Women in developing countries are dying from simple preventable conditions but what impact can the procedures collectively called antenatal care have in reducing maternal mortality and morbidity? More importantly, what is antenatal care? This review found that questions have been raised about the impact of antenatal care (specifically on maternal mortality) since its inception in developed countries, and that although the questions continue to be asked there is very little research trying to find answers. Many antenatal procedures are essentially screening tests yet it was found that there were very few results showing sensitivity and specificity, and that they rarely complied with the established criteria for the effectiveness of a screening test. The acknowledged gold standard measurement of effectiveness is the randomized controlled trial, yet the only results available referred to nutritional supplementation. This service of flawed methodology has been exported to developing countries and is being promoted by WHO and other agencies. This paper argues that there is insufficient evidence to reach a firm decision about the effectiveness of antenatal care, yet there is sufficient evidence to cast doubt on the possible effect of antenatal care. Research is urgently required in order to identify those procedures which ought to be included in the antenatal process. In the final analysis the greatest impact will be achieved by developing a domiciliary midwifery service supported by appropriate local efficient obstetric services. That this domiciliary service should provide care for women in pregnancy is not disputed but the specific nature of this care needs considerable clarification.

Introduction

In the 1990s most developing countries are faced with recession and imposed structural adjustment policies, resulting in restrictions on public sector spending which make it vital that services are both appropriate to the needs of the people and are cost effective (Green 1992). Antenatal care is an umbrella term used to describe the medical procedures and care that are carried out during pregnancy. In promoting antenatal care, it is essential that the effectiveness of this service leaves no room for doubt. However, what evidence do we have that the service we are advocating is effective?

Maternal mortality is generally estimated as 500 000 maternal deaths each year, of which 99% occur in developing countries (Royston and Armstrong 1989). The range in developing countries is 40–800 maternal deaths per 100 000 live births, with an average of 450 maternal deaths per 100 000 live births (Royston and Armstrong 1989). The main causes of direct maternal mortality suggested by Maine (1991) are:

- Haemorrhage: 28%
- Sepsis: 11%
- Hypertension: 17%
- Abortion: 19%
- Obstructed labour: 11%
- Other: 15%

The overall aim of antenatal care is to produce a healthy mother and baby at the end of pregnancy (Lindmark and Cnattingius 1991). Using the available literature this paper examines the effectiveness of...
Marilyn McDonagh

antenatal care as it relates to the outcome for the mother. There are methodological limitations in this process. For example, although the aim of this paper is to look at maternal outcome, maternal and baby risk factors are so interlinked that the literature often does not distinguish between the two. Many papers study child outcomes (e.g. low birth-weight), rather than maternal outcomes, which may be influenced by factors other than those which can be acted upon in the antenatal period.

There are no agreed criteria about what exactly constitutes antenatal care. There is considerable variation in the content of antenatal care worldwide (Lehrman 1981; Royston and Ferguson 1985; Royston and Armstrong 1989; Nagey 1989; Field 1990; Rooney 1992; Gertler et al. 1993). This presented the problem of defining the most common components that collectively make up the service called antenatal care at primary level in developing countries. Bearing in mind all the possible permutations that exist, the author decided to look at the procedures that were routinely carried out in developing countries during an antenatal visit at primary level, with emphasis given to those procedures that were screening for risk factors. It was therefore decided to consider screening for risk factors which included:

- routine measurement of weight,
- routine measurement of blood pressure,
- abdominal examination.

In addition, nutritional interventions were examined as they represent one of the few tangible responses available if certain risk factors are identified. It is appreciated that this list excludes immunization against tetanus, testing for syphilis and the treatment of medical conditions. The reason for the exclusion of tetanus is that it falls under the responsibility of the expanded programme of immunization (EPI) which over the last few years has had an extremely high profile – much higher than that of maternal services. This means that any figures presented for tetanus vaccination would not have been solely obtained by attendance at antenatal clinic. As testing for syphilis cannot be offered in the majority of clinics at primary level it was excluded. The treatment of medical conditions was also excluded, as medical care is not always offered as part of antenatal care due to the vertical nature of women’s care services in many developing countries.

From the point of view of this paper, the ultimate objective of antenatal care is to improve maternal mortality and morbidity in developing countries. This paper reviews the literature from developed and developing countries with the intention of examining the effectiveness of the screening procedures that have been identified as collectively making up antenatal care. The weight given to each section reflects the available literature, thus demonstrating international interest in that subject and/or the ease by which it can be examined. It does not represent any personal weighting placed on the procedure by the author. The discussion will examine the role that these procedures can play in achieving the objective, with the final part of the discussion examining some of the practical problems that are faced when attempting to measure the effectiveness of antenatal care.

The paper looks at effectiveness from the limited perspective of whether the procedure can technically achieve its objective using the randomized controlled trial (RCT) as the gold standard. It is acknowledged that this provides only one measure of effectiveness and does not take account of constraining factors. Although reference is made to potential operational problems in respect to certain procedures, other issues related to effectiveness of a service, such as cost analysis, are not considered. However, the author feels that the priority should be to first examine whether we are advocating effective technical services to women.

Each procedure is considered using three dimensions of effectiveness:

i. Do the procedures and the service called antenatal care achieve their stated objectives (Basch 1990)?

ii. Since the randomized controlled trial (RCT) is acknowledged as the most rigorous evaluation of effectiveness, what results of any such trials are available (Cochrane 1972; Enkin 1992)?

iii. If the procedure is a screening test, how does it conform to the established criteria for the potential effectiveness of a screening test (Wilson and Junger 1969, cited in Rooney 1992: 10) (Appendix I)?

The concept that women require some form of extra care during pregnancy is not being doubted. However, what needs to be questioned is what this care should be.
Evidence for the effectiveness of the procedures that collectively make up antenatal care

Screening for 'at risk' factors

The objective of antenatal care is to screen populations of pregnant women regularly during pregnancy (Llewellyn-Jones 1990). There are two groups of antenatal risk factors screened for during pregnancy:

i. those associated with the women's medical, obstetrical and social history or circumstances;

ii. those arising during the antenatal period (Hart et al. 1990).

