
What is the evidence for the role of antenatal care strategies in the reduction of maternal mortality and morbidity?

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Summary

Antenatal care is practised all over the world, the programmes having essentially similar schedules and content. Adherence to those programmes vary greatly, however, both regarding attendance rates and the time of the first visit, most of the African countries having the poorest records. Little has been done to evaluate antenatal care; its contribution to safer childbirth rests on educated assumptions, not on scientific testing. Some randomised trials have shown no ill-effects of programmes with fewer visits. A large WHO-initiated trial of a new programme with only 4 visits for low-risk pregnant women and interventions scientifically shown to be beneficial has just been completed. Compared to a standard model of antenatal care the new package was equivalent to traditional care in all the pre-selected maternal and child outcomes, besides being cheaper.

By studying preventable factors for each major cause of maternal death, experts have estimated that maternal deaths can be reduced by at least 50%. The relative contribution of antenatal care is difficult to assess. Immunization programmes, iron prophylaxis, early detection of preeclampsia, education, advice and preparation for transport and safe delivery are elements which may make a difference. Inadequate reporting of maternal deaths and causes of death is an obstacle to proper monitoring of the epidemic of maternal death. Revision and upgrading of the systems should go hand in hand with quality improvement of antenatal care programmes.

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Antenatal care

In centuries past, maternal mortality loomed large in every society, being 900 per 100 000 live births in Sweden around 1750 (Högberg 1985). During the twentieth century, the maternal mortality ratio in the Nordic countries (Denmark, Norway, Sweden) and the Netherlands fell from 300 to less than 10 per 100 000 births, the most rapid decline appearing after the second world war. The same trend has been observed in most other industrialised countries. The maternal mortality estimate for developed countries in 1990 was 17 per 100 000 births (World Health Organization 1996).

A Memorandum from the British Ministry of Health in 1929 (Ministry of Health 1929) outlined the principles and details of antenatal care, including timing and content of the visits. It prescribed a number of visits, starting as early in pregnancy as possible, continuing at 4-week intervals until the 28th week, then every two weeks until the 36th week, and then weekly until the onset of labour. This programme of prophylactic care continued for about fifty years before anyone thought of evaluating its effectiveness (Chalmers 1989). In addition to a basic set of tests and interventions, others were added according to temporal or permanent need, as defined nationally or locally. Ultrasound is a case in point. In case of complications, care should be delivered according to need.

It follows that there are many different ANC models. Midwives, general practitioner MDs and specialist obstetrician/gynaecologists are ANC caregivers, with no set rule about who does what, except in cases of high risk and complications. A WHO-initiated survey of maternity services in Europe in the early 1980s revealed that the officially recommended number of antenatal visits ranged from 5 or less in Luxembourg and Switzerland to 14 in Finland with a fair degree of compliance (Blondel *et al.* 1986) and that little was known about the actual content of care for pregnant women, except that screening practices varied greatly, as shown in Table 2 (World Health Organization, Regional Office for Europe 1985). A questionnaire survey of prenatal screening for 23 different tests and procedures, covering 67 university units in 9 countries in Europe, revealed substantial practice differences both between countries and in what was recommended versus what was actually done (Heringa & Huisjes 1988).

Antenatal care is one of the “four pillars” of safe motherhood, as formulated by the Maternal Health and Safe Motherhood Programme, Division of Family Health, of the World Health Organization (WHO) (World Health

Organization, 1994). The other three are family planning, clean/safe delivery and essential obstetric care. The package was devised to ensure that women should be able to go safely through pregnancy and childbirth and have healthy infants, in other words, to prevent the dreaded outcomes: maternal death, and perinatal and infant death.

Although there were many more stillbirths than maternal deaths one hundred years ago, the maternal deaths constituted a much larger problem, in society as well as medically. There were 25 stillbirths per 1000 births in Norway in the year 1900, ten times the maternal mortality ratio (Maltau 2000). In 1967 the stillbirth rate for births past 28 weeks was still 11 per 1000 births (Medical Birth Registry of Norway 1997).

