THE PREVENTION OF 
PERINATAL MORTALITY 
AND MORBIDITY 

Report of a WHO Expert Committee
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WHO EXPERT COMMITTEE ON THE PREVENTION OF
PERINATAL MORTALITY AND MORBIDITY

Geneva, 25 November - 2 December 1969

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THE PREVENTION OF PERINATAL MORTALITY AND MORBIDITY

Report of a WHO Expert Committee

A WHO Expert Committee met in Geneva from 25 November to 2 December 1969 to discuss the prevention of perinatal mortality and morbidity. The meeting was opened by Dr J. Karefa-Smart, Assistant Director-General, who welcomed the participants on behalf of the Director-General.

1. INTRODUCTION

Preconceptional factors and conditions arising during pregnancy, parturition, or the early neonatal period may influence perinatal mortality, the health of the newborn, or the ultimate development of the child. Improved care relevant to the perinatal period can thus promote better health throughout the world.

Standards of maternity care have improved in recent years, particularly in developed countries, and the number of perinatal, rather than maternal, deaths is now used as an index of the quality of maternity care. This is appropriate since pregnancy care is being increasingly aimed at improving the prospects for the fetus. Good fetal care necessarily implies good maternal care.

Attention is now being given also to perinatal morbidity, with emphasis on avoiding factors that may adversely influence the health and development of the child. The Committee therefore considered the prevention of conditions in the perinatal period that cause long-term sequelae as well as perinatal mortality and immediate morbidity.

Problems relevant to the perinatal period must be considered in the context of approximately 100 million births annually in a world population of over 3500 million distributed among more than 220 countries and territories; one half of this population lives in 6 countries, namely, China (mainland), India, the USSR, the USA, Indonesia, and Pakistan. Perinatal problems are clearly so complex, with many inter-relating factors, some of them specific to certain countries, that the Committee felt able to present only a general survey of some aspects in its report. The problems were approached from the standpoint of both developed and developing countries. In the latter, which contain 72% of the world’s population, perinatal mortality risks are several times higher than in the developed countries.
In adopting this global approach, the Committee emphasizes that, as noted by the WHO Scientific Group on Paediatric Research,1 "in most 'developed' countries poverty and other adverse social conditions still exist, with all their well-recognized ill effects on child health, and . . . the provision of health services to at least some sections of their communities is far from satisfactory. Conversely, in many 'developing' countries there are sections of the community whose living conditions and health standards are relatively high".

Accurate knowledge of the extent of the problem is essential before priorities can be assigned, plans made, and methods of implementation recommended. The Committee reviewed the statistical information available from different parts of the world and, realizing the need for much more information and for comparable, standardized data, made suggestions for improving perinatal definitions and reporting.

In considering possible prevention, and in formulating criteria for standards of normal care and for the early recognition and treatment of any deviation from normal, the known etiological factors were reviewed. These include the biological, socio-economic, and nutritional influences that arise prior to pregnancy, continue throughout pregnancy and labour, and interact with the obstetric conditions that may complicate the outcome. After birth, the need for the newborn to adapt to an extra-uterine environment introduces new factors. It is, however, becoming increasingly possible to predict, prior to birth, which infants will be at high risk during the first week of life.

The Committee discussed the organization of services for mothers and newborn babies on a world-wide basis and considered standards of optimum care as well as interim standards for those countries where optimum care is not yet possible.

2. THE EXTENT OF THE PROBLEM

2.1 Perinatal mortality ratios

The most common definition of perinatal mortality, used in nearly half the countries in the WHO European Region, but less often elsewhere, covers fetal deaths occurring at 28 weeks or more of gestation and deaths of live born infants occurring in the first week after birth. Variations in the definition of perinatal mortality and differences in completeness of registration of perinatal deaths make interpretation extremely difficult and international comparisons mainly unreliable.

Perinatal mortality ratios (PMRs) reported by individual countries for 1965 vary from 18.3 to 82.0 per 1000 total live births (Table 1). A number of countries, mostly highly developed and many with reliable reporting systems, report PMRs of under 25, a figure that provides a useful target. In many industrialized countries, the present ratios are less than half those recorded 30 years ago. The outstanding causes of death are now basic problems such as congenital malformations, intra-uterine anoxia (often due to toxaemia or antepartum haemorrhage), and extreme low birth weight. The problem of perinatal mortality has become more important than that of mortality after the first week of life, and some countries now have mortality rates of less than 10 per 1000 for the period one week to one year of age.

A study of the few statistics available for developing countries shows a different picture, PMRs between 40 and 80 being quite common (Table 1).

TABLE 1. PERINATAL AND INFANT MORTALITY STATISTICS, CRUDE BIRTH RATE, AND TOTAL POPULATION FOR SELECTED COUNTRIES AND TERRITORIES FOR 1965 *

<table>
<thead>
<tr>
<th>Country or territory</th>
<th>Perinatal mortality per 1000 live births</th>
<th>Late fetal deaths per 1000 live births</th>
<th>Deaths under 7 days per 1000 live births</th>
<th>Infant mortality per 1000 live births</th>
<th>Live births per 1000 population</th>
<th>Population (thousands)</th>
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<td>22.7</td>
<td>64.1</td>
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<td>28.4</td>
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<td>Live births per 1000 population</td>
<td>Population (thousands)</td>
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* The countries and territories are arranged in decreasing order for perinatal mortality ratio. All the data were obtained from official sources, either from the statistical reports published periodically by the various national administrations or else from questionnaires sent out by the Division of Health Statistics of WHO to national health statistical offices. Some of the data were made available by the United Nations Statistical Office.

a Data exclude live-born infants dying before registration of birth.

b Excluding tribal Indians.

c Data for the Federal Republic of Germany include West Berlin.

d Excluding aborigines of unmixed ancestry.

Sample surveys suggest that even higher PMRs may occur. Moreover, the influence of poor diet, disease, and impoverished social environment may result in an even higher mortality rate after the first week and especially between 1 and 4 years; thus out of 1000 live births, 300 children might die before the age of 5 years.

The first source of difficulty in interpreting perinatal data lies in the use of gestational maturity as a criterion, because it relies upon the mother’s memory of the date of her last menstrual period. There is less certainty when delivery occurs at about 28 weeks. There is even less uniformity, however, when any other minimum criterion is used. A minimum birth weight and/or a minimum body length is used by some countries instead of, or in addition to, a minimum gestational maturity, which itself may vary from 20–28 weeks.

Secondly, the inclusion in perinatal mortality data of all live-born infants dying in the first week influences disproportionately the total PMR, depending on whether and how frequently birth registration includes babies born before the 28th week, and on the criteria of “signs of life” used to distinguish fetal deaths from live-born infants.
2.2 Late fetal deaths

It follows from the foregoing that even fewer conclusions can be drawn about late fetal death ratios. These show a sevenfold world variation, from 8.2 to 59.3, in official statistics (Table 1). As the table shows, the relative contributions made by late fetal deaths and by early neonatal deaths to the perinatal mortality ratio vary greatly from one area to another; one or the other may predominate, or their contributions may be approximately equal. Such wide differences are, of course, partly medico-biological in origin but are also accounted for by incomplete registration of late fetal deaths. A wide divergence exists in the definitions of "signs of life" used to distinguish a dead fetus from a live-born infant. In practice, the decision may vary with such factors as place of delivery, accoucheur, status of person completing the certificate, or even considerations such as maternity grants.

2.3 First-week deaths

The variation in early neonatal death rate is from 8.2 to 28.4, which is nearly fourfold (Table 1).

First-day death rates show still greater variation, as much as eightfold, even in economically advanced countries. This may partly be explained by the reasons given above. Comparison is further complicated by the fact that some countries define the first day as the calendar day on which birth occurs, and others as a 24-hour period from the moment of birth. In a few countries, it is the practice to register as late fetal deaths all postnatal deaths occurring before registration of birth or within a specified period. The comparability of early neonatal death rates may be further impaired by the occasional practice of excluding from statistics of first-week deaths infants below a minimum birth weight, length, or gestational maturity, who also fail to survive for 24 hours or for some other specified period after delivery.

Because of all these inconsistencies, the Committee decided to review the definitions of perinatal mortality and its components, and to make recommendations about these and other factors related to the perinatal period in the hope that this would permit more accurate and comparable statistics to be gathered at world level.

2.4 Low birth weight

Low birth weight (defined as 2500 g or less) is undoubtedly the most important factor having an immediate association with perinatal mortality and morbidity. Although the statistics available from various regions of the world must be viewed with considerable caution (being for the most part based on reports from specific hospitals), they nevertheless reveal a
marked variation in the number of newborns weighing 2500 g or less. This
is reflected in the widely differing perinatal and neonatal mortality ratios.
A WHO study \(^1\) was carried out on birth weight in institutions in several
countries. This study has shown that the proportion of infants of low
birth weight ranged from 5.9% to as much as 28%, whereas the mean
gestation periods showed only slight variations (Table 2).