The concept of 'risk factors' and the first group of pre-existing factors will be considered in this section; the second group in the subsequent sections.

The objective of screening for 'at risk factors' is to identify any pre-existing factors that could increase the risk of complications during pregnancy or delivery to the mother or the infant (Hart et al. 1990). The problem with screening is that it requires voluntary participation but the very nature of risk factors make the women at greatest risk the most likely not to attend (Strachan 1987; Gertler et al. 1993). The effectiveness of a screening test is measured by its sensitivity and specificity, which are then compared to a 'gold standard' if it exists (Grant and Mohide 1982). Definitions of these terms can be found in Appendix II.

A definition of a risk factor is 'one link in a chain of associations leading to an illness or an indicator of link. The important fact is that they are identifiable prior to the event they predict' (Backett et al. 1986: 9). For this reason a medical history is obtained at the first antenatal visit in order to identify risk factors. However, WHO (1985) point out that 'abnormality has eluded prediction and because of that the tendency has been to define more and more risk factors' (WHO 1985: 74).

There does however seem to be agreement over a basic core of risk factors relating to parity, age, height and birth interval (Harrison et al. 1985; Greenwood et al. 1987; Kwast 1989; Royston and Armstrong 1989; Hall 1990; Maine 1991). The following list represents the risk factors generally used in East Africa:

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>risk under 15, over 35 years</td>
</tr>
<tr>
<td>Parity</td>
<td>more than 8 pregnancies</td>
</tr>
<tr>
<td>Disability</td>
<td>limp or leg affected by Polio</td>
</tr>
<tr>
<td>Short stature</td>
<td>less than 150 cm</td>
</tr>
<tr>
<td>Previous history</td>
<td>miscarriage or still birth</td>
</tr>
<tr>
<td>Pregnancy interval</td>
<td>less than a year</td>
</tr>
</tbody>
</table>

The differences occur when defining what limits to use within the category. In Tanzania, parity was 10+, height 146cm (Essex and Everett 1977); Williams et al. (1985) used a parity of 4–6 and a height of 150cm. These variations arise more from operational constraints and a fear of over burdening the maternal health facilities than from a scientific basis (Hart et al. 1990). The recommendation from Winkoff et al. (1991) is for more specific indicators.

Published results of the sensitivity and specificity of the risk approach are very sparse making it difficult to evaluate whether risk screening achieves its objective. This is exacerbated by the variations between the protocols currently in use, making comparison difficult. Studies that have been carried out show that most risk assessments classify a high percentage of patients as at risk (Fortney and Whitehorne 1982; Tew 1990). Work from Tanzania stated that 81% of high risk pregnancies delivered normally but that 15% of the high risk cases were not identified during the antenatal period (Abraham and Joseph 1985).

Studies have shown that one-quarter of all significant histories were missed: retained placenta was noted in only 68% of women who had previously experienced this problem and only 15% of previous post-partum haemorrhage were picked up (Chng et al. 1980). The Kasonga Team found that a bad obstetric history, compared to a good, had a relative risk of 9.2 of producing an obstructed labour. However, the sensitivity of the test was very low at 29%, due to the large number of women not at risk (Kasonga Project Team 1984; Maine 1991).

In Kenya Nordbeck et al. (1984) found a sensitivity of 41%, a specificity of 87%, and a predictive value.
of 13\%, using four maternal risk factors to identify perinatal mortality. They felt that none of the screening tests were entirely satisfactory and recommended concentrating on selected factors depending on circumstances in the area.

Various trials have been undertaken with specially designed antenatal cards in an attempt to see if they could improve the recognition of risk factors and so improve overall care (Sims 1978; Abraham and Joseph 1985; Bullough et al. 1990). Results from Abraham and Joseph (1985) found that 70\% of at risk factors were identified using the card, yet problems were found to be similar to the growth card (Gerien and Ross 1991) in that cards were frequently filled in correctly but no further action was taken (Chiphangwi 1987). A paper researching the ‘at risk’ approach stated that ‘the risk approach can only be considered effective if it not only encourages attendance and gives adequate support but also if those identified to be at risk are referred to the appropriate level of care’ (Jelley and Madeley 1983: 115). This study found that only 50\% of those identified as at risk were referred and then 89\% of those referred did not attend the recommended centre. Added to this is the prerequisite that there are centres to which referrals can be made (Hart et al. 1990; Rooney 1992), and further that once at those centres the necessary procedures can and are implemented (Sundari 1992).

Finally, the problem remains that identification of risk does not eliminate or alter the possibility of an adverse outcome nor does low risk mean the pregnancy will be totally safe (Lilford and Chard 1983; Hall 1990). Zander and Chamberlain (1984) remarked that it was like betting on a horse, the favourite does not always win. In Britain risk factors identified at the booking clinic increased relative risk by a factor of three and it was found that the most adverse outcomes occurred in low risk women (Hall 1990). This has also been found in other studies (Nordbeck et al. 1984; Winkoff et al. 1991; Gertler et al. 1993).

Ultimately the system must have credibility. Maine (1991) feels this is the fundamental problem because risk screening has such a low predictive power that many women are referred unnecessarily, causing undue stress and cost to both woman and family. This brings into question the operational capacity of any health service to deal with a burden which ultimately has a low productivity (Hall 1984).

### Routine measurement of weight

There are two objectives of weighing mothers during pregnancy:

i. to monitor excess weight gain so as to detect early signs of pre-eclampsia (Dawes et al. 1992)

ii. to assess the nutritional status of the pregnant mother so the mother arrives in labour in optimum health and the incidence of low birthweight babies is reduced (Dimperio et al. 1992).

It is recommended that mothers are weighed routinely during pregnancy to identify poor weight gain or excess weight gain. Monitoring excess weight gain is used to identify pre-eclampsia but is no longer recommended since high weight gain is not necessarily associated with pre-eclampsia (MacGillivray 1985; Dawes et al. 1992). The additional problem for developing countries is that of definition. What constitutes excess weight gain? (WHO 1991b).

