pregnancy related conditions remains poorly measured and documented. Little rigorous research has been done in the area of obstetric morbidity. Most studies of maternal morbidity from developing countries are hospital-based rather than community-based, and most are retrospective rather than prospective. Direct obstetric complications are usually acute and infrequent from the measurement point of view. Hence they cannot be captured through retrospective surveys involving clinical examination of women (Fortney, 1999). Given that very few women in developing countries deliver within facilities, these do not represent the true extent of maternal morbidity in the community. Moreover, hospital studies shed light only on acute complications of pregnancy, while community based studies tend to rely on self-reported symptoms. Comparisons of self-reports

with medical records have shown that women's perceptions do not provide a reliable estimate of the population prevalence of reproductive morbidity (Fortney, 1999). The geographic focus is uneven, which together with the uneven distribution of interest in particular conditions leads to a skewed perception of incidence and prevalence (Leskin, 1990).

A WHO working group in 1989 defined obstetric morbidity as morbidity in a woman who has been pregnant, regardless of the site or duration of pregnancy, occurring from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes (WHO, 1990a). Maternal morbidity has been classified in several ways. This paper uses the following classification, based on suggestions of the above working group:

Direct morbidity:
- Maternal hemorrhage
- Maternal sepsis
- Hypertensive disorders
- Obstructed labor
- Spontaneous or complicated abortion
- Mastitis and other breast conditions

Residual conditions of direct morbidity
- Vesicovaginal fistula or Rectovaginal fistula
- Stress incontinence
- Secondary infertility
- Pelvic inflammatory disease
- Dyspareunia
- Neurological sequelae: obstetric palsy
- Sheehan's syndrome

Indirect morbidity
- Anemia
- Other nutritional deficiencies
- Malaria
- Hepatitis
- Tuberculosis
- Urinary tract and genital infections
- HIV
- Cardiovascular disease

Psychological obstetric morbidity
- Puerperal psychosis

There are conspicuous gaps in our understanding of the pathogenesis and management of indirect morbidities and long term or residual morbidities. The major elements of reproductive ill health covered in the GBD study include STDs and HIV, reproductive cancers, and maternal conditions (WHO, 1998a). Maternal conditions include only the five direct obstetric complications (hemorrhage, sepsis, hypertensive disorders, obstructed labour, abortion) that result in maternal death. The DALY methodology excludes all indirect obstetric complications, which have been estimated to cause 20% of all maternal deaths or more. Data on maternal morbidity is very sparse, but data on causes of maternal mortality suggests that indirect causes

might be responsible for a greater proportion of maternal deaths in certain regions. Information on the causes of maternal death in five countries of the South East Asia region highlights these differences (table 1) (WHO, 2000a). For example, indirect causes are responsible for 19.3% of maternal deaths in India, 23.5% in Nepal and 45% in Sri Lanka.

Table 1: Distribution of maternal deaths by cause in selected countries of south east Asia region					
	India, 1994 (Office of the Registrar General, India, 1994)	Myanmar, 1989-90 (Ministry of health, Myanmar 1997)	Nepal, 1997-98 (Ministry of health, Nepal 1998)	Sri Lanka 1995 (Ministry of health, SriLanka, 1995)	Thailand 1996 (Ministry of public health, Bangkok, 1998)
Direct causes	66.4	76.6	69.8	54.6	96.3
All indirect causes	19.3	10.3	23.5	45.0	3.4
Unknown unclassifiable causes	14.2	13.1	6.8	-	-

A review of 16 years of maternal deaths (between 1979-1985) in a leading referral hospital in India found that of 116 maternal deaths at the hospital, 55.2 per cent were due to direct causes, 43.1 per cent were due to indirect causes and the remaining 1.7 per cent were due to unrelated causes (Anandakshmi et al, 1997). Studies also suggest that if the length of time included in defining maternal mortality is extended beyond 42 days, the contribution of indirect causes might increase. A study in rural Nepal found that the relative risk (RR) of death during the period from the onset of labor until seven days after end of pregnancy was 37.02, the RR for 2 to 6 weeks, 7 to 12 weeks and 13 to 52 weeks after pregnancy were 4.8, 2.6 and 1.01 respectively (Pradhan et al, 2002). During the conventional maternal mortality period, all 22 deaths were attributed to direct causes, whereas during the 6-12 week period, 3 out of the 5 deaths were related to respiratory infection, leishmaniasis and hepatitis.

A much-ignored aspect of maternal morbidity is residual or long-term morbidity, which is attributable to delivery or abortion, and includes conditions such as uterine prolapse, fistula, and secondary infertility. It is estimated that 15 million women annually develop long-term disabilities due to pregnancy related complications (WHO, 1993).

Despite the large numbers of women who are estimated to have suffered maternal morbidity, little is known about their health effects, psychological, social and economic consequences (Commission on behavioral and social sciences and education, 2000). The consequences of maternal morbidity can be direct, on the mother, or indirect on children, families and society.

II. A framework for identifying research priorities

We may identify research priorities in respect of key morbidities, by identifying lacunae in our understanding of the following:
      a. What is the burden of the problem?
      b. What are the determinants?

      c. What are the current options for intervention, and how effective are these interventions in addressing the problem?

In this paper, we have discussed some specific areas of maternal morbidity, which in our view are least explored. Most of these are indirect or residual long-term morbidities.

1. Malaria
2. Tuberculosis
3. HIV
4. Hepatitis
5. Anemia
6. Micronutrient deficiencies other than anemia
7. Prolapse
8. Fistula
9. Psychological morbidity
10. Mastitis and other postpartum problems

II. Specific areas of maternal morbidity and research priorities

1. Tuberculosis

It is estimated that tuberculosis leads to the death of more women and men each year than any single infectious disease (Murray, 1996), with the highest prevalence in South-East Asia. Although most studies find that *infection* is more likely among men than women after the beginning of adolescence, it nevertheless appears that more women than men of reproductive age are likely to develop the disease (Dolin, 1998). Hence TB remains a leading cause of death among women of reproductive age. Up to 80% of all deaths among women due to TB occur during the childbearing years (Connoly, 1996). Concerns exist that gender differentials in TB case detection and treatment outcomes may be due to variety of factors such as differences in reporting of respiratory morbidity, gender distinctive barriers to access, and stigma. It is now recognized that the proportion of female cases identified rises more following active rather than passive case finding. Thus it is likely that a large number of pregnant women have coexisting TB. The spread of HIV infection has resulted in extensive epidemics of tuberculosis, increasing the expected incidence and mortality up to five fold (WHO, 2001). HIV has also facilitated the epidemic spread of drug-resistant strains.

No data is available on the incidence of TB in pregnant women. Very little data is available on the contribution of TB to maternal mortality, although some of the recent studies have shed light on maternal mortality on coexistent HIV and TB. One prospective study in South Africa found that the maternal mortality (defined as death of a mother within one year post delivery) rate for tuberculosis and HIV-1 co infection was 122/1000, while for tuberculosis without HIV-1 co-infection it was 38.5/1000 (Khan et al, 2001). Fifty four percent of maternal deaths caused by tuberculosis were attributable to HIV-1 infection. A hospital-based study in Andhra Pradesh, India found that the mortality rate for HIV-1 with tuberculosis and anemia was 12%; while for tuberculosis with malnutrition and without HIV-1 it was 4%. Out of 40 maternal deaths, 25%

were HIV-1 infected and 12.5% were co-infected with tuberculosis (Tamma et al, 2003). Research is needed to understand the true incidence and prevalence of TB during pregnancy, and its contribution to maternal mortality.