<table>
<thead>
<tr>
<th>Area</th>
<th>Percentage weighing 2500 g or less</th>
<th>Median birth weight (g)</th>
<th>Median gestation period (weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ireland</td>
<td>5.0</td>
<td>3478</td>
<td>40.5</td>
</tr>
<tr>
<td>Poland</td>
<td>6.8</td>
<td>3380</td>
<td>40.1</td>
</tr>
<tr>
<td>Venezuela</td>
<td>7.9</td>
<td>3206</td>
<td>39.7</td>
</tr>
<tr>
<td>Greece</td>
<td>9.5</td>
<td>3297</td>
<td>39.8</td>
</tr>
<tr>
<td>Rhodesia</td>
<td>11.0</td>
<td>3234</td>
<td></td>
</tr>
<tr>
<td>China (Taiwan)</td>
<td>11.3</td>
<td>3196</td>
<td>40.0</td>
</tr>
<tr>
<td>Japan</td>
<td>11.3</td>
<td>3029</td>
<td>40.2</td>
</tr>
<tr>
<td>Guatemala</td>
<td>13.3</td>
<td>3076</td>
<td>39.5</td>
</tr>
<tr>
<td>Iran</td>
<td>14.2</td>
<td>3024</td>
<td>39.4</td>
</tr>
<tr>
<td>The Philippines</td>
<td>14.2</td>
<td>2989</td>
<td>39.6</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>16.5</td>
<td>2991</td>
<td>40.4</td>
</tr>
<tr>
<td>Malaysia</td>
<td>16.8</td>
<td>2965</td>
<td>39.8</td>
</tr>
<tr>
<td>The Sudan</td>
<td>17.2</td>
<td>3057</td>
<td>40.2</td>
</tr>
<tr>
<td>Syria</td>
<td>19.9</td>
<td>3057</td>
<td>39.8</td>
</tr>
<tr>
<td>India</td>
<td>28.0</td>
<td>2771</td>
<td>40.6</td>
</tr>
</tbody>
</table>

\(\text{*}\) Tabulation from WHO Study on Birth Weight referred to in section 2.4.
\(\text{a}\) Groups are arranged in order of increasing proportion of live-born infants weighing 2500 g or less.

This suggests that, in countries with low median birth weight and a high
percentage of babies of low birth weight, a considerable proportion of the
babies may be “small-for-dates”, a group that has received more attention
recently, although little is known about the immediate or long-term risks
to which such infants are exposed.

2.5 The extent of available care in pregnancy and labour

The range of figures for trained attendance at birth extends from virtu-
ally nil in those countries where maternity services are still rudimentary
to over 99% in industrialized countries with well-developed health services.
This is reflected in equally wide variations in the numbers of trained obstet-
ricians, midwives, and auxiliary personnel. One trained midwife per
1000 population is thus not uncommon in those developed countries where
midwives carry out the majority of deliveries.

In contrast, one developing country with a population of 10 million has only one trained midwife for every 550,000 inhabitants, one maternity hospital with 40 beds, and 224 doctors to look after all the medical services. An estimate made following a world survey of maternity services carried out by IFOG/ICM led to the conclusion that probably more than half the pregnant women in the world receive neither trained antenatal supervision nor skilled or even unskilled help in labour.

2.6 Demographic statistics

The usefulness of the demographic and social statistics gathered depends upon the degree of development of reporting systems. Data relating to the baby (live birth, late fetal or first week death) and to the mother and father are recorded at the time of registration or notification of the birth or death.

Although much valuable information at the national level is often gathered in this way, there is little standardization of descriptive or statistical presentation. One or more basic facts, such as maternal age, parity, ethnic group, exact gestational age of baby at birth, age at early neonatal death, or birth weight, is nearly always missing. Registrations and notifications often provide even less information on live births than on deaths. The facts concerning early neonatal death are usually limited to those required on the certificate for deaths at all ages. In a few countries a separate perinatal death certificate is used, from which valuable and standard demographic data can be obtained on both late fetal and early neonatal deaths.

2.7 Certified causes of perinatal death

The standard tabulations of causes of death published for early neonatal deaths and, in a very few countries, for late fetal deaths have yielded only limited and sometimes misleading information for purposes of international comparison and etiological study. These tabulations are based on medical certification of cause of death in accordance with the International Classification of Diseases. The current method, employing standard death certificates, is quite unsuitable for perinatal deaths. It makes it impossible to assess the significance of factors occurring during pregnancy or labour, or in the fetus.

The reliability of the certified cause of death varies, depending on the availability of clinical information at the time the certificate is completed.

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and on whether an autopsy has been performed. There is no clear dividing line, therefore, between such categories as asphyxia, atelectasis, immaturity, birth injury, or even neonatal pneumonia.

In one study of several hundred neonatal deaths that were certified as being due to pneumonia, less than 25% showed any pulmonary infection at autopsy. As a result of these and other difficulties, there are marked international differences in, for instance, first week deaths ascribed to "other and ill-defined causes". Clearly, little progress can be made in establishing the causes of perinatal death until accurate diagnostic information is provided, with appropriate revision of the related ICD classifications.

2.8 Results of post mortem examination

The spectrum of post mortem findings in perinatal deaths differs in developed and developing countries. National findings in a developed country are well illustrated by the results of a post mortem investigation of over 90% of all singleton late fetal and early neonatal deaths that occurred during one month in England, Scotland, and Wales. The main findings are illustrated in Fig. 1, each major autopsy finding being expressed as a rate per thousand total births during the same period. The percentage of these post mortem findings is also shown separately for late fetal and early neonatal deaths. The importance is noted of lethal congenital malformations, of which 50% were neural tube anomalies. (Reference is made later to geographical and ethnic differences.) It is probable that only about 10% of all congenital anomalies are due to chromosomal abnormalities and less than 5% to teratogenic agents. Both these factors, therefore, contribute very little to overall perinatal mortality.

Fetal deaths with maceration but without any anomaly (no major antepartum lesion) or with pathological signs of asphyxia only (antepartum anoxia) are really modes of death, since the etiology often lies in the maternal and pregnancy associations, such as advanced age, toxemia, and antepartum haemorrhage. Intrapartum anoxia includes deaths during labour or the first day of life that showed only pathological changes of asphyxia at autopsy. The importance of this category lies in the fact that over two-thirds of the infants were born at term and/or weighed over 2500 g. A study of the clinical associations indicates that this group has responded best of all to improved prenatal and intrapartum care. This group outnumbers first-week deaths due to hyaline membrane or intraventricular haemorrhage, both of which are associated with early pre-term delivery, the frequency of which has not declined although, with better care, more of these very immature babies are surviving. Massive pulmonary haemorrhage is usually a mode of death for the baby whose birth weight is low for its length of gestation.
FIG. 1. MAJOR POST MORTEM FINDINGS AMONG 2188 PERINATAL DEATHS OUT OF 71,000 SINGLETON BIRTHS THROUGHOUT ENGLAND, SCOTLAND, AND WALES IN MARCH 1958 *

Each major post mortem finding is shown as the rate per 1000 total births (bar chart) and as a percentage of late fetal and of early neonatal deaths (pie charts).

Perhaps most important from the preventive aspect are intrapartum and first-week deaths from cerebral birth trauma, and first-week deaths due to pulmonary infection. With better environment and care, these have declined more rapidly than deaths from any other cause.

At national level, as opposed to local level or to ad hoc surveys, autopsies are rarely carried out in sufficiently large numbers, although in at least one country they are performed in over 90% of cases. Autopsy findings permit associations to be made between socio-biological or obstetric factors in pregnancy or labour and specific causes of perinatal death. This method of tabulating clinical and pathological causes is preferable to trying to reach a single, but usually subjective, assessment of the most important clinical or pathological lesion responsible for perinatal death. In many areas conferences are now held among gynaecologists, paediatricians, pathologists, and others concerned with maternity and neonatal care, to review each perinatal death and to learn how improvement can be effected in future cases. This practice should be encouraged.

Post mortem studies carried out in developing countries indicate an excess of deaths from intrapartum anoxia, cerebral birth trauma, infection, and causes associated with premature delivery. Certain lethal congenital malformations and rhesus incompatibility are less frequent causes of death in these countries.

3. FACTORS INFLUENCING THE OUTCOME OF PREGNANCY

The Committee considered factors operating prior to and during pregnancy, and during the early neonatal period, which are associated with perinatal mortality and morbidity and long-term sequelae.

3.1 Preconceptional and interconceptional period

A good standard of health throughout childhood, adolescence, adult life, and pregnancy is necessary for successful reproduction.

The physical and mental health of the future mother, her history of immunization and infectious diseases, her education, the social and cultural conditions in which she has been brought up, and her attitudes and behaviour patterns, including those related to reproduction and family life, influence perinatal mortality and morbidity. Preventive measures must therefore be applied in caring for the health of mothers and children as a continuing process, from childhood through the preconceptional period to prenatal and postnatal care. Postnatal care should include preconceptional care for the next pregnancy.

Malnutrition and severe anaemia adversely influence the course and outcome of pregnancy, affect fetal growth and birth weight, and hence
contribute significantly to perinatal mortality. In some developing countries and in parts of some developed countries, iron deficiency anaemia is common among young girls and especially among women of child-bearing age. Insufficient protein and calorie intake and vitamin deficiency, particularly of folic acid, are frequent in some areas. Ideally, malnutrition and anaemia should be prevented during all the years prior to conception. A rapid succession of pregnancies may aggravate a pre-existing nutritional anaemia, resulting in infants of low birth weight with early iron deficiency.

3.2 Pregnancy and parturition

The developing conceptus interacts with the maternal environment in a highly complex manner. Multiple factors in the mother, such as age, parity, height, socio-economic status, ethnic group, past obstetric history, and smoking habits are likely to be interdependent in their influence on pregnancy outcome. Prenatal care of the mother also exerts an influence on the fetus.

3.2.1 Conception

Little is known of the influence of genetic factors on early fetal deaths. Some studies indicate that segregation of recessive lethal genes, chromosomal aberrations, and dominant lethal mutations are responsible for many early fetal deaths which, in turn, may account for a reproductive loss rate higher than that of perinatal mortality.

The artificial stimulation of ovulation possibly increases the incidence of multiple pregnancy and its associated perinatal risks. Family planning and the limitation of pregnancies can lower perinatal mortality and morbidity in a given community, especially if practised by women at high perinatal risk, e.g., older women and women of high parity. It has also been suggested that the spacing of pregnancies can lower the PMR.

Premature labour has been reported as a complication of repeated dilatation of the cervix when pregnancies have been terminated vaginally.