It is felt by some obstetricians that poor weight gain in the mother is a preclinical sign of poor foetal growth and an indicator of poor nutritional status in the mother (Wynn et al. 1991; Dimperio et al. 1992). However, serious doubts have arisen over the benefit of routine weighing (Durnin et al. 1985; Dawes and Grudzinskas 1991a, 1991b; Dawes et al. 1992; Hytten 1990). Their main argument is that birth weight is not, as previously believed, correlated to the mothers’ weight gain during pregnancy. It is further postulated that maternal nutritional state has little immediate effect on the foetus, except in extreme cases of deprivation (Durnin et al. 1985, Dawes and Grudzinskas 1991a; Lawrence et al. 1991; Susser 1991).

An RCT that found a correlation between maternal weight gain and birth weight pointed out that the effect may have been produced by the height, age or parity of the women (Mara et al. 1979). A subsequent RCT did not obtain the same results (Kardjati et al. 1988). The factors cited by Mara et al. (1979) were studied further by Raman in 1981 who found that the mean birth weight was lower in teenagers than older women of the same economic status. He also found that short maternal stature contributed to low birth weight, but the effect of short stature was reduced when women belonged to a higher economic group, postulating that better nutrition worked to balance this effect. Contrary to classical theory, Briend (1985) found that heavier women had smaller babies. He also
found that although the nutritional status of women in Senegal was similar to women in affluent societies, birth weights were significantly lower indicating other forces at work.

The major problem arising in routine weighing is that of definition. What is an adequate weight gain during pregnancy? (Durnin et al. 1985) 10.5–13.5 kgs is the recommended weight gain for a woman in a developed country but this reduces to 5–9 kgs for developing countries because it is appreciated that any more is impractical (WHO 1991b), or might not even be desirable. Garner et al. (1992) point out that women do not want big babies because they know that in their circumstances, with little medical support, it is dangerous for their health and subsequently that of the baby. There are also systematic errors incurred during weighing due to poor attention to detail and inadequately maintained equipment (Gerein and Ross 1991).

It is suggested that routine weighing could create unnecessary stress and strain for the mothers (Durnin et al. 1985; Dawes et al. 1992), especially in developing countries where food is in short supply, particularly for women (Leslie 1991). The stress and guilt that routine weighing could produce in the woman may reduce any other benefits obtained from visiting the clinic and may actually deter further visits (Nabarro and Chinnock 1988).

There is general agreement in the literature that the most important factor for both mother and child is the mothers pre-pregnancy weight (Kardjati et al. 1988; Dawes et al. 1992; WHO 1991b). In a retrospective study Dawes and Grudzinskas (1991a) found that maternal booking weight had a positive predictive value of 20% compared to routine weighing of 12.9%, for identification of poor foetal growth. Finally, the whole practice of routine weighing and subsequent action tends to ignore the determinants of malnutrition, the role of infections such as malaria, and the excess work that women are compelled to do at certain times of the year (Prentice et al. 1987; Leslie 1989, 1991; Neel and Alvarez 1991; WHO 1991b).

**Nutritional interventions**

**Nutritional advice**

The justification for weighing is that if women have not gained sufficient weight, nutritional advice can then be given. It is postulated that this acts as an effective intervention resulting in a change of behaviour and consequently an increase in mean birth weight and maternal nutritional status (Dimperio et al. 1992). Nagey (1989) points out that there are vast gaps in our knowledge of recommended daily allowances. To this is compounded the fact that little advantage is to be gained by giving advice that cannot be implemented (Nabarro and Chinnock 1988; Tew 1990), and which will often be interpreted by the mother as ‘her fault’ if she cannot implement it. In some cases medical staff will engage in victim blaming. In many countries women are of low status and it is customary for them to eat last of whatever food is left (Leslie 1991). This is often combined with a lack of cash to buy the necessary extra food if food is scarce. Few evaluations look at the impact of health education on the practices of women and those that do are not very optimistic (Ratnaike et al. 1984; Field 1990). People remain sceptical that nutritional advice does result in a change in behaviour, suggesting that as yet it cannot be classified as an effective intervention (Nabarro and Chinnock 1988; Field 1990; Garner et al. 1992).

**Food supplements**

Food supplements are given during pregnancy in the belief that this is an effective intervention to prevent low birth weight and improve maternal nutrition.

Food supplements were found to be effective in Guatemala (Habicht et al. 1973) but there was no control group and the results have not been repeated by other studies. An RCT carried out by Rush et al. (1980) showed that increased protein supplementation actually decreased birth weight. Benefits were only obtained when supplements were given in the early stages of pregnancy. It is now argued that supplementing food increases birth weight only during famine and extreme conditions (Prentice et al. 1987; Susser 1989). This is supported by an RCT trial in Java that found little benefit from supplementation of pregnant women except during the lean season (Kardjati et al. 1988). Jewell (1990) argues that the human race has evolved through very unfavourable periods and that it would be remarkable if the body had not developed some protective mechanism by which to protect the foetus, in all but the worst conditions. This theory is supported by the work of Durnin et al. (1985) and Poppitt et al. (1993) which showed that energy saving mechanisms came into action during pregnancy with a reduction in basic metabolic rate. Research by Prentice et al. (1987)
found that supplements given during the wet season, when women were in a negative energy balance, caused an increase in birth weight. In the dry season, with women in a positive energy balance although consuming only 60% of the recommended daily allowance, no increase in birth weight was recorded.

It had been thought that food supplements to the mother could have possible long-term advantages for the children but Rush et al. (1980) found no evidence for this hypothesis. A longitudinal study by Kusin et al. (1992), however, found that the children of mothers who had received supplements were taller when measured five years later. They go on to propose that if these results are correct, supplements to the current generation of mothers could offer long-term benefit for the next. This is backed by history; well-nourished children during the second world war later produced well-nourished women with well-formed bones who were better prepared to cope with pregnancy. Certainly, it is only right to ensure women are in good nutritional status at all times and especially during pregnancy. But are food supplementation programmes the appropriate strategy to achieve this?

It is felt that food supplementation programmes had failed in the past because sufficient consideration had not been given to the recurring costs and the massive logistics of delivery and distribution that are involved (Beaton and Ghassemi 1982). Such programmes are also extremely prone to wastage, theft and leakage (Beaton and Ghassemi 1982; Kardjati et al. 1988; Leslie 1991). Finally, food supplements are only an interim strategy; the problem requires further examination to seek out the root cause of female malnutrition (Leslie 1991).