With the rapid decline in maternal deaths, the focus of medical attention in developed countries shifted to the offspring. This change of emphasis is apparent in the content of current antenatal care programmes. However, in global context, the situation for mothers is still bleak. Out of the 585 000 mothers who die annually, only 9000, or 1.5%, died in developed countries including Central and Eastern Europe (Table 1). Therefore, reducing maternal deaths to “acceptable” levels must continue to be the top priority global challenge in reproductive health. The question is whether antenatal care programmes as practised in developing countries today are well structured to that end, and if not, how they can be remedied.

Table 1. Estimates of maternal mortality by WHO regions, 1990

WHO region	MMR	N of maternal deaths
Africa	940	213 000
The Americans	140	23 000
Eastern Mediterranean	440	68 000
Europe	59	7 000
South-East Asia	610	235 000
Western Pacific	120	39 000
World total	430	585 000

SOURCE: World Health organization (1996). Maternal mortality ratio (MMR) : maternal deaths per 100 000 live births.

Note: the text reference to developed countries (17 per 100.000 births) refers to another categorization of the countries).

In 1978 the WHO had developed the “risk approach” concept as a managerial tool for maternal and child health care, in particular for countries where access to medical care was limited (World Health Organization 1978). The risk approach was a strategy to identify risk factors for undesirable outcomes, with care to be delivered according to individual needs. However, because there are high levels of false positive and false negative results the approach was not successful as a public health measure. Nevertheless, the risk approach spurred thoughts and was the basis for later attempts to induce changes. Obviously, in individual cases clinicians should identify risk factors and give the advice or take the action that they believe is necessary, but public health physicians should regard every woman as being at risk and work towards a system which will result in emergency obstetric care accessible to all women.

PRACTICE

All over the world antenatal care has been adopted and follows the same principles as in Europe and the U.S.A., at least as far as recommendations on timing and content go. Practice is a different matter. A WHO compilation on coverage of maternity care (World Health Organization 1993b) showed that while 98% of the pregnant women in the developed countries attend the programmes, most of them from the first trimester onwards, less than 70% receive antenatal care in most countries in Africa, in India and Arab-speaking countries in Asia. Many of those who attend, come only once or twice, often late in pregnancy. In the Russian Federation, the proportion of late (after the first trimester) or no attendees has been relatively stable at 28-30% in the period 1985-1995 (U.S. Department of Health and Human Services 1999).

Many factors interfere with satisfactory implementation of antenatal care in developing countries; Nylander & Adekunle (1990) listed some: Inadequate resources, illiteracy and poverty, cultural and traditional practices and religious practices. Eseko (1998) conducted a cross-sectional, population-based study in Arusha region in Tanzania, interviewing 342 women who had given birth within the past two years. Of these, 98% had attended antenatal care services, 27% starting after the 20th week. Non-attendees were mainly grand multiparae (para 7 or higher). When the women were asked to give the reason they thought led to under-utilization of the services, ignorance (“don’t know the purpose of antenatal care”) was given as the main reason, by 57% of the respondents. Of the women living in the rural district, 49% said there

was no money for transport.

Whereas in Europe practice regarding tests and interventions varied greatly between centres (Table 2), the services in antenatal clinics in Arusha, Tanzania, were clearly deficient, according to the women who had attended (Eseko 1998). Blood pressure was never measured in 24% of them, and 61% never had their urine tested. Blood was never examined in 55%, and 71% never had any health education at the clinic. In a pre-trial study in 53 antenatal clinics in Argentina, Cuba, Saudi Arabia and Thailand we registered what was reportedly done and what was actually done (Piaggio et al. 1998) and found much better compliance with the rules than the Arusha study did. There were some deficiencies in weight gain monitoring in Cuba and Thailand, and breast examination was only done on 55% of the women in Argentina. All other tests and examinations were done in 95-100% of the cases.