3.2.2 Early adverse influences on the conceptus

Drugs. Whereas the most dramatic teratogen for man is undoubtedly thalidomide, a dozen or more drugs are available that can in some way damage or have an influence on the fetus. The fetus may be more exposed to drugs in industrialized countries, where the consumption of pharmaceutical products is higher. The indiscriminate use of drugs and traditional remedies of unspecified composition in developing countries could, however, present a greater hazard. The problem is not so much one of drugs being administered to women who are known to be pregnant, as of the
administration of drugs to women who become pregnant while under treatment. Even in countries where prenatal care is practised systematically, the pregnant woman is usually first seen after the period of fetal organogenesis and the obstetric attendant rarely has the opportunity to influence this aspect of fetal welfare.

Governments should extend the testing of drugs, and approve and supervise their use, keeping in mind the potential risk to the fetus. However, teratogenic risk to the human fetus cannot be identified by laboratory tests or animal evaluations, but only by testing a drug on man himself.

**Diseases.** Rubella in the early weeks of pregnancy is an established teratogen. With the potent vaccine now being introduced rubella could become a preventable disease. This vaccine is considered safe for children, and its safety during pregnancy is being evaluated.

Cytomegalovirus has been implicated as another possible viral teratogen.

**Radiation.** It is advisable to consider radiation as always dangerous to the fetus. Generally accepted views are: (a) the effects of doses below 1 R will not significantly exceed those of natural background radiation; (b) doses exceeding a few R may cause discernible fetal damage; (c) the probability of fetal damage increases with the radiation. It is, however, impossible to establish a threshold level above which cell damage may occur, necessitating termination of pregnancy. Therefore management must be determined individually for a particular patient and situation.

As with drug exposure, radiation exposure is undoubtedly commoner in the industrialized than in the developing countries. Limitation of radiation is essential, and all requests for diagnostic radiology in women should bear the date of the patient's last menstrual period. The period of maximum danger is before the patient knows that she is pregnant.

The long-term cumulative effect of background radiation in causing genetic mutations should also be noted.

### 3.2.3 General health in pregnancy

A favourable environment with good living conditions is a prerequisite for successful childbearing. Where environmental conditions are poor, perinatal death ratios are higher, birth weights are lower, and premature labour is more common.

In areas of food shortage, pregnant women, lactating mothers, and infants are the first groups in the community to suffer. Malnutrition may contribute to maternal mortality, fetal loss, low birth weight, and faulty lactation. Overnutrition and obesity may also have a harmful effect on the outcome of pregnancy.
Acute infectious diseases, especially common in developing countries, may have an intensified effect on the pregnant woman and seriously influence the fetus. Important examples are infectious hepatitis, smallpox, tuberculosis, malaria, syphilis, listeriosis, brucellosis, and toxoplasmosis.

Work in pregnancy. There may be a high incidence of premature labour among women in industry. Improved legislation regarding maternity benefits, initiated by the International Labour Office Maternity Protection Convention, 1919, and adopted by many countries, has helped to improve the health of mothers and infants and has reduced perinatal problems. It is possible that mothers in the upper socio-economic group can carry out professional work until late in pregnancy without harmful effects. However, it is difficult to judge without further information, dissociated from socio-economic factors, on the effect of work in pregnancy.

3.2.4 Obstetric status

Many interrelated factors concerning maternal obstetric status are known before pregnancy and facilitate primary selection, at the first prenatal visit, of mothers at high perinatal risk.

Maternal height has a negative linear correlation to PMR. There is a linear relationship between PMR and the socio-economic group of the father and maternal grandfather. Smoking adversely affects birth weight and PMR, irrespective of its association with socio-economic group and parity. PMR has a J-shaped curvilinear relationship to both maternal age and parity, and is lowest at 20–29 years and parity 1 to 4. The risks are cumulative, and women over 35 years of age who have had 4 or more children and who smoke must be regarded as a particularly high risk (Fig. 2). It must be emphasized that statistical risk should be used as a guide and not applied strictly to the individual.

A patient’s past obstetric history gives a good indication of her capacity for successful pregnancy. Perinatal and early pregnancy loss tend to recur in a given patient. In addition to the factors already mentioned, a history of a series of abortions, low birth weight babies, perinatal deaths, caesarean section, cardiovascular or renal disease, or diabetes increases the risk.

3.2.5 Extramarital pregnancies

The adverse statistical association between extramarital pregnancies and perinatal mortality is well known. In many cases it may largely be due to age, parity, social class, and quality of care. The Committee felt that the problem was too complex for generalizations to be made on a worldwide basis.
FIG. 2. CALCULATED PERINATAL MORTALITY RATE IN MOTHERS OF DIFFERENT AGE, PARITY, AND SOCIAL CLASS GROUPS (HUSBAND'S OCCUPATION) ACCORDING TO SMOKING HABITS

Social class:
- Professional and managerial
- Skilled workers
- Semi-skilled and unskilled

3.2.6 Secondary obstetric factors

During pregnancy secondary obstetric factors, i.e., those developing during the prenatal period, are of great significance.

Bleeding in early and late pregnancy, whether due to a defective ovum, defective utero-placental development associated with later abruptio placentae, or abnormal implantation manifested by placenta praevia, indicates a high-risk conceptus. Bleeding in late pregnancy that is not classified as abruptio placentae or placenta praevia, and which may be from the placental edge, is also associated with premature labour and an increased perinatal risk.

Toxaemia carries a high risk, especially when associated with proteinuria and when of early onset.

Multiple pregnancy increases the risk of complications during pregnancy, parturition, and the early neonatal period.

Rhesus iso-immunization has a marked geographical localization in populations with a significant number of women who have the Rhesus blood group antigen d (Rh). In typical Caucasian communities, one pregnancy in 200 shows fetal affliction. Although this condition has a low perinatal mortality, it presents a great problem to individual families. In addition to recent advances in therapy, the possibility now exists of preventing iso-immunization in subsequent pregnancies by administration of anti-D (anti-Rh) IgG. The protection scheme will be difficult to apply in every case and cannot as yet be used in preventing disease due to c (hr), Cw (rhw), and K antibodies, so that greater vigilance will be needed in future to detect the less frequent case of sensitization.

Haemoglobinopathies such as sickle cell anaemia are of great importance in some countries and, unless screening is applied to populations at risk and impeccable care given to pregnant women with abnormal haemoglobins, there is an increased perinatal mortality and a higher incidence of babies of low birth weight.

3.2.7 Premature labour

The presence of some secondary obstetric factors may necessitate delivery prior to term, usually in the interests of the fetus to remove it from an unfavourable intra-uterine environment. Other factors, e.g., multiple pregnancy and toxemia, carry an increased risk of spontaneous premature labour. Premature labour may also be associated with congenital uterine abnormalities, or with an incompetent cervix thought to be due to previous overdistilation.

In cases of toxemia, cardiovascular or renal disease, and multiple pregnancy, fetal nutrition is reduced and the baby is of low weight relative
to its gestational age. Less well understood is impaired intra-uterine growth due to fetal and utero-placental factors not associated with obvious obstetric disease.

Premature labour is on the whole poorly understood; it is associated with low socio-economic status and with maternal infections, e.g., urinary tract infection and listeriosis. A certain amount of "iatrogenic immaturity" occurs when, owing to lack of conceptional data (date of last menstrual period, etc.) or to errors in calculation, induction of labour or elective caesarean section is performed sooner than indicated.

3.2.8 Factors in labour

The influences on fetal outcome that are well known to arise or become manifest during labour have received much attention in the past, particularly in developed countries. They include mechanical factors such as disproportion, unstable lie, malpresentation, cord prolapse, prolonged labour, and traumatic delivery. Non-mechanical factors include the influence of analgesic and anaesthetic drugs, maternal ketosis, and infection, which may produce in the fetus hypoxia, cerebral damage, infection, or disturbances of acid-base equilibrium. A fetus that has already been under prenatal stress because of an unfavourable intra-uterine environment will be more likely to suffer from the additional difficulties of labour.

Both the pre-term \(^1\) and the post-term \(^1\) fetus are at increased risk during labour. The modern concepts require that the high-risk fetus be delivered in the best available environment, with optimum support during labour, adequate monitoring equipment, facilities for immediate caesarean section, attendance of obstetric, anaesthetic, and paediatric specialists, and a neonatal intensive care unit. In developing countries, the fetus is frequently exposed to the risks of pregnancy and labour without the possibility of the place of delivery being selected, and often without the services of a trained accoucheur.

3.3 The early neonatal period

The course of the newborn during the first days of life is largely predetermined by hereditary factors, the maternal environment, and the effects of labour. The supporting care systems designed to aid initial adaptation to the new environment at birth will be of greatest value for the high-risk fetus, but must also be available for the rare case of a low-risk neonate who fails to adapt. In an ideal environment, which provides nutrition and warmth without infection during the first days of life, the healthy

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\(^1\) The Committee agreed to define pre-term as before 37 weeks (259 days) of gestational age (calculated from the first day of the last menstrual period), term as from 37 to before 42 weeks (294 days), and post-term as from 42 weeks.
neonate usually does well. The high-risk neonate may need much more elaborate care if life is to be preserved and sequelae prevented.

In addition to extensive information on obstetric and other factors, which must be available at delivery, an initial assessment of the newborn should take into consideration adaptation, birth weight, gestational age, weight and nutritional status in relation to gestational age, and the presence of physical abnormalities. An early prognosis can thus be made. The risk of death rises as the birth weight decreases; whilst only 1% of all neonates weigh 1500 g or less, they account for roughly 50% of neonatal deaths.

Most neonatal problems appear within 24 hours of birth, when maximum observation and care are needed. On the first day of extra-uterine life, major problems may arise from primary apnoea, delayed intrapartum anoxia (meconium aspiration), congenital malformations, the complications of extreme immaturity, or low birth weight for gestational age. The problems that may arise in the first week are infections, neonatal jaundice, metabolic disorders, special problems of low birth weight babies, and consequences of birth injuries.