Distribution of iron and folate supplements
Since World War II it has been common practice to distribute iron and folate universally to all pregnant women in Britain whether needed or not (Hibbard 1988; Montgomery 1990). The objective of giving iron and folate is to maintain stores throughout pregnancy and prevent severe anaemia (Montgomery 1990). The rationale of this practice is now being questioned in developed countries (Hibbard 1988; Montgomery 1990). Doubts have arisen because it is felt that the majority of women are not anaemic but have a 'physiological anaemia' which occurs due to haemodilution, a normal process (Montgomery 1990). Iron is depleted whether or not iron supplements are given and returns to normal levels very quickly after pregnancy (Montgomery 1990). Studies have actually found an association between high haemoglobin levels and unfavourable outcomes (Koller et al. 1980, cited in Montgomery 1990: 212). Consequently universal distribution is no longer seen to be justified; instead, vulnerable groups should be targeted (Hibbard 1988). Opponents argue that universal distribution should continue as it is cheap and covers large groups of women (Horn 1988).

In developing countries the situation is very different. It is estimated that two-thirds of women are suffering from anaemia and that anaemia is often the underlying cause of maternal mortality (Royston and Armstrong 1989; WHO 1992a). Fears have been expressed that routine iron supplements increase the likelihood of infection in areas of poor hygiene. However, after a review of the literature, administration of routine oral iron was deemed safe (Tomkins and Watson 1989).

Although there is very little evidence that supplements are effective in improving the outcome of pregnancy for mother or baby (Hemminki 1985; Rooney 1992), it is generally felt that iron supplements and folic acid can have a profound beneficial effect in developing countries (Royal College of Obstetricians and Gynaecologists 1979; Royston and Armstrong 1989; Tew 1990). Some obstetricians believe that the reduction in anaemia is one of the most important functions of antenatal services (Royal College of Obstetricians and Gynaecologists 1979; Royston and Armstrong 1989; WHO 1992a). Fears have been expressed that routine iron supplements increase the likelihood of infection in areas of poor hygiene. However, after a review of the literature, administration of routine oral iron was deemed safe (Tomkins and Watson 1989).

Research has shown malaria to be responsible for severe anaemia especially in primigravids, reducing their tolerance of haemorrhage and prolonged labour (Brabin 1991; Reubin 1993). In areas with a high prevalence it is recommended that malaria prophylaxis be given in conjunction with iron and folate.
pressure (Redman 1982a). Observation of blood
As with routine weighing, there are intrinsic
and mortality ranges from 7% to 25% (Rooney
systematic and random errors in recording blood
presenting with a diastolic blood pressure over
obtain but one study found 5.4-33.2% of women
incidence of eclampsia in Britain ranges from
diastolic limit should be reduced (Koblinsky et al.
has been suggested that in developing countries,
measurement of blood pressure as a screening test
antenatal period is to screen for hypertension which
for eclampsia is flawed: the natural history of the con-
tion has been used successfully to prevent eclampsia
restrictions and diuretics have not been found to be
eclampsia becoming eclampsia (Rosenberg and
Once identified there is still no clearly defined treat-
pressure recording (MacGillivary et al. 1969; Villar
found a wide range of values and little
standard practice even in a supervised clinical set-
treatment schedule or effective intervention to prevent
becoming eclampsia (Rosenberg and
interim solution is rest with regular monitoring. Dietary
restrictions and diuretics have not been found to be
effective (MacGillivary 1985; Redman 1982b). Seda-
tion has been used successfully to prevent eclampsia
but it requires good technical expertise (MacGillivary
Routine blood pressure reading is carried out in con-
junction with examination for the presence or absence
of oedema and proteinuria. A study using only
oedema and proteinuria to screen for pre-
eclampsia and therefore not a useful sign,
although a combination of hypertension and pro-	einuria is certainly significant (Redman 1982a).
The results of testing for proteinuria found 25% false
positives and 6% false negatives using ‘urine stixs’
(Enkin et al. 1989).

Research examining blood pressure screening for pre-
eclampsia found that 30% of cases were not detected
during routine antenatal visits. Results obtained a sen-
sitivity of 71%, specificity of 95%, and a positive
predictive value of 40% for pre-eclampsia during
pregnancy, labour and the puerperium (Hall et al.
1980). Hall and Chng (1982) point out a problem of
over-diagnosis. Their study found that 13.5% of the
women diagnosed had transient hypertension or could
be classed as false positives, and this increased with
gestation producing a ratio of false positives to cases of
1.3:1 (Rosenberg and Twaddle 1990).

Routine measurement of blood pressure
The objective of measuring blood pressure during the
antenatal period is to screen for hypertension which
acts as an early and detectable sign of toxaemia
(Rosenberg and Twaddle 1990). However, the
measurement of blood pressure as a screening test
for eclampsia is flawed: the natural history of the condi-
tion is not known (Rosenberg and Twaddle 1990)
and there is a problem of defining the limits
(Redman 1982a; Cuckle and Wood 1984). The
preclinical state of pre-eclampsia has been defined as
a blood pressure reading of 140/90 mmHg but it
has been suggested that in developing countries,
where women start pregnancy undernourished,
the diastolic limit should be reduced (Koblinsky et al.

The incidence of eclampsia in Britain ranges from
10 to 1.3 per 10,000 maternities, accounting for one-
fifth of maternal deaths (Redman 1982a). It is more
common in primigravidas (MacGillivary 1985). The
figures for developing countries are difficult to
obtain but one study found 5.4-33.2% of women
presenting with a diastolic blood pressure over
90 mmHg during pregnancy (Koblinsky et al. 1992),
and mortality ranges from 7% to 25% (Rooney

As with routine weighing, there are intrinsic
systematic and random errors in recording blood
pressure (Redman 1982a). Observation of blood
as this has been found to be a successful intervention

Although universal distribution is recommended in
developing countries, there are major operational
constraints in the successful implementation of such
a policy: attendance at the clinic early enough to
receive supplements (Shears and Mkerenga 1985;
Reuben 1993), compliance in those who do receive
supplies (Schultink et al. 1993), problems of cost
(Hemminki 1985) and the logistics of maintaining
regular supplies (Royston and Armstrong 1989). All
these factors affect the impact of any distribution pro-
gramme. Shears and Mkerenga (1985), for example,
quote figures of less than 30% of women effectively
protected. A cautionary note concerning universal
distribution is also expressed by Hemminki (1985)
who feels that the determinants of malnutrition could
be forgotten and complacency set in causing a failure
to recognize other nutrient deficiencies often found
together.