Table 2. Screening during pregnancy in 24 countries within the European WHO region

Procedure or condition screened for	Number of countries where screening is			
	routine	selective	not done	Not answered
Blood group	21	1	0	2
Toxoplasmosis	3	14	4	3
Rubella	8	13	1	2
Tetanus	1	7	14	2
Syphilis	5	19	0	0
Amniocentesis	0	22	0	2
Ultrasound	3	19	0	2

SOURCE: World Health Organization, Regional Office for Europe (1985)

EVALUATION BY TRIAL AND BY MONITORING

Considering the variant models of antenatal care and their occasional poor delivery, is it at all possible to find out if antenatal care has, in fact, contributed to a decline in maternal mortality, as it was originally designed to do? A prospective trial comparing one programme to no programme is out of the question, for ethical and other reasons. In developed countries maternal mortality is so low that any attempt at reaching the number of participants needed for statistical power is bound to be futile. The five randomised trials which had been performed and published up to 1998 to test the effect of

fewer visits, had different designs, and the outcome measures were typically preterm delivery, low birthweight, Apgar score, caesarean section, pre-eclampsia and other maternal morbidity (Khan-Neelofur *et al.* 1998). None of these studies had the power to study an effect on maternal mortality, which has been the problem of all studies of antenatal care in the aggregate.

Evaluation can also be done by statistical monitoring of events, but it is difficult to draw conclusions about a causal relationship from parallel temporal trends. Biases and confounding are bound to creep in and obfuscate the picture. Statistical monitoring is nevertheless a prerequisite as background information, without it we do not know what goes on, and planning for improvement becomes a hazard.

As antenatal care represents a system of several components: a set of tests and interventions delivered at pre-set intervals, one should consider the objective of each element and decide if it is really effective, and secondly, critically review if that objective has been reached. This was done by an expert panel on the content of prenatal care convened by the U.S. Department of Health and Human Services, which recommended a more goal-oriented programme with fewer visits than that which was advised by the American College of Obstetricians and Gynaecologists at the time (Department of Health and Human Services 1989). McDuffie *et al.* (1996) tested that programme against the traditional one and found on average 2.7 fewer visits, but no significant differences in main outcomes (preterm delivery, low birth weight, preeclampsia, caesarean section).

In 1992 Rooney reviewed the evidence on the effectiveness of antenatal care and stated that it is striking how little is known (Rooney 1992). She made a list of antenatal interventions known to be effective, which is still valid (Table 3). It should be noted, however, that some of the effect measures listed in Table 3 are process and not outcome variables, and therefore not clear indicators of the effectiveness of antenatal care.

Table 3. Antenatal interventions known to be effective (adapted from Rooney 1992)

Condition/stage	Test or treatment	Effect
Prevention of anaemia	Routine iron and folate during pregnancy	Reduces, prevents fall in haemoglobin, reduces percentage of anaemic women
	Malaria chemoprophylaxis	Reduces percentage of anaemic women
Detection, investigation of anaemia	Copper sulphate test	Detects Hb level below chosen cut-off
	Colorimetric tests	Estimate Hb concentration
	Packed cell volume Coulter counter	Measures haematocrit Diagnoses types of anaemia
Treatment of iron-deficiency anaemia	Oral iron	Can raise Hb by 0.40.7g/dL per week
	I.M. or I.V. iron	Can raise Hb, need for trained staff, involves hazards: infection, anaphylaxis
	Packed cell transfusion	Raises Hb immediately, but involves several hazards (as above, and others)
Detection, investigation of PIH	Blood pressure	Detects hypertension
	Testing "clean" urine	Detects proteinuria; preeclampsia
Treatment of severe preeclampsia	Transfer for expert care	Control of disease. Reduced case fatality
Treatment of eclampsia	Supportive first aid	Reduced case fatality
	Speedy transfer to first referral level facility	Reduced case fatality
	Expedited delivery	Definitive treatment
Screening for infection	Magnesium sulphate*	Reduces recurrence risk
	Serology for syphilis	With effective treatment, reduces fetal loss and maternal and infant morbidity
	Microbiology for gonorrhoea	With effective treatment, reduces fetal loss and maternal and infant morbidity
	Bacteruria screening	Appropriate antibiotics prevent pyelonephritis and preterm delivery/ low birth weight
Primary prevention of infection	Tetanus immunization in pregnancy or women of childbearing age	Prevents maternal and neonatal tetanus

*Not in original table; added by Per Bergsjø

Villar & Bergsjø (1997) evaluated recent studies with regard to power for elimination or alleviation of specific adverse maternal and newborn outcomes. There is a number of randomised trials addressing specific adverse end points, but none to evaluate the problem of maternal death. Any statement on possible effects from antenatal care on maternal death is arrived at by inference, not by direct evidence.