Studies differ on whether the rate of progression of TB changes during pregnancy (Schafer et al, 1975). The available literature on the subject, much of it dating from pre-chemotherapy era is confusing. Several studies by the middle of the twentieth century found an increased rate of deterioration of tuberculosis during the first postpartum year (Hedwall, 1988, Gierke, 1956). It was thought that the descent of the diaphragm after parturition leads to changes in the intra-thoracic pressure, which is accompanied by hormonal fluctuations, the nutritional strain of lactation, insufficient sleep and altered immunity. All of these increase susceptibility to pulmonary tuberculosis. However, it is not universally accepted that an increased risk of progression exists in postpartum period (Espinal et al, 1996), compared to the potential for deterioration that exists in any untreated patient over a one-year period (Selikoff, 1965). Studies to date suggest that if effective chemotherapy is given, tuberculosis need not be any more risky during pregnancy than it would be otherwise (Khilnani, 2004, WHO, 2000a). However, the effect of pregnancy on untreated or inadequately treated tuberculosis is still an open question. Further research is needed to assess whether pregnancy or puerperium alter the progression of TB and the factors influencing its progression in pregnant women.

Some studies have shown that pregnant patients with active tuberculosis have few of the typical symptoms. Between 20 and 67% of pregnant women presenting with pulmonary TB are unaware of their disease and have no significant symptoms (Carter et al, 1994, Wilson et al , 1973, Vallejo, 1992). Moreover, a chest radiograph is contraindicated in the first trimester. This might lead to delay in diagnosis of the condition for pregnant women. Research is needed to understand whether pregnancy and puerperium influence the recognition of symptoms of TB, and the differences in diagnosing the condition among pregnant women, non-pregnant women and men.

Whether TB during pregnancy leads to a poorer outcome for the mother or fetus is not clear. Some studies have shown no adverse effect (Selikoff et al, 1965), while others have found an increased risk of toxemia, hemorrhage, miscarriage and difficult labour among women with tuberculosis (Bjerkedal et al, 1975). There is general agreement that appropriately treated TB does not worsen the outcome of pregnancy. However, since several women in developing countries do not have access to prompt and complete treatment, greater understanding is needed on the influence of untreated TB on both maternal and fetal outcome of pregnancy.

The WHO control strategy of TB, "DOTS", adopted in 1998 by 119 countries (WHO, 2001a, WHO, 2000) promotes passive case finding of pulmonary, contagious cases of TB. The DOTS strategy is considered efficient and most cost-effective for controlling TB today. However, this strategy has been criticized for not being gender sensitive and not taking into consideration the different life conditions affecting women (Diwan et al, 1998). One of the reasons is that only limited information is available on how the different life conditions and biology of males and females affect the risk of infection, progression to disease, case fatality and access to care and cure from TB (Granje et al, 1998). Studies have found that women are more likely to be diagnosed through active case finding and that the prevalence among men and women becomes similar as a result of active case finding (Cassels et al, 1982). Diagnosis requires

repeated visits to a health facility with appropriate equipment and expertise for smear microscopy, and treatment requires drug therapy for a minimum of six months, which should be observed by a health worker or a trained volunteer. Women's lack of financial resources, access to transport and social mobility is likely to affect the accessibility of diagnosis and treatment. The stigma attached to tuberculosis additionally affects care seeking among women. A study from Mumbai, India, showed that married women with tuberculosis expressed fears of rejection by their spouses or families, while unmarried women worried about reduced chances of marrying as well as losing their jobs (Nair et al, 1997). Women in Bangladesh reported lack of confidentiality offered by formal health services as a reason for preferring traditional healers (Fair et al, 1997). Cultural norms that discourage deep coughing (to bring out sputum) on part of women may affect sputum-positivity rates. Lastly, women appear to face greater delays in diagnosis and treatment at the institutional level.

Guidelines on which TB drugs to use in pregnancy are not consistent. Among the first line drugs, streptomycin is contraindicated in pregnancy. For uncomplicated TB in pregnancy, WHO recommends a six-month regimen based upon Isoniazid, rifampicin and pyrazinamide (WHO, 1997), with the recommendation to use ethambutol if a fourth drug is needed. However, pyrazinamide does not have sufficient studies to ensure its safety during pregnancy, and textbooks and reviews continue to recommend that its use be avoided during pregnancy (Khilnani, 2004, Tierney, 1998). Further research is needed to understand more clearly the effects of first line TB drugs on the fetus and woman. Because of metabolic changes accompanying pregnancy, the tolerance of TB drugs might be altered. Research is needed to on how pregnancy alters the tolerance of TB drugs, and what is the compliance and adherence to TB treatment among pregnant women.

Most drugs utilised for treating drug resistant tuberculosis are contraindicated during pregnancy (WHO, 1997b). These include aminoglycosides, ethionamide, prothionamide, and fluoroquinolones. Guidelines on management of drug resistant TB tend not to address management of the condition during pregnancy (WHO, 1997b), while some accounts recommend therapeutic abortion for multi-drug resistant TB (Khilnani, 2004). Given that resistant strains have become more common because of HIV, greater clarity is required on management during pregnancy, with identification of safe drugs.

There is a lack of information on women's treatment-seeking behaviour during pregnancy and puerperium, barriers to treatment and health systems issues like where to locate services for detection and management of the disease. Would pregnant women with TB be better diagnosed at antenatal clinics or DOTS centers? What are the knowledge, perceptions, beliefs and concerns of pregnant and puerperal women, regarding TB treatment? What difficulties do women face during pregnancy and puerperium in treating TB, and how can antenatal services and national tuberculosis programmes best be organized to meet the needs of women with TB? What are the rate of cure and default among pregnant or postpartum women?

2. Malaria

Malaria is a major cause of maternal mortality, accounting for 23% of maternal deaths in hospital studies and 18% in community studies (Brabin et al, 2002). Reviews and studies on

malaria have shown that cerebral malaria is a major maternal killer and contributes to severe maternal morbidity in several countries of sub-Saharan Africa and in southern Asia (Brabin, 1991). Accurate estimates of the incidence of cerebral malaria in pregnancy are lacking. However, its consequences are serious, with case fatality rates approaching 50% (Looareesuwn et al, 1985).

The detrimental effects of plasmodium falciparum infection during pregnancy are well known – maternal consequences include placental infection, anemia, febrile illness, cerebral malaria and puerperal sepsis (WHO, 2004). Consequences for the fetus include stillbirth, abortion, congenital infection and low birth weight. Pregnant women are considered to be more susceptible to p. falciparum -- their risk of developing serious disease as a result of infection is 2-3 times greater than that for non-pregnant women living in the same area (Luxemberger et al, 1997). Malarial parasitemia is greater among pregnant women than for non-pregnant women, and is characterised by placental invasion by plasmodium falciparum (van Den Brook et al, 1998).