The effectiveness of antenatal care

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developing countries using anti-hypertensive (Oxford Perinatal Data Base) with the view to controlling pre-eclampsia until the baby can be born with a chance of surviving.

**Abdominal examination**

The objective is 'to predict and efficiently detect those conditions that may adversely affect the health of the pregnant mother or her child and then guide the subsequent management' (Godfrey 1981: 1253). In most developing and developed countries this is achieved by measuring fundal height using a tape measure, listening for foetal heart sounds and manually palpating to feel the position of the foetus. The limitations of these screening examinations is that they must be carried out regularly throughout pregnancy to be useful. The transitory nature of these measurements makes evaluation of effectiveness very difficult (Hall 1990).

Palpating is the main method of estimating foetal position and wellbeing but the method has never been proven useful (Godfrey 1981; Grant and Mohide 1982). One study from Aberdeen found that foetal position had been detected in 88% of cases before labour (Hall et al. 1985). In studies from Kasonga and The Gambia malposition was rarely identified correctly (Greenwood et al. 1987; Rooney 1992). In Kenya a risk system which included identification of foetal position produced a sensitivity of 41%, specificity of 87% and a predictive value of 13% (Nordbeck et al. 1984). Finally, the identification of malposition will never alter the position of the foetus. The eventual outcome is dependent on the availability of efficient obstetric facilities with staff who can carry out caesarian sections (Kwast 1992).

Measurement of foetal growth does not directly affect the mother, but if poor growth is identified it will inevitably result in stress and perhaps guilt for the mother, indirectly affecting her health. For this reason its effectiveness will be discussed. As a procedure, some have found it difficult to do well (Chiphangwi 1987) and an inadequate measure of foetal growth (Sims 1978). In contrast, others found it an excellent method (Kestler et al. 1991). Figures are scarce, intra-uterine growth retardation was suspected or diagnosed in less than half the women who subsequently delivered a small for gestational age baby, a ratio of 1:2.5 of correct prediction to incorrect (Hall et al. 1980: 79). The large number of false positives places a load on the system and increases both the tendency to unnecessary interven-

tions (Hall et al. 1980; Tew 1990) and the stress on women.

In developing countries some large hospitals have access to ultra-sound (Nylander and Adekunle 1990). A comparison of palpation and ultra-sound found very little difference between the two methods, both produced over 50% false positives (Tew 1990). It is suggested that simple and appropriate technology should be encouraged, especially when the cost-effectiveness of sophisticated high-tech equipment cannot be proven (Faundes et al. 1988; Tew 1990; Briggs and Orumabo 1991).

**Discussion**

The discussion will first examine the results of studies that have investigated the impact of antenatal care on maternal mortality; secondly, hypothesize from the evidence in the review on the role that each procedure can play in reducing the direct and indirect causes of maternal mortality and morbidity; thirdly, examine the role that actually attending antenatal care could play in reducing maternal mortality and morbidity; and finally, look at the scientific evidence surrounding antenatal care and the problems in obtaining it.

**The impact of antenatal care on maternal mortality**

Very few scientific studies have examined the role of antenatal care in reducing maternal mortality. The results of studies investigating the impact of antenatal care are mixed. The work from Zaire found that antenatal care reduced maternal mortality by 17-fold. The main impact had been a reduction in severe anaemia, cases of obstructed labour, and treatment of medical conditions (Royal College of Obstetricians and Gynaecologists 1979). In Vietnam antenatal care was found to reduce maternal mortality by improved nutrition and screening for high risk (Swenson et al. 1993). A prospective study in The Gambia (Greenwood et al. 1987) and a retrospective analysis from Tanzania (Moller et al. 1989) found no relationship between attendance at antenatal care and maternal mortality. Figures from Lesotho show that although 85% of women attend antenatal care, maternal mortality has not reduced in line with this increase in attendance (WHO 1993). Other studies found that maternal mortality was lower in villages receiving community-based maternity services which included antenatal care. The improvement, however, was attributed to the availability of local midwives (Lamb et al. 1984; Fauveau et al. 1991) and an efficient referral system (Fauveau et al. 1991).
The effectiveness of antenatal care

The interesting feature in all these studies was that the content of antenatal care was rarely mentioned; it was simply stated that antenatal care was given. With the available information it is difficult to establish why the results from Zaire were so different from the results in The Gambia and Tanzania. To make any inference from the information we need first to establish what was meant by antenatal care in each study. Then we need to know who visited the clinic, how often and the quality of the service offered. It is apparent that the term 'antenatal care' is a variable itself, making the comparison of outcome impossible.

Antenatal care procedures and reduction of causes of maternal mortality

On a first visit to an antenatal clinic an obstetric history is obtained, seeking risk factors that might affect the outcome of pregnancy. Benefits can be obtained by screening for the ‘risk factors’ associated with obstructed labour and haemorrhage (WHO 1989b), although the preceding review demonstrates that this screening is not very sensitive. The few results there are range from 29–41% sensitivity (Kasonga Project Team 1984; Nordbeck et al. 1984). The major problem in evaluating ‘risk factors’ is that there is no standard.

The procedure of abdominal palpation near the end of pregnancy can identify malposition and potentially reduce deaths from obstructed labour and the morbidity associated with prolonged labour. But again research indicates low sensitivity. Ultimately, haemorrhage and obstructed labour are acute emergencies requiring local obstetric facilities (WHO 1989b). These facilities require staff trained to carry out caesarian sections and blood transfusions (Rosenfield 1992).

Blood pressure monitoring can prevent deaths from toxaemia. Results from Aberdeen showed a sensitivity of 70% (Hall et al. 1980) but results from Tanzania were low (Moller et al. 1989). The major problem arising when monitoring for toxaemia is that the natural history of the condition is not known. What is known is that the incidence of toxaemia varies from country to country and within countries.