In the developed countries early neonatal death rates below 10 per 1000 have been achieved. The position in developing countries is very different. Lack of prenatal care and skilled assistance at delivery will lead to the problems discussed above, while infection is common and specific cultural practices involving, for example, male circumcision and unhygienic cord treatment, may lead to haemorrhage and infection. Jaundice is a serious problem. Lack of special care for low birth weight babies makes the maintenance of breast feeding particularly important.

3.3.1 Apnoea and meconium aspiration

Mortality and morbidity from primary apnoea have been reduced by modern resuscitation techniques, in particular by controlled endotracheal oxygenation. Primary apnoea has many causes, but is usually due to inhalation of meconium or depression of the respiratory centre, following intrapartum anoxia or birth injury. Unless treated, secondary apnoea will ensue, with permanent injury or death.

3.3.2 Variations in birth weight and gestational age

The first-week complications associated with low birth weight are responsible for up to 70% of early neonatal mortality and morbidity.

The problems are better analysed by considering together birth weight and gestational age, as known or estimated from the best available data including length, head circumference, and behaviour. Curves of mean birth weight/gestational age are now available for some populations, and it is possible to predict the degree or type of risk for a particular infant
by using the relevant percentile curves or the curves at 1 and 2 standard deviations from the mean.

At the 50th percentile in a "normal" population, the curve is almost a straight line until the end of the 38th week, after which time, the average fetus appears to outgrow maternal growth support. This deviation occurs sooner if there is any intrinsic or extrinsic condition affecting fetal growth earlier in the third trimester.

*Pre-term births* (under 37 weeks). Here, the problem is usually physiological immaturity, which is more serious the lower the gestational age. Whilst most infants are of reasonable weight for age, some, from a highly unfavourable intra-uterine environment, e.g., severe toxæmia, may also be of low weight relative to their gestational age. The problems include:

(a) respiratory distress syndrome (hyaline membrane disease), which increases steadily as gestation falls below 36 weeks and may lead to severe ventilatory, biochemical, and blood-gas disturbances;

(b) immature thermoregulation;

(c) immature sucking and swallowing mechanisms;

(d) increased susceptibility to infection;

(e) hyperbilirubinaemia, often associated with immaturity of hepatic enzymes; the danger of kernicterus is increased in the presence of acidosis or hypoglycaemia, and after administration of sulfonamides or excess of synthetic vitamin K to the mother or infant;

(f) hypoglycaemia, especially in the presence of respiratory distress or infection.

*Small-for-dates babies.* A low birth weight for gestational age, as shown by reference to percentile or standard deviation curves, carries an increased risk of mortality and morbidity. The associated conditions may be grouped under the following headings: congenital malformations; infections in early pregnancy; maternal, paternal, and ethnic influences of a genetic type; and the more important and complex influences of socio-economic status, toxæmia, chronic nephritis, malnutrition, anaemia, malaria, and smoking. The fate of infants in the congenital malformation group will depend on the type of malformation rather than on the birth weight. Early infections such as rubella, toxoplasmosis, and cytomegalic inclusion disease appear to affect organogenesis and the number of cell divisions more than does fetal nutrition. There are also inter-relationships, which require further study, between the maternal, paternal, and ethnic, genetically-determined influences and the effects of socio-economic status, nutrition, and other influences in late pregnancy. Whilst the incidence of small-for-dates babies is four times higher in some ethnic groups than in others, the mortality rate of these infants may be as much as four times
lower. There is also evidence that better nutrition, throughout several generations, may increase the size of babies in some ethnic groups.

There is increasing concern regarding the contribution of maternal malnutrition to faulty intra-uterine and postnatal development and to long-term sequelae. This is based largely on animal investigations and indirect evidence in man. Direct evidence has been difficult to acquire, because human malnutrition rarely occurs alone but is usually associated with poverty, poor health, deficient medical care, infectious disease, poor hygiene, and other detrimental influences. So-called "placental insufficiency" may be influenced by many factors, including the genotype of the conceptus and environmental factors, and is best not used as an etiological factor.

Small-for-dates babies, clinically malnourished at birth and with depleted glycogen stores, present the greatest single problem; they must be distinguished early from those who, though small-for-dates, present no clinical indication for intensive neonatal care.

The PMR of babies below the third percentile of birth weight may be up to 6 times higher than that of babies whose birth weight is average for the duration of pregnancy. It is higher in males than in females and death is often associated with massive pulmonary haemorrhage. Often there is poor temperature regulation and marked hypoglycaemia after the first few hours of life, either asymptomatic or with neurological signs. The weight loss after birth is small, if any. There is often hypothermia and dehydration with or without a high serum sodium.

Large-for-dates and post-term babies. Maternal diabetes or pre-diabetes appears to account for approximately 10% of babies over the 90th percentile of weight for gestational age. Neonatal complications include hypoglycaemia, increased risk of infection, mechanical difficulties in labour, and complications of immaturity if induced pre-term.

Babies with high birth weight for gestational age, delivered at term or post-term, may experience intrapartum mechanical difficulty, with hypoxia and cerebral and peripheral birth trauma. Meconium aspiration is a frequent complication.

3.3.3 Infections

Infections in the mother may influence perinatal outcome by acting in early pregnancy, by causing premature labour with or without fetal infection, or by affecting the infant during labour or in the neonatal period.

Congenital infections that affect the fetus include toxoplasmosis, cytomegalic inclusion disease, and congenital syphilis. Rubella is in a separate category because it intervenes in the early weeks after conception; the affected fetus usually develops an altered immunological reaction, and
continues to excrete rubella virus throughout fetal life and sometimes for several months to a year after birth.

The newborn may be contaminated during labour and delivery, particularly with Gram-negative organisms, frequently as a result of prolonged rupture of the membranes or of prolonged labour or obstetrical manipulation. The newborn may be directly infected during passage through the birth canal.

Postnatally, the neonate is susceptible to infections through contamination from his environment, i.e., from personnel, equipment, or procedures, or by cross-infection. Low birth weight and small-for-dates infants are particularly vulnerable to infection.

In developed countries, serious neonatal infections are comparatively rare with the exception of pulmonary infection. Meningitis sometimes develops, however, as a result of infection acquired during or after birth, and may lead to death or subsequent long-term sequelae. Intrapartum and postpartum contamination of the fetus are common in developing countries, where infection is possibly the most important and most readily preventable health problem of the neonate. Neonatal tetanus is an outstanding example.

3.3.4 Jaundice

Neonatal jaundice must never be regarded as physiological until all known pathological causes have been excluded. This applies particularly to jaundice within the first 36 hours, when it is most often due, in developed countries, to rhesus or other blood group incompatibilities or to other causes of haemolysis.

Other causes include neonatal hepatitis, infections, galactosaemia, congenital obstructions, and medication given to mother or baby. In developing countries, neonatal infections are a common cause and G6PD deficiency is common in certain populations. Delayed feeding of low birth weight babies is an avoidable cause which, as with other causes of raised indirect bilirubin level, can lead to kernicterus.

3.3.5 Haemorrhage

The classical form of haemorrhagic disease of the newborn due to vitamin K deficiency is preventable nowadays. However, another form of bleeding is seen in newborns, chiefly among low birth weight infants. This form can neither be prevented nor successfully treated with vitamin K; it occurs during neonatal asphyxia, respiratory distress, or infection, and may be severe enough to cause hypovolaemia. Its precise mechanism is still unknown. Sometimes there is thrombocytopenia; more often there is a decrease in the level of one or more coagulation factors, especially factors II, V, VII, and X.
Intracranial haemorrhage may take the form of intraventricular haemorrhage in immature babies, subdural haemorrhage from a tentorial tear, or a slowly progressive subdural haematoma causing vomiting and neurological signs after the perinatal period. A subcapsular hepatic haematoma may rupture into the peritoneal cavity. Adrenal haemorrhage occurs more rarely. Umbilical haemorrhage may also occur.

3.3.6 Congenital malformations

Congenital malformations are an important cause of perinatal mortality and morbidity (Fig. 1) and may be found to account for 10–20% of perinatal deaths, depending on the frequency of autopsies.

Rather marked variations have been noted in the incidence and prevalence of congenital malformations, which are only partly the result of differences in reporting. Factors that are known to affect the rate of specific malformations include maternal age, parity, social class, sex of child, and ethnic group.

Major neural tube malformations are known to be frequent in the United Kingdom (especially Northern Ireland), in the Sikh population of India, and in the United Arab Republic, while a low rate is reported in Japan, Australia, and most parts of Africa. These malformations are more common among the lower socio-economic groups, at age and parity extremes, and in female fetuses. The prevalence of clubfoot and congenital dislocation of the hip is much increased in girls. There is a sharp rise in Down's syndrome and some other chromosomal aberrations among offspring of women over 40 years of age. Teratological malformations are produced by congenital rubella, certain drugs and chemicals such as thalidomide and amniotin, and irradiation. Congenital malformations of genetic origin are rarely due to a single gene.

Major chromosomal aberrations constitute another group of congenital malformations that frequently lead to early death. It is estimated that one in 300 live-born children carries such an aberration, which is often, but not always, associated with obvious malformation. Such chromosomal aberrations are frequent among early fetal deaths.

Hereditary metabolic disorders. These are rare. They contribute to neonatal or infant mortality (maple syrup urine disease, galactosaemia, etc.), to mental retardation (phenylketonuria), or to other serious handicaps in survivors (e.g., cystic fibrosis of the pancreas). Current interest in these neonatal problems relates to the possibility of avoiding long-term sequelae by early diagnosis and therapy.