The effects of other 3 parasites that cause malaria in humans are less clear. The evidence for increased morbidity of plamodium vivax malaria in pregnancy is equivocal. Some studies have suggested that a greater risk of acquiring P. vivax infection in pregnant women than in non-pregnant state (Camargo et al, 1996). However, another study conducted in a predominantly p. vivax endemic region of Sri Lanka failed to detect a significant impact of malaria on pregnancy (Wickremasinghe et al, 1995). A study among non-immune pregnant women in Thailand reported that vivax malaria during pregnancy is associated with maternal anemia and low birth weight, but to a lesser degree than that caused by p. falciparum (Nosten et al, 1999). Plasmodium vivax causes less than ten per cent of malaria in Africa, and more than 50% in other regions (Mendis et al, 2001). Studies are needed to better define the effects of P. Vivax malaria on pregnant women and newborns. The role of chemoprophylaxis and intermittent treatment in the management of this infection also needs to be examined.

Risk factors for getting infected and developing severe disease include the endemicity of P. Falciparum transmission, parity, age and HIV status. In areas of relatively stable malaria transmission, the principal effects of malaria infection during pregnancy are maternal anemia and the presence of parasites in the placenta. In areas of low or unstable malaria transmission, pregnant women have little or no immunity to malaria, and may die as a direct result of severe malaria or indirectly, as a result of severe anemia (WHO, 2004). Nulliparous women are more prone to placental infection than multiparous women. Some studies have found age to be a significant risk factor even after adjusting for gravidity (Granja 2002, WHO, 2003). Young women are more likely to die from malaria than older women. Studies have suggested that higher rates of malaria among young primiparas could be attributed to psychological, social and economic factors rather than biological factors (Okonofua, 1992). This needs to be explored further. HIV infection may further impair the efficacy of immune responses during pregnancy, and reduce antimalarial immunity (Steketee 1996).

Malaria infection in pregnant women is largely asymptomatic in areas of greatest burden and thus requires a preventive approach (WHO, 2004a). This traditionally has comprised weekly chloroquine (CQ) prophylaxis to reduce malarial parasitemia and maternal anemia. The implementation of the policy of chemoprophylaxis has however been limited by a number of

factors, including (i) spread of antimalarial drug resistance, particularly to chloroquine (ii) poor compliance with a weekly regimen, and (iii) adverse effects, especially pruritus due to chloroquine. Since this strategy has been shown to of limited effectiveness, it is no longer recommended (WHO, 2004).

Concern has been voiced that the pregnancy malaria situation is deteriorating and no appropriate obstetric technologies to manage this threat are immediately available (Bergstrom, 2001). There are a limited number of safe and effective anti-malarial drugs for use during pregnancy. New drugs are not available or accessible for wide circulation in the countries most affected or they are too expensive for large-scale use. WHO recommends that halofantrine, tetracycline, doxycycline and primaquine should not be used during pregnancy (WHO, 2004). Resistance of P Falciparum to chloroquine is common in practically all malaria endemic areas, while resistance to sulfadoxine-pyrimethamine is becoming common in South America and South East Asia (WHO, 2000c). Artemisinin and its derivatives are recommended for use in severe malaria and also for treatment of uncomplicated malaria during second and third trimesters of pregnancy in areas of multiple drug resistance (WHO, 2001a). There is, however, lack of data on the actual use of artimisinin derivatives in pregnancy. Pre-clinical studies have shown that artimisinin and its derivatives do not exhibit mutagenic or teratogenic activity, but these drugs caused fetal resorption in rodents at relatively low doses (WHO, 2001a). Formal trials to test the safety of artimisinin derivatives during pregnancy are needed, but may be difficult to conduct. It is important that clinical experience is vigilantly recorded when women are exposed to these drugs.

WHO issued a strategic framework for malaria control in pregnancy in 2003 (WHO, 2004). It recommends intermittent preventive treatment (IPT) using 2 doses of sulfadoxine-pyrimethamine after quickening, for malaria prevention and control during pregnancy, in areas of stable transmission. Sulfadoxine-pyrimethamine (SP) is the recommended pharmaceutical treatment during pregnancy due to its relative efficacy and safety, because it is a single dose treatment, and this treatment has shown a reduction in incidence of low birth weight (Verhoeff 1998). Insecticide treated bednets (ITN) should be provided to all pregnant women as early in pregnancy as possible and symptomatic women should receive effective case management of malaria and anemia. For uncomplicated malaria in pregnancy, the recommended antimalarial drugs are chloroquine and SP. Quinine is an alternative for areas where both CQ and SP are not effective, and is the drug of choice for uncomplicated malaria in the first trimester and for severe malaria.

However, there is a need for alternative safer anti-malarial drugs for IPT especially during the latter half of pregnancy. Among the currently available alternatives to CQ and SP, mefloquine, quinine, proguanil, amodiaquine and a combination of pyrimethamine and dapsone are available for use during pregnancy. Most of these suffer from problems with compliance, resistance or are too expensive. With the emergence of SP resistance in southern Africa, there is a need to evaluate other antimalarial drugs, either alone or in combination.

Operations research is needed to determine the feasibility and effectiveness of IPT in the programme setting. Many cultural factors determine how women perceive drugs and other components of treatment. Research is also need to understand care-seeking patterns -- what are the perceptions, beliefs and concerns of pregnant and puerperal women regarding malarial

treatment and prophylaxis? What is the compliance with intermittent therapy among pregnant women? From where do pregnant women with malaria seek care - antenatal clinics or other health facilities? It is also important to understand providers' practices regarding malaria in pregnancy, so that successful implementation plans can be developed.

3. Viral Hepatitis

Enterically transmitted hepatitis is a common problem in developing countries, with both sporadic cases and epidemic outbreaks. The causal agents are hepatitis A and hepatitis E virus. The main mode of transmission is faecal-oral. Homologous immunity after infection probably lasts for life, at least for hepatitis A. The case fatality rate for enterically transmitted hepatitis is usually low (less than 1 in 1000), but is much higher among pregnant women infected with hepatitis E during late pregnancy. In such cases, the disease can be fulminating and case fatality rate may reach 20% (WHO, 2001b).

The case fatality rate for hepatitis A is not known. A study in Angola found a high case fatality rate for jaundice during pregnancy (Strand 2003). Among 20 pregnant women with jaundice, 6 died, whereas there was no death among 40 pregnant women without jaundice in the control group. Major causes of jaundice among the cases were hepatitis E and p. falciparum infection. The contribution of viral hepatitis to maternal mortality widely varies between different settings. Viral hepatitis was found to be a major cause of maternal mortality in Ethiopia, ranking third among the leading causes of maternal mortality (Kwast, 1987). A hospital-based study from India has found that viral hepatitis was responsible for 11-12% of maternal deaths (Anandlakshmi, 1997). Another hospital-based study from South India found that hepatitis (5.8 percent), heart disease (4.7 percent) and anemia (2.3 percent) were the leading factors among indirect causes (Rajaram et al, 1995).

Considering its contribution to maternal mortality, it is likely that a much higher proportion of women suffer from hepatitis. However the effects of viral hepatitis on pregnancy are not well understood. For hepatitis A, the risk of transmission to the fetus appears to be nil but the risk of pre-term birth appears to increase (Steven, 1981). In the above Angola study, there was foetal loss in 55% and stillbirth in 30% of cases, compared to one stillbirth among control women. Clearly, the effects of hepatitis on maternal outcome need to be explored further.