Finally, the WHO Reproductive Health Library (World Health Organization 2000) deserves to be mentioned as a unique electronic set of updated reviews focusing on evidence-based solutions to reproductive health problems in developing countries, drawing on the Cochrane database and other sources.

OUTLINING A WORKABLE MODEL

There are several recommendations on how to practise antenatal care, some given by university teachers, others by gynaecological societies and others again by governmental decision. A handful of randomised and other comparative trials have addressed the question if there is a model of antenatal care which is superior to the others, with the qualification that local conditions may dictate specific tests or interventions, e.g. Sikorsky *et al.* (1996) in London and Tucker *et al.* (1996) in Scotland. A randomised controlled trial in Harare is pertinent to the problem of antenatal care delivery in developing countries. Munjanja *et al.* (1996) tested a model of fewer but more objectively oriented visits and fewer procedures per visit. Women in the new programme had fewer visits, less antenatal referrals and significantly less preterm deliveries, and there were no differences in other outcome indicators. There were 6 maternal deaths out of 9394 women in study clinics and 5 out of 6138 in control clinics, which indicates equivalence in this respect but is without statistical significance.

Partly in response to a workshop in Sweden in 1990 (Lindmark & Cnattingius 1991) the World Health Organization in 1991 convened an expert group to work out a new model for antenatal care with emphasis on essential elements that have been demonstrated to improve selected pregnancy outcomes. A radical new model was proposed, with four visits for those at lowest risk, the first as early as possible, preferably before the 12th week, the second at or near week 26, the third near week 32 and the fourth in weeks 36 to 38. One post partum visit should be added. The protocol for a randomised controlled trial was drafted, based on the hypothesis that the new model would be as effective as the traditional one and that it would cost

less. After some years of preparation, this trial took place at 53 antenatal care centres in four countries (Argentina, Cuba, Saudi Arabia and Thailand), randomised to deliver either the new package or the traditional one. Recruitment started in May 1996, and by the end of 1998 all of the nearly 25 000 participating women had delivered or aborted. The completed data file was ready for analysis in September 1999. The overall results are published in the *Lancet* (Villar *et al.* 2001). Briefly told, women in the new model clinics had a median of 5 visits, those in the traditional ones 8. Women in the new model were referred more often to a higher level of care, but the rates of hospital admission, type of admission by diagnosis and length of stay were similar between the groups. The rates of several outcome variables were also similar. Pertinent to the present discussion, there were 7 cases of eclampsia in the new and 8 in the traditional model, and 7 and 6 maternal deaths, respectively. In economic terms, the new model turned out to be cheaper. Regarding user satisfaction (Langer *et al.* 2000) most women in both arms of the trial said they were satisfied with antenatal care. Women in the new model were less satisfied with the fewer visits and longer spacing (differences not significant), but significantly more satisfied with the new model in relation to information on labour, delivery, pregnancy complications and emergency procedures.

It is reasonable to propose this model as a standard for antenatal care, with modifications according to local needs.

Maternal mortality

The reason why so little work has been done in trying to prove that antenatal care is effective is the difficulty in measuring maternal mortality. In countries with good vital registration one should assume that every maternal death would be on record. In practice this is not so. The health worker responsible for notification may forget to put pregnancy after the primary cause of death, which may be haemorrhage or lung embolus, or simply not realise that the woman was pregnant. In some societies or religious groups notification of abortion may be omitted to avoid embarrassing the surviving family (Royston & Armstrong 1989). Official rates are underestimates to varying degrees. In the revised 1990 estimates of maternal mortality (World Health Organization 1996) the reported numbers for developed countries with good vital registration were adjusted by a factor of 1.5 to account for misclassification. Official rates in developing countries are likely to be wider off the mark. Jamaica has a reasonably good registration system. In 1979 the

official ratio was 48 per 100 000 live births, while Walker *et al.*(1986) in a confidential inquiry using various sources identified more than twice as many, to a ratio of 108 maternal deaths per 100 000 live births. Figures from Tanzania are another example. The revised 1990 estimates (World Health Organization 1996) quoted 770 for Tanzania, differing from the official estimates (185) by a factor of 4. Results from a recent study in Arusha region are shown in Table 4, the figures ranged from 320 to 444 by different methods of registration, while the official figure from the same district was 140 (Olsen *et al.* 2001).