1 The term "congenital malformations" is used to include not only anatomical defects but also molecular and cellular abnormalities present at birth. See Wild Hlth Org. techn. Rep. Ser., 1968, No. 400, p. 9.
4. LONG-TERM SEQUELAE

The identification of long-term sequelae of perinatal complications and of the contribution that perinatal complications make to developmental and mental deficits of childhood is exceedingly difficult and complex. Controlled experimental work in which the contribution of a single factor is isolated is not usually feasible with human beings as it is with animals. Knowledge of humans is based on associations that have been identified through analysis of retrospective or prospective data.

Perinatal stress may be modified in many ways by the social environment in which a child is reared. It may be largely compensated for by a favourable social environment, or intensified by an unfavourable one.

While mental retardation, cerebral palsy, delayed motor development, reading and learning disorders, and other school and behaviour problems have been reported as sequelae, the scope of the problem is ill understood and the proportion of such defects resulting from perinatal disorders has not yet been fully elucidated.

It is well known that relatively long-standing fetal hypoxia, associated with conditions such as eclampsia, abruptio placenta, or knotted cord can lead to brain damage, including cerebral palsy. There is, however, increasing evidence to suggest that a mere history of maternal pre-eclampsia, antepartum haemorrhage, or even breech delivery is very unlikely to result in measurable impairment of childhood performance.

Most children surviving acute hypoxic episodes, shown by fetal bradycardia, meconium staining, fetal acidosis, or low Apgar score as a neonate, appear to be free from major neurological defects. Intrapartum mechanical trauma to the fetal brain is also nearly always associated with fetal hypoxia. It is impossible, therefore, to separate the mechanical from the hypoxic component as an occasional cause of severe mental or neurological handicap seen in such children at follow-up.

Intellectual performance in children decreases slightly from first to second birth order, although the risk of perinatal mortality is higher in first than in second births. Intellectual performance increases with maternal age, allowing for parity; however, certain central nervous system malformations and Down's syndrome occur more frequently in children born to mothers over 40 years of age. A rapid succession of pregnancies in the same woman may contribute to mental subnormality in the child. Children born within a year of the birth of a previous child appear to have a lower intelligence than those born after a 2-4-year interval. The difference is partly due to a relatively low average birth weight in children conceived shortly after the last pregnancy.

Recent work indicates that children of diabetic mothers who have suffered episodes of ketosis during pregnancy may also have lower intelli-
gence. In addition, maternal ketosis without diabetes in the third trimester of pregnancy is associated with lower intelligence in the offspring.

Certain intra-uterine infections, namely, rubella, cytomegalic inclusion disease, and toxoplasmosis, may lead to central nervous system damage and mental retardation. In the postnatal period, neonatal meningitis, which is usually of bacterial origin, frequently results in severe and permanent damage to the central nervous system.

Hyperbilirubinaemia is also a well-established cause of brain damage, and is largely preventable.

Motor retardation, decreased intelligence, learning deficits, reading impairment, and other school and behaviour problems are reportedly associated with a birth weight of 2000 g or less, but multifactorial analysis shows that some of these difficulties are due to low socio-economic status. The group of children weighing 2500 g or less at birth does not appear significantly to increase the need for providing special education. When gestational maturity is considered alone, there is a slight deterioration in measured performance both in pre-term and post-term children, but this is not enough to produce a significant degree of handicap except in those born very prematurely.

On the other hand, many neonatal problems known to be detrimental to the central nervous system occur more frequently in the child who is born very prematurely or with a very low birth weight. Examples are apnoea, respiratory distress syndrome, hyperbilirubinaemia, and hypoglycaemia. The relative influence of associated obstetric and neonatal complications on the risk of ultimate handicap is not known for these children. It is not surprising, therefore, that permanent handicaps are found more frequently among children of very low birth weight. Spastic diplegia occurs almost exclusively in children who are born very prematurely and who weigh 1500 g or less at birth.

There is a special group of low birth weight babies born at or near term, who are small-for-dates and who differ in many respects from low birth weight babies born before term. Their subsequent developmental pattern is not fully known, although there is a strong suspicion that their postnatal physical and mental development is often impaired. This is supported by studies of twins, in whom reduced intra-uterine growth is frequently found. The effect may be more evident in one of the pair, with resulting marked differences in birth size. The smaller of the two often remains smaller and also shows lower intelligence at school age. The most critical period for growth and differentiation of the central nervous system extends from the last trimester of pregnancy through the first months of postnatal life. Low birth weight may reflect poor fetal nutrition during the third trimester and either alone or in association with inadequate postnatal nutrition, may directly and irreversibly affect the development of the central nervous system, with consequent reduced mental capacity and learning ability.
5. HEATH SERVICES FOR MOTHERS AND CHILDREN

The Committee agreed that health services for mothers and children must be planned and organized within the context of general health services, and within the broad programme for social and economic development of the country. The development of a network of basic health services at peripheral, intermediate, and central levels can provide suitable and effective health services for mothers and children, including domiciliary, ambulatory, and hospital care.

The maternal and child health component of basic health services is well described in the WHO document "Basic Health Services". Among other factors related to maternal and child health services, this document highlights the shortage of "qualified paediatricians and obstetricians in many countries. Under these conditions, direct services to mothers and children will in the main be provided by general physicians, medical or health assistants, midwives and nurses and their auxiliaries."

This is certainly not the case in developed countries, where specialist gynaecologists and paediatricians are trained and are available in increasing numbers, even though not in proportion to the rate of growth of the reproductive population. Even in some developed countries, however, the care of most mothers and children is not always carried out by specialists, and specialist gynaecologists and paediatricians are being used to different extents in referral services and in teaching centres. Details of the organization and administration of maternal and child health services are well covered in the fifth report of the WHO Expert Committee on Maternal and Child Health.

5.1 Communication problems

Although there are effective maternal and child health programmes in many parts of the world, the Committee noted with concern that individual services are often isolated from each other. There is inadequate communication between gynaecologist and paediatrician, even in the same hospital, and usually little contact between these specialists and their colleagues in public health and maternal and child health. Modern concepts necessitate continuity of care by an integrated team of health workers.

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1 "Basic Health Services", mimeographed document WHO/PHA/69.39.
2 The Committee agreed to define a specialist gynaecologist as an obstetrician and gynaecologist with some years of postgraduate training, usually to a standard prescribed by an appropriate professional body, and a specialist paediatrician as a paediatrician with some years of postgraduate training, usually to a standard prescribed by an appropriate professional body.
In developing countries communication problems are of a different type. There are vast areas with little or no services at all, and travel and communication between sites of care may present considerable difficulties. The planning of integrated programmes using multipurpose workers is essential in order to reach mothers and children in developing areas.

5.2 Organization

In both developing and developed countries, the teaching or regional hospital should be at the apex of a pyramid of regional care.

A WHO Expert Committee on Social Aspects in the Teaching of Obstetrics and Gynaecology considered that “the appointment of the professor of obstetrics and gynaecology as specialist adviser to the maternity services of the region and the creation of a maternity liaison committee would be of benefit both to the health services and to the teaching programme”. The Committee endorses this recommendation, with the addition of the professor of child health or paediatrics.

In less densely populated areas far from teaching hospitals, regional integration is advised at the level of the base or district hospital, with technical supervision of all services affecting mothers and children by regional specialists in gynaecology, paediatrics, and community health. The regional supervision of standards of care (as measured by local evaluation of perinatal mortality and morbidity), including care given separately in the gynaecological and paediatric specialist services, is very important.

The district hospital, with full facilities for caesarean section and neonatal care, should also provide complete laboratory and other diagnostic services, using reference laboratories for assistance as necessary.

Modern care necessitates in-patient prenatal care for special observation and procedures. Sufficient beds must be available for prenatal care in district hospitals, and intensive prenatal monitoring facilities in teaching units. Each hospital should be a general one with associated specialties, but the gynaecologist should remain the co-ordinator of care for every hospitalized pregnant woman.

Major laboratory services should provide adequate quality control of their procedures; this can be facilitated by automated techniques.

Problems such as respiratory distress syndrome, prematurity, and acute neonatal surgical emergencies occur in both developed and developing countries. While developing countries at present have few facilities and trained staff for intensive care of infants, as the countries progress they can establish units in teaching hospitals which are equipped to provide a high

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standard of special care, combined with simple care of the type that allows for a smooth transition from hospital to home.

At the peripheral level and serving perhaps 20,000–25,000 people should be health centres with midwifery beds and a medical officer and/or midwife. These would provide services that the general medical officer and midwife have been trained to perform, including assisted vaginal delivery, manual removal of placenta, urgent blood transfusion, and care of the neonate not involving prolonged or intensive care, or specialized procedures or laboratory aids. Each health centre would also serve sub-centres, dealing with patients within about 8–10 km. Here the midwifery would be domiciliary, and the care provided by auxiliary health workers.

The best possible transportation facilities must be provided to ensure rapid and safe transfer of patients up the chain of services to reach the necessary level. In some cases it is desirable to by-pass intermediate services; in the extreme case, a mother might be moved direct from home or sub-centre to the teaching hospital. Where possible there should be arrangements for sending out a flying squad from the district or teaching hospital, to deal with problems such as eclampsia, ruptured uterus, postpartum haemorrhage, and neonatal tetanus, when special treatment is necessary before or during transportation.

6. STANDARDS OF CARE

The Committee is aware of wide variations in health care for mothers and babies throughout the world. In laying down optimum and interim standards it is realized that there will be many areas where intermediate standards prevail, and that each country must select its own standards in accordance with its needs and facilities. In those areas with relatively low mortality rates, improvement can be effected by meticulous attention to standards of care. Since the intention is to focus on prevention of morbidity rather than its lifelong treatment, optimum standards of care are considered in some detail.

6.1 Preparation for childbearing and family life

Education in the school years should include preparation for family life, encompassing such subjects as the physiology of human reproduction, nutrition, hygiene, and sex education, based on each country's cultural and social pattern. Preparation is best started in schools as an integrated part of the educational programme, and the teacher should be specially prepared to carry out this task. In some developing countries, however,
a large number of school-age children either do not attend school or cease
to attend after a few years. Health care and health education of these
children should therefore be made available through health and community
services.