Routine weighing will have no influence on maternal mortality and its role in antenatal care is certainly doubtful (Chalmers 1990; Dawes et al. 1992). The identification of women of low body weight will only be beneficial if the means are available to correct the situation.

None of the procedures discussed in this paper will have any effect in reducing the number of deaths from sepsis or abortion. The major contribution to the reduction of deaths from sepsis and abortion will be to legalize abortion, with local obstetric facilities offering safe legal abortions (Kwast 1989; Renfrew and Chalmers 1990). This may be an unrealistic proposal for many countries but local facilities should be able to deal with incomplete abortions and have the necessary supplies of antibiotics (Rosenfield 1992). A contribution could be made if the antenatal visit was used for health education which included the training of mothers and instruction of local traditional birth attendants (TBAs) about the ‘three cleans’ necessary for a safe delivery (Royston and Ferguson 1985; Hart et al. 1990).

The evidence seems to indicate that the most important contribution can be made by the distribution of iron, folate and malaria prophylaxis, which can help to improve the nutritional status of women making them better able to withstand haemorrhage and prolonged labour and improve chronic anaemia (Royal College of Obstetricians and Gynaecologists 1979; Sai and Measham 1992; Rooney 1992; WHO 1992a, 1993). This distribution has also been found to improve growth in teenagers, reducing death from obstruction (Harrison et al. 1985); but this contribution is limited to the women who attend, and to those who attend early enough for the supplements to have any benefit.

The only reliable method of improving nutritional status is by improving the socioeconomic conditions in the country and by advocating female education (Rossiter 1985; Caldwell 1986; World Bank 1993). It is interesting to note that in the 1930s, before pregnancy was medicalized, ‘schools for mothers’ were considered the most effective method of improving maternal and child health.

The potential role of antenatal care.

A vital contribution could be made if attendance at an antenatal service influenced women to select a trained birth attendant. This would help reduce deaths from delayed referral, sepsis, obstructed labour and morbidity associated with prolonged labour and poor obstetric technique (Greenwood et al. 1990). But this has not been found to be the case. In one survey, 81% of women attended antenatal care yet only 57%
were subsequently attended by a trained attendant (Adekunle et al. 1990). These results could be due in part to a lack of trained attendants but the trend is that many more women attend antenatal care than seek trained assistance at delivery (Leslie and Gupta 1989). Research from Jamaica actually showed that attendance at antenatal care resulted in women having less chance of being delivered by a trained person (Gertler et al. 1993). The reasons for this are unclear but certainly cultural practices and mothers’ perception of antenatal care are important factors (Paul 1993). This is compounded by a service that provides various ‘ritually performed’ diagnostic procedures, leaving little time to offer a well-designed quality service which offers appropriate counselling and empowerment to women to look after their own health (Jelley and Madeley 1983; Wong et al. 1987; Hay 1990; Gertler et al. 1993).

Antenatal care as a screening programme in developing countries is affected by the fact that the basic concept of screening procedures involved necessitates regular attendance. The appropriate frequency and number of visits continues to be debated in developed countries (Hall et al. 1980; Blondel et al. 1985; Lindmark and Cnattingius 1991). Antenatal care in developing countries by definition can be one visit (Royston and Ferguson 1985), which must inevitably reduce the effectiveness of the procedures that require regular attendance. Furthermore, timing becomes an issue (Thomas et al. 1991). To increase the possibility of effective intervention, low body weight, risk factors and medical conditions should be identified as early as possible. Yet studies show that monitoring for pre-eclampsia is not cost-effective until after 32 weeks (Hall et al. 1980; Lindmark and Cnattingius 1991) and abdominal palpation to identify malposition is required as late in pregnancy as possible (Hall et al. 1980).

Evidence on antenatal care and the problems of obtaining it

In reviewing the history of antenatal care, it was found that questions have been asked about antenatal care since the 1930s when Drs Browne and Aberd (1932) asked why, although antenatal care had become a routine part of obstetric practice, the massive reduction in mortality that had been envisaged had not been seen. The paper makes interesting reading as the situation in 1932 is in many ways relevant to developing countries today. It states that although antenatal care can reduce the incidence of complicated deliveries, many conditions go unrecognized and there is often unnecessary interference. Furthermore, it can do little to prevent sepsis or postpartum haemorrhage and has done very little for eclampsia. Finally they state ‘much of what passes under the guise of antenatal care is too irregular, too infrequent, too ill-organised’ (Browne and Aberd 1932: 4).

In 1980, the Short Report (House of Commons Social Services Committee 1980) expressed concern that there was a lack of knowledge on the practices and procedures which form part of established antenatal care and recommend more research on the impact of antenatal care. In 1984 Hall asked the following question about antenatal care ‘Are our accepted practices based on valid assumptions?’ The reasons for doubt are clear. Much of the justification for antenatal care stems from studies looking at attendance at clinic, and the timing and quantity of visits, using perinatal mortality and birth weight as the main outcome measures (Jelley and Madeley 1983; Strachan 1987; Nordbeck et al. 1984). The methodology is often flawed as women who attend antenatal clinics are a self-selected group or volunteers (Lederman 1985). These women are destined to have a better outcome, a stance supported by several studies (Lewis 1982; Ahmed et al. 1990).

There is also a fundamental error in equating the number of visits made by a woman during antenatal care with outcome, called ‘the preterm bias’ (Tyson et al. 1990), and a tendency to confuse quantity with quality (Enkin and Chalmers 1982). There continues to be considerable debate over the issue of quantity; in Europe where the recommended number of visits ranges from 3–15 no significant difference in outcome was noted (Blondel et al. 1985). This is compounded by the lack of controlled trials to prove the effectiveness of procedures used in antenatal care or their effect on maternal mortality in developing countries (Cochrane 1972; Hall et al. 1980; Peoples-Sheps et al. 1988; Chalmers 1990; Tew 1990; Lindmark and Cnattingius 1991; Enkin 1992; Rooney 1992). The World Health Organization (1985) concluded that no more than 10% of routine procedures used in obstetrics have been scientifically evaluated. There are those who accept that antenatal care has not been proven scientifically but continue to believe in a persistent association between antenatal care and outcome (Nagey 1989; Lederman 1985). Lederman (1985) argues that clear benefit and better outcome would be seen if all the high risk mothers attended as recommended, but because they do not the results
are weakened. Nagey (1989) feels strongly that the word ‘care’ has been lost in all the analysis and the ‘benefits exceed the sum of the components’ (p 525).