Table 4. Estimates of maternal mortality ratios (with 95% confidence intervals) in two divisions in Arusha region, Tanzania 1995 and 1996 (Olsen *et al.* 2001). Different modes of registration.

Mode of registration	Number of maternal deaths	Maternal mortality ratio
Direct registration		
Antenatal cohort	11	320 (160-580)
Multiple sources	26	380 (250-560)
Indirect sisterhood method		
Household sample (15-49)	58	362 (269-456)
Antenatal clinic sample (15-49)	142	444 (371-517)
Official statistics	19	140 (80-210)

Hospital statistics on maternal deaths may also be unreliable, as deaths occurring in surgical and gynaecological wards are often not reported. To find all deaths requires a careful survey of all registers in the hospital including the mortuary. Furthermore, cultural and religious constraints may occasionally lead to underreporting, especially if there is an official inquiry following an unexpected death of a woman of fertile age. However, in geographic areas where almost all the women deliver in hospitals, the maternal mortality figures will reflect the true situation reasonably well.

Bias will increase with the proportion of births outside of hospitals and the direction of the bias is not immediately obvious.

In developing countries with varying degrees of death registration but poor cause of death registration, it is difficult or impossible to obtain national data on maternal deaths with any degree of completeness. One alternative is to follow a cohort of pregnant women and try to ascertain the outcome on each and every one. This is feasible only for ad hoc research surveys. The other possibility is to do household surveys in defined areas, inquiring about pregnancy outcomes. The "sisterhood method" has been devised for this purpose: a set of simple questions about whether or not the sisters of the respondent are still alive, and additional questions on cause of death for those who are not. By combining information from several sources, it is possible to obtain the true number, but this is cumbersome and can hardly be used for continuous monitoring.

CAUSES OF MATERNAL DEATH

The decline of maternal mortality in developed countries in Norway and Sweden was primarily due to falling rates of puerperal infection and post-abortion sepsis, while deaths from eclampsia did not change much (Maltau & Grünfeld 1983, Högberg & Joelsson 1985). Turning to the present-day situation, the Maternal Health and Safe Motherhood Programme (World Health Organization 1994) made an estimate of the global mortality from the main obstetric complications, which is shown in Table 5. As only 1.5% of maternal deaths occur in developed countries, the distribution will reflect the third world situation.

Haemorrhage (from placenta praevia, abruptio placentae, uterine atony, ectopic pregnancy, post partum tears and coagulopathies) is the leading cause. Sepsis continues to take its toll, and a similar number die in consequence of unsafe abortion. Hypertensive disorders of pregnancy can hardly be prevented, but the complications can often be averted or treated successfully. Obstructed labour, as a rule ending with a ruptured uterus, is important as a preventable cause. It is of some interest to note that in the Russian Federation the maternal mortality ratio increased by 12% during the 1990s, to 23 per 100 000 live births, and that the vast majority was due to abortion other than legally induced pregnancy terminations (U.S. Department of Health and Human Services 1999).

Table 5. Estimation mortality from the main obstetric complications worldwide and impact of possibly preventable deaths. The compilation was done before the estimates were revised; hence the lower total number than in Table 1.

Cause of death	Number and % of deaths		Possibly preventable:	
			%	no.
Haemorrhage	127 000	25%	55%	70 000
Sepsis	76 000	15%	75%	57 000
Preeclampsia/eclampsia	64 000	12%	65%	42 000
Obstructed labour	38 000	8%	80%	30 000
Unsafe abortion	67 000	13%	75%	50 000
Other direct causes	39 000	8%	~	~
Indirect causes	100 000	20%	20%	20 000
TOTAL	510 000	100%		269 000

SOURCE: World Health Organization (1994).

In addition to the direct causes listed in Table 5, anaemia and malaria deserve to be mentioned as important indirect causes. Both conditions are prevalent in tropical countries, and both are aggravated by pregnancy. In Moshi, Kilimanjaro region, Tanzania, Bergsjø, Seha & Ole-Kingori (1996) found that 75% of the pregnant women had Hb lower than 110 g/l and 7% below 70 g/l. Bondevik *et al.* (2000), measuring haematocrit (hct) in pregnant women in Kathmandu, Nepal, found anaemia (hct below 34) and severe anaemia (hct below 24) in 62% and 4% respectively. Anaemia figures as a cause of death in many of the studies quoted in the Global Factbook (AbouZahr & Royston 1991). The risks and severity of malaria in pregnant women were analysed by Brabin (1991). In a survey of maternal deaths in 1995 and 1996 in highlands of Arusha region, Tanzania, we found verified cerebral malaria as primary cause in 20 out of 45 cases (Hinderaker *et al.* 2001).