For successful childbearing, a woman's health and nutrition should be
a lifelong consideration, and good nutrition in childhood is certainly as
important to successful childbearing as it is during pregnancy. Nutrition
education, therefore, based on local food habits, availability of food, etc.,
is an essential part of preparation for childbearing and family life.

The detection and treatment of physical and mental disorders during
childhood and adolescence can be incorporated into the school health
programme, although school health examinations may not be possible
in many developing countries, because of limited resources and the greater
importance of other health needs. Infectious diseases are still a major
health problem of all age groups in many developing countries. In develop-
op countries, psychological problems may become evident at school
and psychological support should be readily available.

Preparation for childbearing and family life during the preconceptional
period should include marriage counselling, advice on timing and spacing
of pregnancies, genetic counselling, early detection of physical and mental
problems, and health education. When a woman who has been using con-
traceptives such as an intra-uterine device seeks the advice of a health worker
prior to discontinuing contraception, the opportunity should be taken for
a preconceptional health appraisal.

With the scarcity of health services in developing countries it is not
possible to reach all women during the preconceptional period, but efforts
should be made to meet their most important health needs by whatever
services are available. Nutrition, control and prevention of infection, and
advice on family planning should be given priority.

6.2 Optimum care in pregnancy and labour

The current concepts of optimum care imply the existence of a chain
of clinical services ranging from a midwife and/or family doctor/obstetrician,
who care for the patient in pregnancy and labour at home or in a small
maternity hospital, to a specialist gynaecologist and paediatrician in a
well-equipped hospital with full facilities for caesarean section, neonatal
intensive care, and special facilities for anaesthesia, pathology, and radio-
logy. The prenatal care may be given at home, at the doctor's office, at a
clinic or hospital, or in all of these.

Unfortunately, in some places communication is inadequate among
the various units of this chain. The Committee believes that optimum care
is not possible unless ideal communication and co-ordination exist among
all services that offer care to every mother and baby. Specialist gynaecologists and paediatricians should act in an advisory capacity for the services in their region.

Whilst full, regular, specialist care for every mother and baby is not yet feasible even in developed countries, it should be possible to refer every mother and baby urgently for specialist assistance, and their transfer up and down the "chain of care" should be administratively simple. There should be a regional obstetric service, having appropriate numbers of obstetric units with maximum facilities, linked by good communications to the smaller maternity hospitals and to the domiciliary obstetric service where this exists.

The above principles and the discussions that follow have important implications for the teaching of specialists, family doctors, midwives, health administrators, and potential mothers. Teaching of family doctors should emphasize early recognition of high-risk patients. It is of much greater importance to the family doctor to be able to diagnose multiple pregnancies by 28 weeks of gestation than to manage labour in such cases, since they should be referred to a specialist.

6.2.1 Pregnancy

The old-established principles of prenatal care, which were mother oriented, now need supplementation by principles of simultaneous fetal care. At each prenatal examination, part of the procedure should be specifically directed to the growth and well-being of the conceptus. Whilst such care is primarily the duty of the obstetric attendant and abnormalities will be referred to a specialist gynaecologist, the latter may from time to time consult with paediatric colleagues.

Establishing the duration of gestation. Women must be educated to appreciate the importance of menstrual history and to visit the physician early in pregnancy. Obstetric care without adequate knowledge of the age of the conceptus can be compared with infant care without knowing the age of the baby. The first prerequisite, therefore, is accurate menstrual dating with clinical confirmation at an early prenatal visit (8–10 weeks).

The early diagnosis, preferably before 10 weeks of gestation, of pre-existing hypertension, oedema, and proteinuria is particularly important, since these cases require maximum care and should be referred early to a specialist gynaecologist for assessment.

Selection of high-risk conceptions should be made at the first prenatal visit, and cases developing signs of high risk should be referred subsequently. As discussed in section 3.2.4, primary selection is based on history, age, parity, socio-economic status, height, medical disorders, and past obstetric history. Secondary selection, as noted in section 3.2.6, is based on abnormalities arising during pregnancy.
Tests for anaemia, positive syphilis serology, and blood group and rhessus antibodies should be carried out in all pregnant women. Routine testing of urine, for organisms, glucose, and protein, and of patients' weight, blood pressure, and oedema should be performed at least monthly. In those countries where haemoglobinopathies are important, screening tests should be included.

Assessment at 28 weeks. The Committee discussed the advisability of every mother being seen by a specialist gynaecologist at least once during pregnancy. This was regarded as desirable. The 28th week is a key time for a thorough re-assessment with careful examination of the conceptus. In addition to the usual prenatal observations, it is wise to repeat haemoglobin and Rh antibody screening, as well as evaluation for multiple pregnancy.

In-patient rest and observation should be considered at this stage in cases of toxaemia, multiple pregnancy, or recurrent premature labour, particularly if maternal cardiac volume is low.

6.2.2 Specific clinical problems

Toxaemia. Toxaemia of early onset (before 34 weeks) carries a very high perinatal risk and cases should be transferred to specialist care. In the absence of specific therapy, the management of toxaemia consists of rest to improve blood flow to the fetus, careful observation, and well-timed induction with control of fetal status by oestriol assays.

There is a place for hypotensive therapy in patients with pre-existing hypertension or where there is thought to be a significant risk of cerebral haemorrhage in the mother. The benefit lies mainly in controlling the maternal disease while attaining maximum fetal maturity. Hypotensives and diuretics may mask important indicators of fetal jeopardy. Cigarette smoking has been shown to be associated with lower birth weight; this effect of lowering the birth weight is more pronounced in the presence of toxaemia, therefore smoking in pregnancy should be discouraged.

Haemolytic disease. All patients should have antibody screening using polyvalent cell suspensions, at booking and again at 28 weeks. Those with D(Rh0), e(he+), C*(Rh+), and K antibodies at a titre of 1 in 16 or higher should have amniocentesis, the timing being determined by the past history. Induction should be based on the results of liquor scan for pigments at 450 mu. Fetal transfusion should be considered in the most severe cases.

Anti-D (Rh0) protection schemes are now available. Ideally, all D-negative mothers with D-positive babies should be protected within 72 hours of delivery irrespective of ABO compatibility. Protection must also be made available in cases of abortion.
Antepartum haemorrhage. This is an important cause of perinatal mortality, and may be due to placental separation in abruptio placentae, placenta praevia, and other causes.

In abruptio placentae the fetus is usually dead at diagnosis, but if alive can probably be saved by urgent section with simultaneous resuscitation of the mother.

The treatment of placenta praevia has become more conservative as regards timing and more radical as regards method of delivery. Until about 37 weeks, conservative therapy is indicated, with transfusion if necessary; further haemorrhage after 37 weeks usually indicates the need for caesarean section. In the absence of recurrent haemorrhage, and assuming that the diagnosis is confirmed, planned section at about 39 weeks is ideal.

Minor, unclassified antepartum haemorrhage (often placental edge bleeding) is associated with higher than average fetal loss. These cases should be under specialist care, fetal growth carefully noted, and oestriol assays performed.

Unstable lie. Such cases should be referred to a specialist gynaecologist. Apart from the need to consider mechanical causes such as placenta praevia, care begins at about 38 weeks with admission to an obstetric unit to await spontaneous labour. The presentation will usually correct itself at the onset of labour, otherwise caesarean section is advisable.

Multiple pregnancies. The risk to babies and mother (particularly maternal risks of severe pre-eclampsia and eclampsia) are so great that all cases should be under specialist gynaecological care. Where practicable, hospitalization from 28/29 weeks is advisable, up to 32/33 weeks in all cases and until delivery in cases of higher multiples than twins.

Breech presentations. Whether labour is premature or mature, breech presentations should be delivered in hospital, with a gynaecologist and anaesthetist always present. Failure to progress in labour should be the main indication for caesarean section. The size of the baby is an important consideration.

Diabetes and latent diabetes. Frank diabetics require specialist care throughout pregnancy, and delivery in an obstetric unit, with strict blood-glucose control. Ketosis should be scrupulously avoided. In the absence of other complications, induction (and a short trial of labour) is arranged prior to term. Toxaemia, or failure to maintain a rising oestriol excretion curve, will indicate earlier induction. Caesarean section is indicated if induction fails to give progressive labour within 12 hours, if delivery is prolonged to 20-24 hours after induction, or earlier if there is evidence of fetal distress. Latent diabetics, or "prediabetics", should be managed during labour in the same way as mild diabetics.
Disproportion and caesarean section. Disproportion so severe as to indicate elective section is now rare in advanced countries. Many cases can, therefore, have a trial of labour. The indication for elective section, including repeat section, should be carefully evaluated to avoid unnecessary delivery of an immature fetus. Where there is a good indication for a repeat section (for example, for contracted pelvis), every effort should be made to confirm maturity. All caesarean sections should be done under the supervision of a specialist gynaecologist.

Spontaneous premature (pre-term) labour. This remains a grave problem, responsible for much perinatal mortality and morbidity. Prior to 35 weeks the mother should, if possible, be transferred to a unit with neonatal intensive care facilities.

In the presence of progressive cervical dilatation, attempts to arrest labour are usually of no avail and labour should be managed so as to minimize fetal stress. Regional analgesia, ideally lumbar epidural, will sedate the mother and aid relaxation of the soft parts, without depressing the fetal respiratory centre. The second stage should be short, with episiotomy and often prophylactic low forceps delivery. Should labour not be fully established, attempts to halt or defer contractions may be made using intravenous ethanol, which is the best available therapy.