The diagnosis of hepatitis is suspected on clinical grounds (acute jaundice, dark urine, anorexia, malaise, extreme fatigue and right upper quadrant tenderness), with confirmation is by a laboratory test (IgM for hepatitis A and E). It is likely that the diagnosis gets delayed among pregnant women because initial symptoms like anorexia, nausea and fatigue are common during pregnancy, and therefore may not be taken seriously. The difference in care-seeking behavior for hepatitis between pregnant and non-pregnant women needs to be studied, so that interventions can be designed accordingly. In developing countries, laboratory tests for jaundice and hepatitis are seldom available in primary care settings. Simpler and more affordable screening methods need to be developed for diagnosis of hepatitis at primary health care levels.

The management of hepatitis consists of a well-balanced diet and sedentary living. Current policy is to recommend of hospitalization of all pregnant women until they are able to consume

a normal diet liver function tests have returned to normal (Williams Obstetrics, 1989). Poor women in developing countries may not be able to avoid a regular work routine, hence there is need to test more ambulatory management protocols for viral hepatitis in pregnancy, that primary care providers could adopt.

4. Anemia in pregnancy and the postpartum period

Anemia during pregnancy is widely prevalent -- more than half of all pregnant women in the world are anemic (WHO, 1991). Among the six WHO Regions, South-East Asia has the highest prevalence (table 2).

Table 2: Magnitude of the iron-deficiency anemia problem (adapted from Friere, 1997)

Regions	Prevalence of anemia in pregnant women (%)
Africa	52
The Americas	40
Europe	18
Eastern Mediterranean	50
Southeast Asia	74
Western Pacific	40
Developed countries	18
Developing countries	56
Total	51

Not only is anemia more common during pregnancy, but it also tends to be more severe. The prevalence of severe anemia (hemoglobin below 7 gm%) among pregnant women in one region of Tanzania was 7% (Bergsjo, 1996), while in rural Bangladesh, more than 10% were severely anemic in postpartum period, both 48 hours after delivery and 2 weeks later (BRAC, 1994).

Brabin et al estimate that between 16,800-28,000 women die each year from anemia-related causes (Brabin et al, 2001). Anemia contributes to maternal death both directly and indirectly -- acute onset of anemia in pregnancy can lead to rapid cardiac decompensation, which can cause lactic acidosis, shortness of breath and heart failure (Brabin et al, 2001). It also aggravates the effects of sepsis and haemorrhage – the latter puts women at risk of hypotension and death with even moderate bleeding (Steketee, 2003). Maternal anaemia also increases the incidence of low birth weight, anaemia and protein-energy malnutrition in infants. It produces fatigue and diminished work productivity, inhibits the body's ability to regulate temperature when exposed to cold and alters hormonal production (Friere, 1997).

The contribution of anemia to maternal death varies by region, ranging from 6.4% of maternal deaths in Africa, 7.3% in Asia and 3% in Latin America (Brabin et al, 2001). A study in the

Gambia found anemia to be an indirect cause of death in 8% of maternal deaths and a co-factor in another 41% (Hoestermann et al, 1996). Anaemia was reported to be an indirect cause in almost one-fifth of maternal deaths (19.3 %) in rural India (Office of the registrar general, 1994).

The etiology of anemia is well understood - throughout most of the developing world, deficiency of micronutrients such as iron, folic acid and vitamin A, which are important for the production of health red blood cells, is the leading cause of anemia. Malaria and hookworm infestations also contribute to mortality and morbidity due to anemia (Steketee, 2003). The hemodynamic changes of pregnancy lead to hemodilution, which aggravates anemia. Early childbearing in already anemic adolescent girls, the tendency of women to avoid prenatal care in early months of pregnancy, and dietary patterns during pregnancy are also likely to influence the prevalence of anemia during pregnancy.

Inexpensive solutions to the problem have been identified. Routine iron supplementation is recommended in almost all contexts for 6 months (INACG, 1998). Where the prevalence of anemia in pregnant women is high (> 40% or more), supplementation with 60 mg iron and 400 mg folic acid is recommended during pregnancy and continued in postpartum period for 3 months to enable women to acquire adequate iron stores. Where the problem of hookworm is endemic (prevalence 20-30% or more), anthelminthic treatment is also recommended once in the second trimester of pregnancy (INACG, 1998). However, while the geographical distribution of anemia is well understood, information is lacking on the prevalence of parasitic infections in geographical regions.

However, high prevalence of anemia among pregnant women persists despite the availability of effective, low cost interventions for prevention and treatment (Friere, 1997). The proportion of women consuming iron supplementation remains low in pregnancy and postpartum period, due to inadequate coverage of antenatal, and even lower coverage of postnatal care. Side effects of iron preparations and cultural beliefs lead to poor compliance of iron supplements by pregnant women. Because the level of coverage of antenatal and postpartum care is low in several countries, alternative mechanisms might be adopted for early identification of iron deficiency and monitoring of pregnant women. One study from Australia suggests that low dose (20 mg) iron can effectively prevent iron deficiency anemia when given during pregnancy and has less of a tendency to produce gastrointestinal side effects, thus preventing discontinuation of supplementation (Makrides et al, 2003). Research is also needed to identify the optimum supplement with minimal side effects and better compliance, its dose, and frequency of consumption.

For combating iron deficiency anemia, PAHO/WHO recommends a comprehensive approach consisting of a set of interventions that include (i) fortification of a widely and frequently consumed food product that is low cost and readily available in the market (ii) provision of iron supplements to pregnant women; and (iii) dietary diversification promoted through marketing activities, mass communication and education (Friere, 1997). However, food fortification programmes would need operations research to identify food products that can serve as vehicles, an assess the industrial capacity to process them, analysis of packaging, marketing and distribution of products, identification of appropriate target population, acceptability, and quality assurance mechanisms.

Treatment of moderate and severe anemia is essential to prevent the risk of cardiac decompensation and maternal death. However, several women with moderate or severe anemia may not be recognized in primary care settings. In order to improve the detection of moderate and severe anemia, the screening techniques need to be simplified and widely available. Detection of anemia requires hemoglobin estimation using dilutional techniques or a special filter paper and color comparison cards (hemoglobin color scales), and assessment of pallor, which has low sensitivity and specificity. The accuracy of dilution techniques is adversely affected by manual dilution -- there is a need for further development of accurate and reliable non-dilutional techniques. The hemoglobin color scale is not widely available. Operations research is needed to test ways to ensure its wide distribution.

Moderate anemia (hemoglobin levels 7-10 gm%) needs to be treated promptly to prevent severe anemia. Treatment of severe anemia requires oral iron, transfusion (packed cells or blood) and antimalarials and anthelminthics (WHO, 2000d). However, there often is little readiness for blood donation among family members in situations where women's status is low. Greater understanding into the perceptions, especially on part of men and family decision makers, about blood donation and transfusion in different communities is needed. Appropriate communication messages may then be designed and tested on the basis of such formative research. Several women with severe anemia or their families, may not be willing to travel to district level even when blood transfusion is available and may have to be treated at primary level, especially in mid-pregnancy. The second best option -- intramuscular and / or oral iron might be assessed, especially for remote and interior areas. However, there are concerns about adverse reactions of intramuscular iron, especially when used in primary care situations. The feasibility of administration of intramuscular iron preparations by paramedics needs to be tested, and their adverse effects need to be recorded in program setting. Research might also be needed to develop better and safer injectable preparations that can be used by paramedics in primary settings.