Although it is easy to criticize the lack of scientific evidence it is much more difficult to rectify the situation. The major constraint is ethical; it is rarely possible to carry out an RCT on a service that is already well established as it would mean withdrawing the service from one group (Peoples-Sheps et al. 1988; Bobadilla 1992). Another problem is sample size because although maternal mortality is high, deaths in each community are often too small to offer significant results (Rosenfield 1992). To overcome this problem RCTs using geographical units have been proposed (Lindmark and Cnattingius 1991). There then remains the issue of selecting a valid scientific sample due to the problem of non-attenders being different to the attenders (Peoples-Sheps et al. 1988). Finally there is the need to match for all possible potential confounding variables, which are numerous.

Doubts about scientific evaluation are compounded by the practical issue that antenatal care is often the only service provided for women, and in many cases it offers the only opportunity to reach women. It would seem prudent to make better use of this opportunity and provide a service more appropriate to women’s needs.

The available evidence and the preceding discussion indicates that the procedures collectively carried out during an antenatal visit, or simply attending antenatal care, can have very little effect on maternal mortality or morbidity in developing countries at the present time. This is exacerbated by the fact that the service is generally caring for those least in need. The evidence indicates that for antenatal care to have any effect it must be part of a system of care that culminates in good local obstetric facilities with adequately trained staff (Kwast 1989; Winkoff et al. 1991; WHO 1991a). Furthermore, without these obstetric facilities the possible impact of antenatal care in reducing maternal mortality and morbidity is doubtful. It is estimated that first level obstetric care could result in a reduction of 80–85% in maternal mortality (Belsey 1990). The single important contribution that obstetric facilities have to play in improving maternal mortality can be seen from the study of a religious group in the USA. This group, who lived under good socioeconomic conditions, refused any medical intervention and had a maternal mortality rate of 850 per 100 000 compared to an average of 6 per 100 000 live births for the rest of the population (Belsey 1990).

Conclusion

All the collated evidence suggests there are substantial grounds to doubt the effectiveness of the procedures ritually performed during an antenatal visit and that are collectively called antenatal care. It seems as if antenatal care, as part of MCH services, was exported from developed countries to developing countries because it was believed to be an appropriate and beneficial service. Yet the justification for exporting this service to deal with the prevailing conditions in developing countries is not apparent. Research shows that questions were being asked about the possible lack of impact of antenatal care on maternal mortality as early as 1932 (Browne and Aberd 1932). The questions have continued to be posed and have not been answered satisfactorily, especially concerning maternal mortality and morbidity in developing countries (Hall et al. 1980, 1985; Hall 1983; Enkin and Chalmers 1982; Tew 1990; Enkin 1992; Bobadilla 1992; Rooney 1992).

Ultimately what is required is an improvement in socioeconomic conditions, the promotion of female education simultaneously with a broader concept of what constitutes women’s health, and the gathering of more accurate statistics to increase understanding of the needs of women (Graham 1992; Koblinsky et al. 1992). Recent efforts have seen maternal health moving away from a purely pregnancy-related orientation to reproductive health (WHO 1992b) but this is not far enough. A definition of woman’s health by Van der Kwaak (1991) cited in Koblinsky et al. (1992:31) states ‘A woman’s health is her total wellbeing, not determined solely by biological factors and reproduction, but also the effects of work load, nutrition, stress, war and migration, among others’. If services were delivered based upon a broader concept of women’s health and with a view to empowering women to look after their own health needs, there would ultimately be a welcome reduction in the unacceptably high levels of maternal mortality and morbidity currently prevalent in developing countries. The ultimate bonus would be healthier families and all the attending benefits resulting from this desirable achievement.

References


Koblinsky M, Campbell O, Harlow S. 1992. Mother and more: 


Balliere's

House of Commons Social Service Committee. 1980. 


Horn E. 1988. Iron and folate supplements during pregnancy; sup-

Hibbard B. 1988. Iron and folate supplements during pregnancy: 

Hay S. 1990. High use of poor quality prenatal care in the 

during pregnancy in Nigerian teenage primigravidae. Brit-

Hart R, Belsey M, Tortore E. 1990. Integrating MCH Services 


Aberdeen, UK: Aberdeen University Press. 

Lewin J. 1989. Women’s time: a factor in the use of child sur-


Moller B, Lushino O, Meink O, Gebre-Medhin M, Lindmark G. 

Mara J et al. 1979. Nutritional supplementation and the outcome 

Kwast B. 1989. Maternal mortality: levels, causes and promising 

Kwast B. 1992. Midwives: key rural health workers in maternity 
care. International Journal of Gynecology and Obstetrics 38 

maternal and child mortality rates in three isolated Gambian 

Lawrence M, McKillop F, Durin J. 1991. Women who gain more 

fat during pregnancy may not have bigger babies: implications 
for recommended weight gain during pregnancy. British Jour-


Lederman S. 1985. Prenatal Care and Pregnancy Outcome. New 
York: Centre for Population and Family Health. 


Leslie J. 1989. Women’s time: a factor in the use of child sur-


Leslie J. 1991. Women’s nutrition: the key to improving family 
health in developing countries. Health Policy and Planning 

Leslie J, Gupta G. 1989. Utilization of Formal Services for Mat-

ernal Nutrition and Health Care in the Third World. Washington 
DC: International Centre for Research on Women. 

Journal 284: 788. 

Lilford R, Chard T. 1983. Problems and pitfalls of risk assess-
ment in antenatal care. British Journal of Obstetrics and 

Lindmark G, Cnattingius S. 1991. The scientific basis of antenatal 

Llewellyn-Jones D. 1990. Fundamentals of Obstetrics and 


New York: Centre for Population and Family Health. 