Spontaneous premature rupture of membranes. Here the decision lies between the hazard of intra-uterine infection and that of delivery of an immature baby with a potential infection. The consensus favours augmentation of labour with oxytocin after 37 weeks, and awaiting spontaneous activity at an earlier period of gestation. The place of antimicrobial agents is more controversial and further controlled studies are needed. Should frank intra-uterine infection develop, the fetus is better delivered and section may be advisable if labour does not ensue. The diagnosis of amnionitis can often best be made by amniocentesis.

Maternal infection. Increasing interest is being shown in the transmission of maternal infections to the fetus during pregnancy and labour. Examples are the known risks of rubella and syphilis early in pregnancy, and the risks of spread to the fetus of gonorrhoea and monilia from the genital tract at delivery. Vaccinia in the mother may affect the fetus in the third trimester; vaccination in pregnancy is thus best avoided.

A febrile illness in late pregnancy may be associated with premature labour (without necessarily a significant fetal infection) and the patient should be confined to a hospital suitable for an immature baby. Diagnostic tests should be carried out for urinary or genital tract infections, pulmonary complications, and other infections that seriously affect fetal well-being. Herpes genitalis is almost always an indication for caesarean section because of its severe effect on the newborn.
The small-for-dates fetus. The diagnosis can be made from a reduction in maternal weight gain, fetal growth, or liquor volume, and low maternal oestriol excretion that fails to rise adequately. The patient should be referred at once to the best available care. Investigations include frequent oestriol studies (2–3 per week) and amniocentesis or amnioscopy, including examination for meconium and estimation of liquor volume. It is essential to realize that the pre-term fetus frequently fails to pass meconium even when in extremis. Radiology, ultrasound cephalometry, or B scan for size may be considered.

The small-for-dates fetus provides a good example of the need for a fetal intensive care unit in obstetric departments of teaching hospitals. Maximum monitoring can be provided during labour, and parenteral glucose fluids given to the mother. At the first indication of fetal distress, or if meconium is present, caesarean section must be seriously considered. Fetal blood-gas and blood-pH studies may enable a few caesarean sections to be avoided.

Prolonged pregnancy. By 42 weeks the PMR is raised in all maternal age and parity groups. When there is no reason to doubt maturity, induction should be considered at term plus 2 weeks, especially in unfavourable age and parity groups. Oestriol assays and amnioscopy may be of value. Additional data on liquor volume, creatinine cell staining, and electrolyte levels may also assist in determining maturity.

6.2.3 Special procedures

Amniocentesis. Although introduced to aid diagnosis in haemolytic disease, this technique has found other uses. An unfavourable decrease in liquor volume may be detected by dilution studies, and samples of liquor may be analysed for antibodies in haemolytic disease, for creatinine and electrolytes in doubtful duration of pregnancy, and for meconium in suspected fetal distress. The estimation of 17-ketosteroids and pregnanetriol may be used to detect fetal adrenal hyperplasia, and cells may be collected from the liquor staining to determine age. Cell collection is also useful for chromosome studies to determine sex (important in possible sex-linked hereditary disorders), and to detect chromosomal abnormalities. Suspected intra-uterine infection can be diagnosed immediately by examining a Gram-stained smear of the liquor.

Radiology. Radiographic examination, including amnionography, should be kept to a minimum. In diagnosing multiple pregnancy it should be limited to a single film and carried out only if ultrasound facilities are not available. Radiology for the purpose of pelvimetry is best limited to intrapartum examinations.

Amniography. Amniography is valuable in some cases, not only to show liquor volume and skin thickness, but to extend the range of diagnosis
of fetal abnormality. The use of combined oil- and water-soluble contrast media during amniocentesis has greatly increased the scope of fetal diagnosis. Spina bifida skin defects may be shown, and the absence of fetal swallowing confirms oesophageal atresia in cases of polyhydramnios, so that delivery may be carried out close to suitable surgical facilities. By outlining the skin with oil contrast medium, fat thickness may be determined in suspected fetal malnutrition. This technique will allow the cause of some cases of fetal distress, such as occult cord prolapse, to be detected in labour.

**Ultrasound.** Ultrasound fetal pulse detectors have proved of great value in diagnosing fetal life and in counting the fetal heart rate in early pregnancy, or in those cases with excess liquor during labour. With the A scan ultrasound repeated fetalcephalometry can be performed, and with B scan multiple pregnancy can easily be detected as well as early pregnancy and associated abnormalities.

**Radioisotope scanning.** Scanning with low-dose isotopes is of considerable value in placental localization, prior to amniography or the detection of placenta praevia.

### 6.2.4 Labour

Induction of labour should be used primarily for delivering a fetus from an unfavourable environment; the interval between induction and delivery should not exceed 48 hours, or less in high-risk cases. For induction to be safe it is necessary to have a good indication, confirmed maturity, an engaged vertex presentation, and a favourable cervix. While induction may be indicated in other cases, the decision should be made by a specialist when the above criteria are absent.

The onset of labour is an important time for reassessing fetal and neona
tal risk, with a view to delivery in the most appropriate environment. Apart from obvious cases of immature labour and obstetric abnormalities, the mode of onset of labour may indicate higher risk ahead. A desultory onset of labour, or rupture of the membranes not promptly followed by progressive contractions, are both important warnings of subsequent problems.

During the first stage of labour sedation should depend on the individu
al, and intravenous fluids should be supplied to the mother to counteract dehydration and ketosis.

The early detection of fetal distress can prevent fetal damage during labour. The fetal heart rate should be measured at least hourly in the first stage, and the liquor should be observed for meconium.

In high-risk cases continuous monitoring of the fetal heart by micro
tphone, or scalp clip electrocardiography, should be available. The fetal blood pH may be estimated at intervals from a scalp vein, when facilities
are available. The length of the first stage should be limited to about 36 hours in nulliparae or 24 hours in multiparae. The duration of ruptured membranes should not usually exceed 48 hours.

In the second stage of labour the fetal heart should be auscultated at the end of each contraction. Should meconium be present or slowing of the fetal heart noted, delivery must be assisted. It is difficult to apply arbitrary rules to the duration of the second stage. The old rule of two hours in nulliparae and one hour in multiparae is conservative, and, in the absence of fetal distress, failure to progress over 30 minutes is a better indication for assisted delivery. Where assisted vaginal delivery or caesarean section is indicated, the time from taking the decision to delivery should be as short as possible.

6.3 Optimum neonatal care

6.3.1 Immediate care

The place of delivery should be selected in relation to perinatal risk, in accordance with the principles already discussed. All relevant prenatal data should be available in the delivery room.

Since there are two patients potentially at risk, there should ideally be two trained persons present at birth, often a doctor and a midwife, who should arrange their duties according to the relative needs of the mother and baby. In certain cases specialist gynaecologists, anaesthetists, and paediatricians should be present, and in all cases they should be readily available.

After birth, every baby should receive primary nasopharyngeal toilet. A fall in body temperature is avoided by a suitably heated cot in a designated area of the delivery room. Should routine observation of the vital signs of adaptation, particularly the heart rate, so indicate, the most skilled person instantly available should carry out major resuscitation, essentially endotracheal intubation and controlled ventilation, until spontaneous respiration supervenes. Should this be delayed after ventilation, the need for antagonists should be assessed but the Committee considers that there is no longer a place for analeptics in modern resuscitation. Failure to establish spontaneous respiration within 5 minutes demands full re-evaluation, consideration of the need for early correction of metabolic acidosis, and a chest X-ray to detect diaphragmatic hernia, emphysema, pneumothorax, or any other anatomical abnormality.

A doctor trained in neonatal care should carry out a full examination of the infant as soon as possible after birth, paying attention to the establishment of normal extra-uterine adaptation and examining for malformations.
Assessment should then be made, based on history and examination, so as to decide whether to transfer to the normal newborn nursery (and to the mother) or to the neonatal intensive care unit. Birth records should then be completed, including birth weight, placental weight, and Apgar score.

6.3.2 Subsequent care

Optimally, rooming-in of the “normal” baby with its mother should be practised as soon as possible, but not necessarily continuously. This arrangement improves the mother-child relationship, lessens the risk of infection, and facilitates the establishment of lactation. Normal nursery facilities are also advisable where rooming-in is practised. In neonatal nurseries, there should be infection control with regular bacteriological tests and evaluation. Attention to hygiene, particularly hand washing, is necessary. Wearing a mask is no longer considered useful. Throughout the baby’s institutional stay, regular observation should be continued, feeding supervised, and appropriate health education given to the mother.

The most physiological food for the infant is breast milk. In developed countries, breast feeding has unfortunately declined. For artificial feeding a choice is usually made from among cow’s milk preparations; it is impossible at present to make the choice on a scientific basis, but the need for early feeding and adequate calories is now recognized. Vomiting is nearly always due to illness of the baby, rather than being an indication to change the method of feeding. Failure to pass meconium within 24 hours, vomiting, or progressive abdominal distension are indications to look particularly for a major malformation or perinatal infection. A specialist paediatrician should be available throughout for consultation.

Discharge from neonatal care should always be preceded by a further medical examination, and screening tests for such metabolic disorders as phenylketonuria. At this time any necessary immunizations, e.g., BCG, can be initiated and arrangements made for after-care and any special follow-up. Appropriate notification should be made to any central agency registering risk of handicap or malformation.

When obstetric and neonatal facilities do not reach the above standard, as when delivery takes place in the home, the basic principles still apply. There should, however, be facilities for immediate transfer of the sick neonate, preferably in a heated appliance, to a neonatal intensive care unit or to properly equipped paediatric unit.

Temporary observation units. Babies who have required resuscitation or who, at first clinical assessment, are considered to be ill or at risk, should be observed closely for the next few hours. This temporary observation should be carried out where there are adequate staff or, alternatively, in the neonatal intensive care unit. Fig. 3 is a flow chart illustrating the use of a normal nursery observation unit and a special care unit.
6.3.3 Neonatal intensive care units

The best way of further reducing mortality and morbidity is to provide sufficient neonatal intensive care units, with staff specially trained to deal with babies of low birth weight and those assessed at higher than average risk. The size, staffing, equipment, and facilities for such a unit should be related to local conditions and the population to be served. Modern neonatal intensive care units are best sited in or adjacent to a large obstetric unit, for the purposes of training, of providing easy access for mother and baby, and above all of promoting liaison and exchange of views between obstetric and neonatal personnel.