5. HIV in pregnancy

The HIV/AIDS epidemic intersects with the problem of maternal mortality in many ways. The extent of the contribution of HIV/AIDS to maternal mortality is difficult to quantify, as the HIV status of pregnant women is not always known. The prevalence of HIV in pregnant women attending antenatal clinics varies widely between regions. In Kenya, Malawi, Nambia, Rwanda, South Africa, Tanzania, Zambia and Zimbabwe, the prevalence among pregnant women is more than 10%, while in Thailand is was 2.3% in 1995 (UNAIDS, 1999).

HIV infection and AIDS-related deaths have become one of the major causes of maternal mortality in many resource-poor settings. HIV impacts on direct (obstetrical) causes of maternal mortality by an associated increase in pregnancy complications such as anaemia, post-partum haemorrhage and puerperal sepsis. HIV is also a major indirect cause of maternal mortality and morbidity through increased susceptibility to opportunistic infections such as tuberculosis, *Pneumocystis carinii* pneumonia and malaria (McIntyre, 2003).

However, it is not confirmed whether pregnancy accelerates the progression of HIV infection -- some recent prospective studies have not found any acceleration of HIV in pregnancy, while

one study suggested that HIV infected women with pregnancies were more likely to develop bacterial pneumonia, urinary tract infections and other infections (UNAIDS, 1999, Johnstone, 1998). Infectious complications are more common during postpartum period, especially after caesarean section.

The role of antenatal HIV testing is debated. Voluntary testing of pregnant women is recommended in several developed countries. However, identification of pregnant women is not considered appropriate in situations where counseling and testing services are inadequate (UNAIDS, 1999). Routine testing without consent and without access to counseling is considered an unacceptable practice, and may have more disadvantages e.g. reluctance of women to use services because of fear of discrimination, and stigmatization. Increased risk of violence, higher levels of psychological sequelae are also reported. The potential benefits of voluntary HIV testing before or during pregnancy are that it enables women to take decisions regarding continuation of pregnancy, facilitates early counseling and treatment, helps in preventing transmission to sexual partners, and allows opportunities for preventing transmission to the child along with appropriate follow-up of the child. HIV testing is not available in several primary care settings in developing countries, especially in rural areas. With increasingly sensitive and specific simple and 'rapid" tests becoming available, on-site testing might become more feasible. Reports of use of same day rapid test results in a resource poor setting have suggested that this is an acceptable and appropriate intervention. The feasibility and effectiveness of such tests needs to be further tested.

The management of HIV positive women during pregnancy is multifaceted, combining medical and obstetrical management with counseling and social support. There is no evidence that there is need to increase the number of antenatal visits for HIV positive pregnant women, provided there are no complications, although additional counseling may be required (UNAIDS, 1999). Attention needs to be paid to HIV related infections, such as tuberculosis and coexisting STDs, especially syphilis testing. A hemoglobin estimation and complete blood count are recommended, since anemia is common in HIV positive pregnant women. The value of vitamin A supplementation in reducing transmission has not been proven.

Malaria in pregnancy may be associated with increased risk of mother to child transmission of HIV, and intermittent preventive treatment is recommended in endemic areas. Prophylaxis for other opportunistic infections such as tuberculosis and Pneumocystis carinii pneumonia (PCP), is also recommended. Such prophylaxis should continue throughout pregnancy, since the risks to the fetus of maternal sulfonamide administration in the third trimester are outweighed by the risk to maternal health of PCP. The relative advantages and limitations of specific interventions for HIV in pregnancy need to be better understood.

The use of antiretroviral drugs in pregnancy should be considered from the standpoint of both health of the mother and prevention of transmission. The current recommendation for antiretroviral therapy is that monotherapy with ZDV is sub-optimal treatment and that two anti-retrovirals with possible addition of a protease inhibitor is preferable (UNAIDS, 1999). Although there is theoretical risk to the fetus with combination therapy, there is limited experience with the use of other retrovirals such as lamivudine, stavudine, and protease inhibitors in pregnancy. Some have recommended stopping these treatments during the first

trimester and restarting the combinations, but this carries a risk of developing resistance. The safety of newer compounds in pregnancy needs to be studied.

There are conflicting reports on the importance of obstetric interventions (e.g. scalp electrodes, scalp blood sampling) in the facilitation of transmission. There is increasing evidence that elective cesarean section may help prevent transmission of HIV to the baby, but it carries the risk of higher postoperative morbidity in HIV positive women (UNAIDS, 1999). Moreover, availability of Caesarean section is limited in developing countries with high HIV prevalence. More effective drugs to prevent mother to child transmission would prevent such postoperative morbidity in HIV positive women.

6. Micronutrient deficiencies other than anemia

Women in developing countries suffer from various nutritional deficiencies during their childbearing years, which affect health during pregnancy and lactation. Dietary surveys have consistently shown that multiple micronutrient deficiencies, rather than single deficiencies are common (Mackey, 2000). Micronutrient deficiencies other than anemia also play an important role in maternal morbidity and mortality. Micronutrients play an important role in immune system and their deficiency influences the rate, duration and severity of infections.

Numerous studies have shown that pregnant women have an increased risk of vitamin A deficiency, particularly in populations in which such deficiency is endemic. The endemicity of vitamin A deficiency can be assessed by its prevalence in preschool children -- WHO estimates for preschool children show that vitamin a deficiency is most frequent in South East Asia (69%), Africa (49%), followed by Western Pacific (27%) (WHO, 1995). In Bangladesh, 37% of poor urban lactating women were found to have low serum retinol levels. A significant proportion of pregnant women develop night blindness especially in third trimester – in India, national family health survey found that 12% of women suffered from night blindness in pregnancy (IIPS, 2000). Some studies have suggested that preventing vitamin A deficiency of women before or during pregnancy greatly reduces their risk of mortality and morbidity around the time of childbirth, probably through increasing resistance to infection and lowering levels of anemia (Christian, 1998, Vitamin A global initiative, 1997). In Nepal, the risk of maternal mortality up to 12 weeks after delivery was lowered by about 40% among women who received routine supplements of vitamin A or beta-carotene, compared to those who received a placebo (West et al 1999). Also, low serum vitamin A levels in pregnant women have been associated with increased transmission of HIV to infants, and increased transition from HIV to AIDS (Mackey, 2000).

It is not known as to how frequently night blindness of pregnancy progresses to ocular consequences such as xerophthalmia and blindness. Similarly, it is not understood as to how night blindness affects pregnant women's' ability to carry out routine tasks after evening hours, including the risk of fall. These consequences of vitamin A deficiency need to be understood more clearly. How women perceive this night blindness would determine whether or not they seek care for it, yet there is little data available on women's perceptions and their care seeking behavior for night blindness. It must however be acknowledged that effective vitamin A

prophylaxis would prevent women from lapsing into night blindness, leave alone necessitate specific treatment.