To register the death of a pregnant woman as a maternal death is not always done, as already discussed. Assigning the right cause to a maternal death can be equally problematic, especially for deaths outside of hospitals and in hospitals with poor diagnostic facilities and no autopsy service. In such cases one must resort to verbal autopsy (World Health Organization (1995).

Although it does not satisfy the definition of maternal death, it is impossible not to mention the toll the acquired immuno-deficiency syndrome (AIDS) takes on pregnant women. In several African countries south of the Sahara upwards of 10% of pregnant women at antenatal care centres are

HIV-positive (UNAIDS & WHO 1998). Given the natural course of HIV infection, 5% to 10% of these will succumb to HIV-related disease during pregnancy and puerperum. This problem will be further elaborated in the section on maternal morbidity.

ANTENATAL CARE AS A TOOL TO PREVENT MATERNAL DEATHS

When discussing prevention, a scrutiny of the causes, and in the present context the part played by antenatal care, is paramount.

Haemorrhage may arise at any time during pregnancy, birth and puerperium. Causes differ, and hence the possibility for their prevention. Acute bleeding will commence before or between routine antenatal care visits and as a rule requires emergency consultation. Bleeding due to spontaneous early abortion is generally self-limiting. Major separation of the placenta is life-threatening, because of acute blood loss and later coagulopathy. Patients with placenta previa are also at high risk and in any case need constant surveillance. Proper antenatal care can lead to the earlier diagnosis of placenta previa, and management according to modern principles can reduce maternal mortality. Referral to second or third level centres for sonographic investigation is mandatory. Education may induce women to seek medical care when they start bleeding in late pregnancy. This education should ideally also be given to husbands, friends or other family members. Advice and counselling are therefore key elements which may help women secure rapid hospital treatment. Previous blood group typing may save blood matching time in emergency situations. Certain individual risk factors should induce more intensive monitoring: history of haemorrhage or coagulopathy in previous pregnancy, grand multiparity, polyhydramnios, hypertensive disease of pregnancy and premonitory bleeding in the present pregnancy.

Anaemia will aggravate the effects of bleeding, and iron prophylaxis should be considered in areas of high anaemia prevalence. This will reduce the proportion of women with low Hb levels and the need of blood transfusions post partum, but trials have not been shown to effect maternal, perinatal and long-term outcomes (see Villar & Bergsjø 1997).

Puerperal sepsis is more prevalent in places with high maternal mortality, mainly due to unclean home deliveries, higher rates of pathogenic genital tract infections and poor cleanliness and delay after rupture of the membranes. The main preventive effort is to secure clean delivery, as advised in the Mother-Baby Package (World Health Organization 1994). The role of antenatal care is mainly educational, with emphasis on cleanliness and the

need to seek care in case of spontaneous pre-term rupture of the membranes. Screening for bacteriuria with adequate treatment if positive is a way to possibly eliminate one focus of infection, but its effectiveness in low-income settings in third world countries is far from established (Olsen *et al.* 2000). Other possibilities for prevention of tetanus and other specific infections are outlined in Table 3. A WHO report from 1991 is still a good source of information (World Health Organization 1991).

Preeclampsia will be diagnosed by blood pressure measurement and detection of protein in the urine. Routine weight recording does not add to the diagnostic accuracy. The rationale behind the increasing frequency of visits in the standard antenatal care programmes was to detect preeclampsia as early as possible, but none of the trials testing schedules of fewer visits have shown any differences for detection and outcome complications of preeclampsia. Those at high risk should be followed more closely or referred to higher level of care (very young primigravidae, those with preeclampsia or eclampsia in previous pregnancies. Eclampsia may strike without prior signs of preeclampsia. All pregnant women and their partners (or sisters and mothers) should be told about early signs and how to react. It remains to be demonstrated that antenatal care leads to improved survival when hypertensive disorders are concerned (Rooney 1992).