Mara J et al. 1979. Nutritional supplementation and the outcome 

Moller B, Lushino O, Meink O, Gebre-Medhin M, Lindmark G. 
1989. A study of antenatal care at village level in rural Tan-

zania. International Journal of Gynecologists and Obstetricians 

Montgomery E. 1990. Iron levels in pregnancy: physiology or 
pathology? Assessing the need for supplements. Midwifery 6: 
205–14. 

Nabarro D, Chinnock P. 1988. Growth monitoring – inap-

propriate promotion of an appropriate technology. Social Science and 
Medicine 26(9): 941–8. 

Nagey D. 1989. The content of prenatal care. Obstetrics and 

group of Guatemalan mothers and neonates. Bol-of Sant-


mortality data in antenatal screening. In: van Ginneken J, 
Muller A (eds). Mother and Child Health in Rural Kenya. 
London: Croom Helm.
Nylander P, Adekunle A. 1990. Antenatal care in developing coun-
Oakley A. 1984. The Captured Womb - A History of the Medical
so little about pre-natal care nationwide; an assessment of re-
Evidence of energy sparing in Gambian women during preg-
nancy: a longitudinal study using whole-body calorimetry.
Increased birthweight after prenatal dietary supplementation
46(9): 12–25.
Raman L. 1981. Influences of maternal nutritional factors affect-
ing birth weight. American Journal of Clinical Nutrition 34:
775–83.
workers and malnutrition: a project that failed. World Health
Forum 5.
Redman C. 1982a. Screening for pre-eclampsia. In: Enkin M,
Chalmers I (eds). Effectiveness and Satisfaction in Antenatal
Redman C. 1982b. Management of pre-eclampsia. In: Enkin M,
Chalmers I (eds). Effectiveness and Satisfaction in Antenatal
Reid M. 1990. Pre-natal diagnosis and screening: a review. In:
Garcia J, Killpatrick R, Richards M (eds). The Politics of
Renfrew M, Chalmers I. 1990. How can prenatal care reduce
Reuben R. 1993. Women and malaria: special risks and appro-
propriate control strategy. Social Science and Medicine 37(4):
Rosenberg K, Twaddle S. 1990. Screening and surveillance of
pregnancy hypertension - an economic approach to the use of
107–17.
Rosenfield A. 1992. Maternal mortality: community based in-
terventions. International Journal of Gynecology and Obstetrics
38 supp: 17–23.
Rossiter C. 1985. Antenatal care: formal education and child bear-
ing. British Journal of Obstetrics and Gynaecology supp 5:
14–22.
Royal College of Obstetricians and Gynaecologists. 1979. Maternity
Care in Developing Countries: What the Community Needs.
London: Royal College of Obstetricians and Gynaecologists.
Royston E, Ferguson J. 1985. The coverage of maternity care:
a critical review of available information. World Health
Statistics Quarterly 38: 267–79.
of prenatal nutritional supplementation in New York City.
Sai PT, Measham DM. 1992. Safe Motherhood Initiative: getting
Low compliance with an iron supplementation program: a study
among pregnant women in Jakarta, Indonesia. American
and child health (MCH) services at village level: a survey in
Tanzania and lessons for elsewhere. Annals of Tropical
Paediatrics 5: 55–9.
Sims P. 1978. Ante-natal card for developing countries. Tropical
Doctor 8: 137–40.
partum care, and outcome: impact of a maternity and infant
Strahan D. 1987. Antenatal booking and perinatal mortality in
16(2): 229–33.
Sundari T. 1992. The untold story: how the health care systems
in developing countries contribute to maternal mortality. In-
Susser M. 1991. Maternal weight gain, infant birth weight, and
diet: causal sequences. American Journal of Clinical Nutrition
Swenson I, Thang N, Nhan V, Tieu P. 1993. Factors related to
the utilization of antenatal services in Vietnam. Journal of
Tropical Medicine and Hygiene 96(2): 76–86.
Care. London: Chapman and Hall.
does it effect pregnancy outcome? Social Science and Medicine
Geneva: United Nations Administration Committee on Co-
ordination/Subcommittee on Nutrition.
measuring of blood pressure during pregnancy. American
Williams C, Jelliffe D, Baumslag N. 1985. Mother and Child
University Press.
Services to Save Mothers Lives: Feasible approaches to reduc-
Health Organization.
Organization, Regional Office for Europe.
Health Organization.
WHO. 1989b. The Prevention and Management of Postpartum
WHO. 1991a. Essential Elements of Obstetric Care at the First
WHO. 1991b. Maternal anthropometry for prediction of pregnancy
outcomes: memorandum from a USAID/WHO/PAHO mother
523–32.
Organization.
of care and prenatal care use in the Philippines. Social Science
and Medicine 24(11): 927–44.
The effectiveness of antenatal care


Biography

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Appendix I. Criteria for a screening test

a) that the outcome in question is an important public health problem in the population.
b) that there is a detectable preclinical phase or high risk state preceding this outcome.
c) that screening tests are sufficiently sensitive and specific to permit identification of those at risk.
d) that there is an effective treatment available for this early disease stage and
e) that early intervention is more effective than waiting and treating overt disease.


Additional requirements that would facilitate monitoring are:
a) the condition should be well defined
b) the prevalence of the condition should be known
c) the natural history of the condition should be known
d) the test should be cost effective
e) facilities offering the test should be easily installed and accessible
f) the test should be simple and safe

(Cuckle and Wood 1984: 2).

Appendix II. Definitions

The SENSITIVITY of a test refers to its ability to single out those people who have the condition being screened for. High sensitivity results in low numbers of false negatives (Gehlbach 1988).

The SPECIFICITY of a test refers to its ability to single out those people who do not have the condition being screened for. High specificity results in low numbers of false positives (Gehlbach 1988). The dilemma faced when attempting to improve effectiveness is that one can only improve sensitivity at the expense of specificity and vice versa (Fortney and Whitehorne 1982).

The POSITIVE PREDICTIVE VALUE expresses the proportion of persons with positive tests who will be found to have the disease, when the test is applied to a population with a specified prevalence of disease (Abramson 1974). Measuring the sensitivity and specificity of a procedure is only part of a screening test and it may be efficient in identifying a condition, however to be effective it must also alter the outcome.