It is not clear whether all pregnant women should receive routine vitamin A supplementation during pregnancy. The vitamin A global initiative recommends that night blindness during pregnancy be used as an indicator to determine whether VAD is a public health problem, with 5% proposed as a cutoff point (VAGI, 1997). It further recommends that that ensuring adequate vitamin A intake of pregnant women should be seen as an essential element of maternal health programs in populations where it is a public health problem. (VAGI, 1997). A WHO/UNICEF/International Vitamin A Consultative Group (IVACG) task force has recommended that pregnant women should receive a diet containing adequate amounts of vitamin A and/or frequent small doses of vitamin A, not exceeding 10000 IU daily or 25000 IU weekly (WHO, 1997). However, recent 4 visit antenatal care model of WHO does not include vitamin A supplements as a routine intervention (WHO, 2002a). A case control study of Nepalese pregnant women found that deficiency generally occurs in the seventh month of pregnancy, that routine maternal vitamin A supplementation reduced the incidence of night blindness by 70% and that beta-carotene was less effective (Christian et al, 1998b). There is need for further research on the benefits of vitamin A supplementation in pregnancy and postpartum period, and whether or not it should be routinely included in antenatal care in developing countries, and the modalities for its distribution (health system, CBD, commercial outlets).

Mild maternal zinc deficiency has been related to complications of labor and delivery, including placental abruption, prolonged labor, premature rupture of membranes and the need for operative delivery (Mackey, 2000). Zinc deficiency has also been reported to be associated with increased risk of pregnancy-induced hypertension. A review of literature by Mackey found that 82% of pregnant women worldwide are estimated to have inadequate intakes of zinc to meet the normative needs of pregnancy, and that zinc deficiency was reported in 25% of postpartum women in Indonesia and 60% of pregnant women in Peru (Mackey, 2000). Evidence on public health interventions using zinc is lacking.

Low calcium intakes have been associated with hypertensive disorders and pre-eclampsia. Analysis of the Cochrane database reveals that among pregnant women consuming low level of calcium (less than 900 mg per day), the risk of high blood pressure was reduced by one half by calcium supplementation, and the risk of pre-eclampsia was reduced greatly among these women (Villar and Belizan, 1998). In the United States, where baseline calcium intakes were higher, calcium had no effect on HDP.

Vitamin B12 deficiency is found to be common in India, partly because of limitation of dietary animal products. In addition, riboflavin deficiency was found to be endemic in the Gambia, China, Indonesia, the former Soviet Union and India (Mackey, 2000). The influence of these deficiencies on health of pregnant women needs to be better understood.

The consequences of malnutrition go well beyond the health consequences. They also influence their ability to sustain work and care for their families. This is an area that needs to be taken on board. Solutions proposed to prevent calcium, zinc and other micronutrient deficiencies include supplementation and food fortification. However, the need for these supplements is not conclusively confirmed and they have not yet found place in standard antenatal care guidelines.

7. Prolapse

Uterine prolapse is one of the problems that results from childbearing as a result of injury or stretching of pelvic ligaments. WHO studies on family formation patterns and health in Columbia, Pakistan, Philippines and Syria indicate that the condition affects 3 to 25 percent of women under 45 (WHO, 1990). The prevalence of prolapse as determined by clinical examination on the basis of eight community based studies in different parts of India found a prevalence rate between less than one percent and 27% (Oomman, 2000). The results of a multi-centre study carried out in Egypt and Jordan found a prevalence of 56.3% and 34.1% respectively. It revealed that age and parity remained the most predictive factors for the prevalence of prolapse despite controlling other factors; and that the accompanying symptoms were feeling of bulge, backaches, vaginal discharge, post coital discomfort and bleeding (Mawajdeh SM et al, 2003). In Sao Paulo, Brazil, a gynecological screening program for women attending a clinic for non-gynecological complaints found a rate of 40 cases of genital dystopia (rectocele, cystocele, perineal rupture or uterine prolapse) per 1000 women (Pinotti et al, 1981). The mechanical stress of many pregnancies and long labors are predisposing factors. The prevalence of prolapse and its determinants need to be better understood. For example, what is the contribution of different obstetric practices (e.g. bearing down, episiotomy for tight perineum, various positions of delivery, early resumption of work after delivery, etc) to the occurrence of prolapse, and how does it correlate with the duration of labour or birth weight. Similarly, how do the age at first childbearing, short birth intervals and number of births influence the risk of developing prolapse?

Women with prolapse suffer from many symptoms ranging from mild to severe. In one Nigerian study of women with second or third degree prolapse, reported symptoms included difficulties with urination, pain, stress incontinence, frequency of urination, backache, sensation of pelvic pressure. Other common symptoms are constipation and pain on defecation (Otubu, 1982). Although some degree of relaxation of pelvic muscles and a consequent mild degree of genital prolapse may not be totally preventable, severe forms of early uterine prolapse are avoidable. Avoidance of bearing down before full dilatation of cervix, avoidance of strenuous work in early postpartum weeks, timely episiotomy in cases of tight perineum, and pelvic floor exercises have been suggested. The feasibility and efficacy of preventive measures is not known. The feasibility of implementing preventive practices such as pelvic floor exercises needs to be tested in field conditions.

Prolapse is most commonly treated by vaginal hysterectomy or by repair operations. Occasionally, a ring pessary may be used for patients who are not willing for surgery or while waiting for surgery. However, women from low socio economic groups usually do not opt for surgery, either because they cannot afford it, because of long waiting times for surgery in

hospitals, lack of time or fear of surgery (Ravindran, 1999). Vaginal pessaries are not commonly used, because of associated risk of vaginal infections, lack of provider training and also because of lack of availability of pessaries of different sizes made of good quality materials. Given the inability of majority of women in developing countries to access surgery, there is need to either find ways to make surgery far more accessible, or to further explore non-surgical options.

8. Fistula

Fistula is a direct consequence of obstructed labor. It is estimated that 2 million women suffer from this condition. Around 50-100,000 more women are estimated to develop fistula each year (WHO, 1998), most of who are less than 20 years old. The incidence or extent of fistula is not clearly known. It appears that there are important geographic variations in the prevalence of obstetric fistulas; specifically it appears to be more common in sub-Saharan Africa than in other parts of developing world (WHO, 1991a). Most studies related to fistulas are based on hospital records, or on reports by gynecologists or surgeons, and while they provide good indication of the existence of fistulae in particular areas of the world, they do not furnish adequate data on the true incidence of the problem. Frequency rates are sometimes given as proportion of gynecological admissions. A WHO review on obstetric fistula in 1991 showed that the highest percentage of fistula for gynecological admissions is 16.4% reported in Sudan. The frequency of fistula among women coming for deliveries varies from 0.03% in Benin city, Nigeria to 0.34% of births in Zaria, Nigeria (WHO, 1991a).

No comprehensive data on epidemiological trends is available for the South Asian region. A survey conducted to investigate the fistula situation in Bangladesh in 2003 found that the number of fistula cases per 1000 ever married women was 1.69 (UNFPA, 2003a), while data from gynecological admissions in 6 medical colleges of Bangladesh reveal that fistula patients constituted up to 2% of admissions. In four community-based studies conducted in India, between 1989-1993, the prevalence of fistula was found to be 0.5%, 0.5%, 7.6% and 0.3% respectively. In Nepal, obstructed labor accounts for 16.3% of maternal deaths (which is twice the global figure of 8%). A reproductive morbidity survey of more than 2700 patients reporting at gynecological clinics in 2 district hospitals shows that 25% women reported pelvic organ prolapse, and 1% reported fistula (UNFPA, 2003a). Three hospital based studies in India show 73% patients had vesico-vaginal fistula, 5% had recto-vaginal and 5% had both (UNFPA, 2003a); eigthy four percent of patients had only one fistula, 13% had two, and one patient had 4 fistula openings.