Obstructed labour by definition manifests itself at birth. The best predictor is obstructed labour during the previous delivery. For primigravidae, maternal height has been used to select those of low stature for hospital delivery and is still useful in places where one has to select cases for hospital delivery. The test sensitivity is low but obviously increases with decreasing cut-off levels of height. Serial measurements of symphysis-to-fundus distance will detect those with large foetuses and will help select those in special need of caesarean section.

Deaths due to unsafe abortion occur all over the world, with notable exceptions for North America and most parts of Europe where abortion is legal, safe and relatively accessible (World Health Organization 1997). This problem must be attacked at parliamentary and governmental levels, all one can give at antenatal care is education about family planning and the dangers of abortion.

Maternal morbidity

Maternal mortality has been likened to the tip of the iceberg, maternal morbidity to its base (Bergström 1994). This implies that many more mothers

experience disease and suffering in consequence of pregnancy than those who die. Maternal disease is often reflected in the offspring: low birth weight, malnutrition, other ailments, which underlines the importance of this issue. Short term illnesses following childbirth can be classified as 1. Puerperal hypertension, 2. Peripartur cardiac failure, 3. Thrombosis and embolism, 4. Acute prolapse of the cervix, 5. Pelvic instability and pain, 6. Psychiatric illness, 7. Sepsis and other infections, and 8. Others. Some of these were discussed in the section of maternal mortality. Most of them are time-limited and not seen as part of the global problem discussed here. Long term sequelae of debilitating proportion were classified by Royston and Armstrong (1989) into 1. Fistula, 2. Neurological dysfunction, 3. Vaginal stenosis, 4. Sheehan's syndrome, 5. Chronic pelvic inflammatory disease, 6. Infertility, 7. Ectopic pregnancy, 8. Anaemia and 9. Uterovaginal prolapse. To these may be added 9. Urinary stress incontinence. Sheehan's syndrome is extremely rare and some of the others are equally common in developed and developing countries.

Rectovaginal and vesicovaginal fistulas are common in Africa but hardly ever seen in Europe and North America. They are caused by delayed obstructed labour and cause immense pain and suffering. Some medical centres have specialised surgical fistula units; treatment periods are long and results not guaranteed. Demand for treatment is much higher than existing resources. Prevention is clearly possible, as outlined in the paragraph on obstructed labour.

Pelvic inflammatory disease, infertility and ectopic pregnancy are parts of the same problem: genito-urinary infections. Bilateral tubal occlusion as demonstrable cause of female infertility is much higher in Africa than in Asia, Latin America, East Mediterranean and developed countries (Cates *et al.* 1988). Africa, therefore, should be specially targeted for preventive action, as outlined in the paragraphs on sepsis and unsafe abortion. This should go concomitantly with HIV and AIDS education. AIDS education is multisectorial (Bergsjø 1996), and the message probably best heeded at individual level. Antenatal care programmes should have family planning and safe sex as integral parts of the package.

Concluding remarks

It should be emphasized that there is very little factual evidence that antenatal care does reduce maternal mortality. In this brief survey of if and how antenatal care reduces maternal mortality we have left several important

points untouched. The organization and distribution of maternal health services and its providers, the role of non-governmental organisations (NGOs), abortion laws and practices, and levels of education among women are relevant factors which should be clarified and evaluated within each third world country. Governments should clarify gaps between central policies and actually delivered health care, and intensify their efforts to improve the quality of services. Maternal health is an integral part of reproductive health and should not be viewed in isolation; the problem is also linked to HIV and its consequences.

In a critical review McDonagh (1996) emphasized that to have any effect antenatal care must be part of a system of care that culminates in good local obstetric facilities with adequately trained staff. It is easy to agree.

To finally quote Rooney (1992), basic research “both epidemiological and operational, on antenatal care is not an academic luxury; improved information on patterns of maternal health and the efficacy of investigation and treatment are essential to rational planning of effective health services to reduce maternal mortality and morbidity from their current alarming levels”.

However, on the assumption that history occasionally repeats itself, the evolution of maternal mortality in the developed countries during the 20th century gives at least a guarded cause for optimism.

Acknowledgement

I wish to thank Dr. Colin Bullough for valuable comments on the text.

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