The profile of women who suffer from fistula shows that most come from rural areas where health services are poor or not existent, where roads are bad and means of transport are few (Tahzib 1983). They are usually illiterate, poor, and have low mean age of marriage, and childbearing, whose births are at home and assisted by untrained persons. A number of studies in Africa have shown that 50-80% of women were under the age of 20, with the youngest patients being under 13 years old (Tahzib, 1983). In Asia, the majority of women with fistula seem to be under 30, but with a greater concentration in 20-24 years age group. A large majority of patients are primiparous, 50-80% in Africa and 30-95% in Asia (WHO, 1991a). In three studies (2 in Pakistan and 1 in Jordan), there was higher percentage of women who had five children or more. This has been explained by the fact that basic malnutrition along with rapid childbearing

and almost continuous lactation results in demineralization of the bones. The ultimate result is osteomalacia, which is still seen as a major cause of secondary disproportion leading to fistulae and other complications (Ahmed, 1988). Early and frequent childbearing, combined with malnutrition is very common in several developing countries, and its effects on demineralization of bones and its consequences need to be better understood through research.

Women who are malnourished from childhood are likely to be stunted. Although very few studies give information about the height of fistula patients, available studies show that it is a contributory factor, with the average height of fistula patients being lower than non-sufferers. Some researchers maintain that height has a greater influence on incidence of fistulas than age (Harrison, 1989). Further research is needed to identify the relative roles of different determinants on risk for fistula.

Obstetric fistula is a result of obstructed labor, which involves prolonged impaction of fetal part against soft tissues of pelvis and a widespread ischemic vascular injury to a broad area. This results in multiple birth related injuries in addition to fistula. These injuries may include total urethral loss, stress incontinence, renal failure, rectovaginal fistula, rectal atresia, rectal sphincter incompetence, cervical destruction, pelvic inflammatory disease, vaginal stenosis, osteitis pubis, infertility and neurological injuries, including foot-drop (Arrowsmith 1996). It is likely that these morbidities coexist among women with fistula. Women suffering from pelvic injuries and foot-drop have difficulty completing such daily tasks as carrying water or firewood or caring for their children (Commission on behavioral and social sciences development, 2000). The prevalence and patterns of these associated injuries, and their consequences on women's lives are even less understood, and need attention.

The consequences of fistula for women are severe in most societies. Women with fistula are often abandoned by husbands, ostracized by family and friends, and even disdained by health workers, who consider them 'unclean'. Shame and social isolation can lead to depression, divorce and even suicide. There is little information as to how women cope with the problem.

Although surgical procedures can repair a large proportion of fistulas, many women in developing countries do not have access to fistula repair surgery. For example, obstetric fistulas occur throughout rural sub-Saharan Africa, yet there are only two prominent fistula hospitals in the whole sub-Saharan region, one in Addis Ababa, Ethiopia and one in Nigeria (Commission on behavioral and social sciences development, 2000). Fistula patients appear to suffer the condition for several years, without seeking treatment. In one sample of 27 patients in Bangladesh, 12 had suffered the condition for more than 10 years. In Bangladesh, the women themselves and families are often unaware about the consequences of early childbearing, prolonged labor and the possibility of prevention or treatment of fistula, as reflected in the finding that 90% of patients attributed their condition to bad luck (UNFPA, 2003a). The reasons for not seeking treatment included ignorance about the availability of surgery, lack of money and lack of caregivers to be with the patient during treatment. A review of hospital records of 293 fistula patients at a large hospital in Nepal found that 41% of patients suffered the condition for 1-5 years, 10% for 6-10 years, and 6% for 11-20 years. The perceptions of women's and families regarding prevention and treatment of fistula need to be understood in different settings, so that appropriate messages can be designed.

Obstetric fistulas are considered almost entirely preventable, so the ultimate solution is to prevent their occurrence. Long-term strategies suggested by WHO and UNFPA for prevention include improving the status of women, and delaying the age of marriage (thus preventing first pregnancy), while immediate term strategies are improving the nutritional status of women and girls, access to family planning, skilled attendance during childbirth and access to emergency obstetric care (WHO, 1989, UNFPA, 2003, UNFPA, 2002).

Identification of women at risk of developing obstructed labor and fistula has also been suggested on the basis of maternal height for primigravidae and serial measurements of symphysio-fundal distance to detect those with large fetuses. The sensitivity of tests to identify women at risk of obstructed labor/ prolonged labor/operative delivery needs to be tested.

Maternity waiting homes have been suggested as one intervention to prevent obstructed labor and fistula. The operational issues related to maternity waiting homes need to be further explored -- where should the homes be in relationship to comprehensive EmOC facilities; how early should women go to stay there, what services they should offer and what kind of provider would be most effective.

9. Adolescent pregnancy and obstructed labour

There is a disparity in the literature on the effects of young age on prolonged labor. In most developed countries, young maternal age per se has not been shown to be associated with complications such as prolonged labor or need for caesarean section (Treffers, 2002, Scholl, 1994). There is evidence from other studies that young age and physiological immaturity are associated with prolonged and obstructed labor (Kurz, 1997, Suvacarev, 2003). However, in developing countries, age often interacts with other factors such as nulliparity and malnutrition.

The concept of gynecological age was defined in 1977 as the difference between chronological age minus age at menarche (Zlatnik, 1977). The age at menarche in developing countries remains higher than in developed countries (De Silva, 1998, Thapa, 2003, Chumlea, 2003). This might have implications for adolescents in developing countries having their first pregnancies, since they are likely to be of lower gynecological age than adolescent mothers of the same chronological age from developed countries. The association between low gynecological age (< 2 years) and obstructed labor has not been much researched. One study found that vacuum extraction for prolonged labor was significantly associated with low gynecological age (Suvacarev et al, 2003). Data from US suggests that pelvis of a woman grows for 4-7 years after menarche (Kurz, 1997). Since estimation on chronological age is difficult in many areas where birth registrations are low, and records of date of birth are rarely available, more research is needed on the use of gynecological age, and its correlation with prolonged labor/ fistula.

The association between malnutrition in childhood and obstructed labor has not well studied in developing countries. In Japan, 90-95% of girls had reached their adult height by menarche, but girls in Bangladesh continued to grow an additional 20% after menarche (De Silva, 1998). This may mean that girls in developing countries may not have reached their adult size by the time they are reproductively capable, and therefore pregnancy at this time carries a risk of under developed bone structure and resultant prolonged and obstructed labor. Thus early

malnutrition, with resultant under developed bone structure, has serious implications for women whose first pregnancy occurs soon after menarche (CDC, 2000, Zabin, 1998).

10. Postnatal depression

Postnatal depression generally occurs 6-8 weeks after childbirth. Meta-analysis has shown an average prevalence of postpartum depression of 13% in general population (O' Hara, 1996). A recent study in Goa, India detected the postnatal depression in 23% of mothers at 6-8 weeks after delivery; 78% of these patients had had clinically substantial psychological morbidity during the antenatal period (Patel et al, 2002). Economic deprivation and marital violence were important risk factors for postnatal depression. The birth of a female child has also been associated with postnatal depression. Depressed mothers were more disabled and were more likely to use health services than non-depressed mothers. One study of an urban township of South Africa reported a high rate of postnatal depression (34.7%) (Cooper et al, 1999). Evidence from other studies also suggests that antenatal depression is a risk factor for postnatal depression. In Lebanon, the overall prevalence of postnatal depression was found to be 21% but was significantly different between the 2 areas studied (Chhaya, 2002). In both areas, lack of social support and antenatal depression were significantly associated with postnatal depression, whereas stressful life events, lifetime depression, vaginal delivery, little education, unemployment and chronic health problems were significantly associated with depression in one of the areas.

Postnatal depression can disable mothers, affecting their ability to function in multiple roles in the family (Patel et al, 2002). Studies in developed countries provide compelling evidence that maternal depression is associated with long-term emotional, behavioral, and possibly cognitive problems in children (Murray et al, 1997). The consequences of postnatal depression on mother and child in developing countries needs to be better understood. The health-seeking behavior of such women is also not known – whether they seek any care, where they seek care from, what presenting symptoms do they report during their visits to health facilities, how do families respond to it, etc. Does postnatal depression carry the stigma usually associated with mental illness, and does this hinder treatment seeking?

The recently developed IMPAC manual provides guidelines on detection of postpartum blues and depression (WHO, 2003). However, in program setting, there appears to be no specific strategy to deal with the problem at present. Some of the strategies suggested include integration of mental health into maternal health care, routine use of pre and postnatal assessments, to identify and address women at risk of postnatal depression, and routine antenatal counseling to reduce the preference for male children and to promote marital communication (Patel et al, 2003). The efficacy of antenatal interventions needs to be tested through research.

11. Other postpartum problems

Only scanty research is available on nature and extent of postpartum problems and women's needs during postpartum period. Studies based on self reported symptoms have shown that

the number of health problems reported in first postpartum month is high. In India, 23% reported problems, and in Bangladesh nearly 50% reported symptoms 6 weeks after delivery, while in England 47% reported at least one symptom (WHO, 1998c). The most frequently reported problems are genital infections, stress incontinence, backache, bladder problems, headaches, pelvic pains, hemorrhoids, perineal pain, and dyspareunia, and breast problems. Most of these problems (other than genital infections) are considered minor, since they do not lead to maternal mortality and have not been much studied.

i. Mastitis and breast abscess
Breast problems include engorgement, sore or cracked nipples, mastitis and breast abscess. In UK, 33% of women experienced breast problems in first 2 weeks postpartum, and 28% in the weeks thereafter. Studies from developed countries (UK, USA and Australia) show that the reported incidence of mastitis varies from a few to 33% of lactating women, but it is usually under 10%. Estimates of incidence of breast abscess from developed countries show that the incidence varies between 0.04% and 8.9%. Among women from mastitis, 4.6% to 11% develop breast abscess. Most of these studies were hospital based. There are very few studies from developing countries on the incidence of mastitis.

These problems have been cited as reasons for stopping breastfeeding. Mastitis can occur at any stage of lactation, but is commonest in the first 12 weeks (WHO, 2000e). Breast abscess is a severe complication of mastitis, and these conditions together form a considerable burden of disease and involve substantial costs (Evans, 1995, Murphy, 1992). It can occasionally be fatal if untreated (WHO, 2000e). However, it is not known as to how frequently and where women seek care from for breast abscess, and the effectiveness of traditional ways to treat breast conditions. There is evidence that breast abscess might lead to mutilation and disfigurement of breast, as also failure of lactation. More research needs to be carried out on the consequences of mastitis and breast abscess on women, following early and late treatment.

Two principle causes of mastitis are milk stasis and infection (WHO, 2000e). Several studies suggest the incidence of engorgement is reduced when the baby is put to the breast immediately after delivery, and is given unrestricted access to the breast. A fissured nipple is found to be strongly associated with breast abscess, however, it is not known whether presence of a fissure predisposes to entry of infection, or tight breasts due to milk stasis or abscess lead to poor feeding and fissure. The predisposing factors for mastitis might operate differently in developing countries – for example, in several communities, breastfeeding starts after a delay of 2-3 days after birth, but subsequently continues over a long period. Moreover, the correlation of personal hygiene with infective mastitis needs to be understood -- this might be relevant in those communities where cultural practices do not allow women to take a bath or change clothes for several days after delivery.

Management of mastitis requires support to correct the breastfeeding technique, and use of antibiotics if the condition does not improve within 12 to 24 hours. For breast abscess, an incision and drainage, or aspiration of pus through a needle is suggested. However, several women may not have access to incision and drainage. The feasibility of this approaches involving less-skilled paramedical workers needs to be tested in program setting.

ii. Perineal pain or dyspareunia
During the first few weeks postpartum, pain in the perineum and vulva is an important problem, yet research on this issue is scanty. In Egypt, 2.1% of women reported dyspareunia after childbirth (Younis et al, 1993). In the UK, 22% women reported perineal pain after 8 weeks, and 10% after 2-18 months. Pain after 2 months was more prevalent among primiparae, and among women who had assisted vaginal delivery as compared to women undergoing spontaneous vaginal delivery (Glazener CMA, 1995). In a perineal management trial, more than 20% of women experienced pain 10 days postpartum, and 7.5% still had complaints after 3 months (Sleep et al, 1984). There is developing country data on prevalence and determinants of these conditions.

Research is needed to find ways to reduce this morbidity, so that recommendations for practice can be based on scientific evidence. For example, replacing non-absorbable suture material with absorbable suture material for the perineum has been shown to be effective in reducing short-term perineal complaints (Isager- Sally, 1986, Johanson, 1995). The avoidance of unnecessary episiotomies can also reduce perineal pain (WHO, 1996a). In settings where home delivery by untrained persons is common, episiotomy and assisted vaginal deliveries are not common, but spontaneous perineal tears and trauma as a result of repeated vaginal interference might result in perineal pain. These associations need to be better understood.

Summing up

The achievement of millenium development goals requires that critical gaps in our understanding of maternal morbidity be identified and filled. Information on maternal morbidities has by and large emerged from studies centered on maternal mortality. Since maternal mortality is relatively better understood, there is greater understanding of direct and acute maternal morbidities. The residual chronic morbidities and less serious morbidities have not received much attention, both in terms of research and interventions to deal with them. Similarly, prevalence of different indirect morbidities among pregnant and puerperal women, their effects on pregnancy, their consequences, health seeking behavior, and management are not well understood.

Approaches to deal with indirect morbidities tend to be vertical, e.g. women with tuberculosis, malaria and HIV are often covered under vertical programs designed to address these problems. When associated with pregnancy, they need to be dealt with differently, because of the effects of pregnancy on progression of these conditions, and limited choice of drugs during pregnancy and lactation. The feasibility of integrating the management of these conditions into maternal care programs needs to be tested. To achieve this, health systems interventions would be needed, as would a better understanding of health-seeking behaviour.

Early age at childbearing, frequent childbearing, high fertility, macronutrient and micronutrient deficiencies and helminthic infections are extremely common in developing countries. Research will be needed to understand as to how these conditions influence the occurrence of maternal morbidities, and how such effects can be minimized.

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