6.3.4 Special problems

Respiratory difficulties. These consist mainly of respiratory distress syndrome (hyaline membrane disease), massive meconium aspiration, intra-uterine pneumonia, malformations of the upper respiratory tract,
massive pulmonary haemorrhage, and intrathoracic lesions. Respiratory difficulties also occur, due to extreme variations in haemoglobin concentration (less than 6 or more than 24 g per 100 ml), or as transient tachypnoea following abnormal delivery. Recurrent apnoic spells occur in newborns of very low birth weight with or without pulmonary lesions. In all these conditions respiratory difficulty is accompanied by CO₂ retention, hypoxia, and hypoxaemic lactic acidosis.

Treatment should ideally be related to the cause, but symptomatic treatment is usually necessary. Care should be taken to maintain thermal equilibrium, to ensure an early and adequate supply of calories, and to provide optimum oxygenation.

Sucking and feeding problems should be dealt with by tube feeding or by intermittent or continuous intravenous infusion. The need for oxygen therapy depends on the intensity of cyanosis or on the arterial pO₂, if known. A pO₂ of 60–80 mm Hg in the abdominal aorta is desirable. The oxygen should be carefully warmed and humidified; concentrations above 40% should be avoided whenever possible. High oxygen concentrations should be as brief as possible and arterial pO₂ levels above 100 mm Hg should be avoided. Oxygen concentrations above 40% are known to be toxic to the newborn lungs, and in the immature baby can cause retrolental fibroplasia. Metabolic acidosis can be treated with alkalizing solutions given by intermittent injection or continuous infusion, under biochemical control.

Assisted ventilation may be indicated in the presence of respiratory insufficiency of central or peripheral origin. It has been used to treat apnoea associated with circulatory failure, neonatal tetanus, respiratory insufficiency due to severe anaemia, hydrops fetalis resulting from feto-maternal incompatibility, and hyaline membrane disease. Continuous observation is necessary, especially at the time when ventilation is discontinued. Temporary complications and permanent sequelae have been noted, such as laryngeal lesions, sub-glottic stenosis, and bronchopulmonary dysplasia, with or without clinical manifestations.

Other symptomatic therapeutic measures for respiratory difficulties include circulatory assistance, including repeated transfusions, careful correction of metabolic imbalance, and antibiotic therapy. Haemorrhagic diathesis, which is seen in different stages, is an unresolved problem. Despite therapy, intraventricular cerebral haemorrhage may ensue, followed by neurological signs and death.

**Metabolic anomalies.** These fall into two main groups: those associated with poor homoeostasis due to various physiological immaturities, including renal function; and congenital enzyme deficiencies such as galactosaemia and fructosaeemia. Screening procedures and alertness to symptoms in the neonatal period will facilitate early diagnosis.
Acidosis. The control of acid-base equilibrium is one of the most important advances in special care neonatal paediatrics. The infant born at term usually overcomes the mixed acidosis within 4 to 24 hours of birth. The low birth weight infant is more prone to acidosis, which may be due to infection, hypoperfusion because of cardiovascular collapse, ketosis and hypoglycaemia due to fasting, or an inborn metabolic error. The treatment of metabolic acidosis should take its origin into consideration. Management includes control of thermal equilibrium, early and adequate supply of calories, optimum oxygenation and, if necessary, correction by alkalinizing solutions. Late metabolic acidosis frequently appears in low birth weight babies at the end of the first week of life.

Hypoglycaemia. Low birth weight neonates, particularly those that are small-for-dates, have little or no hepatic glycogen and are often hypoglycaemic. Postnatal glycogenolysis does not provide enough glucose, or gluconeogenesis is inadequate; the result may be a fall in blood glucose to less than 20 mg per 100 ml, sometimes associated with cerebral irritation. It is very important to check the true blood-glucose levels in these neonates at regular intervals. If neurological or respiratory symptoms are present, e.g., apnoea, intravenous glucose should be given. It should also be given in cases of asymptomatic hypoglycaemia. The glucose infusion should be continued until the infant's calorie needs are met by regular feeding. In intractable cases of hypoglycaemia, the use of corticosteroids may be considered.

The pre-term infant may also occasionally present with hypoglycaemia, with or without clinical signs; it is usually secondary to respiratory distress or infection. The treatment is as described above.

Hypocalcaemia. Relatively low serum calcium levels associated with hypoproteinaemia may occur in the newborn without clinical symptoms of tetany. Occasionally, however, a low serum calcium accompanied by a relative elevation of serum phosphorus causes tetany and a clinical picture resembling neonatal convulsions. Neonatal tetany is rarely due to neonatal hypoparathyroidism secondary to maternal hyperparathyroidism. Intravenous calcium rapidly controls the clinical symptoms, but sometimes needs to be supplemented with parathormone and high doses of vitamin D.

Infection. Management of early infection depends on prenatal or intrapartum diagnosis, as already discussed. At birth, examination of the placenta, membranes and cord, and aspirated material from the fetal respiratory and alimentary passages can be of great assistance. Infants with a suggestive history require careful clinical observation. If suspicion is high, or confirmed by the above examinations, bacteriological examination should be performed, blood culture obtained, and antibiotic treatment promptly begun. Antibiotics may be given prophylactically to the high
risk mother in labour and the high-risk baby at birth, especially when respiration has been difficult to establish or after manipulative procedures. There is, however, no proof that prophylactic antibiotics are effective in the absence of clinical infection in the baby or of the isolation of a pathogenic organism. Antibiotic therapy should be selected by weighing the sensitivity of the causative organism against the dangers of therapy.

Any baby who develops signs of local infection such as conjunctivitis, skin infection, or omphalitis should be isolated and treated promptly, after swabs have been taken for culture. In many countries, prophylactic therapy is still needed at birth to prevent gonococcal ophthalmia.

Jaundice. The nursing personnel must be trained to watch each infant frequently for the appearance of icterus. If jaundice is progressive, or appears within the first 36 hours, full investigation is indicated to determine the cause. An indirect bilirubin level between 18 and 25 mg per 100 ml has been used as an indication for exchange transfusion, but the threshold depends on the presence of acidosis or hypoglycaemia. Exchange transfusion is a simple, well-standardized technique that prevents hyperbilirubinaemia and kernicterus. It should be repeated as often as necessary during the first week of life whenever the bilirubin threshold is exceeded.

Congenital malformations. At least half of the non-lethal malformations are probably missed during conventional examinations of the newborn. Additional screening tests and improved diagnostic procedures for the early recognition of these malformations are clearly required. The examiner should certainly be alerted to the problem in cases with a suggestive personal or family history or with polyhydramnios. With the development of fetal medicine, more cases will be diagnosed before birth. A single umbilical artery has been reported in 0.5 to 1.2% of births, and the malformation rate is 3 to 5 times higher in these infants. The cord should always be examined, and if it is deficient in a vessel the baby should be reassessed for malformations.

Certain malformations are lethal. Others are life-threatening but can be corrected surgically with variable long-term results. However, the high cost of the remedy should be considered in relation to other needs and to available resources.

6.4 Standards of care in developing countries

At present, most care in the developing countries is concentrated in large cities and in teaching hospitals. The availability of services and care falls off considerably outside such centres, so that large elements of the population have little or no maternity or neonatal assistance.
The Committee favours the adoption of interim standards of care, within the medico-economic possibilities of a country and without detracting from the development of optimum standards.

Perinatal care must be considered as a part of total health care and of the total national development programme; the Committee emphasizes the importance of maternal and child health care as a basis for sound health in adult life, and therefore as a wise national investment.

As soon as possible, every pregnant woman must have at least a minimum of prenatal care, and trained assistance at delivery and during the postnatal period. Preconceptional and interconceptional care, dealing with the problems discussed above (sections 3.1 and 6.1, and along the general lines of health education (section 8.3), should be provided at least by auxiliary workers in close contact with the family. Interim standards of prenatal care involve education, and screening methods to select patients for care at the next level of service. At the lowest level this will be done by auxiliary health workers, who must be able to diagnose pregnancy and detect major abnormalities. During labour and after birth, basic care implies simple hygiene and the detection of major abnormalities.

The Committee endorses the following recommendations of the fifth report of the WHO Expert Committee on Maternal and Child Health,\(^1\) on "minimum MCH activities for maximum coverage":

1. Elementary health education, with special emphasis on nutrition, hygiene, childbearing, child rearing, and fertility problems. Such education can accompany all other activities.
2. The screening of expectant mothers and children, identification of high risks and abnormalities, and referral to more qualified personnel.
3. Assistance during delivery and the puerperium, ensuring maximum safety and cleanliness. Care should be taken to avoid undue interference and harmful practices.
5. The distribution of simple medicines, food supplements, and, whenever in accordance with policy, some types of contraceptives.
6. The provision of information on community health problems. The peripheral unit or worker should serve as a point of contact and arrange attendance for itinerant services and mass campaigns.

The Committee wishes to draw particular attention to record-keeping. As soon as possible in each country every baby should be weighed at birth, and simple records kept of pregnancy and child development. All personnel should be instructed in such procedures.

Once adequate teaching has been given in simple asepsis, basic resuscitation measures can be taught to auxiliary midwives. This illustrates the principle of a stepwise development of care depending on the assimilation

of earlier teaching. When qualified midwives are present as birth attendants, 
other resuscitation measures and examination at birth may be added.

The Committee notes the great value of breast feeding particularly 
in developing areas, where failure of lactation is accompanied by a high 
infant mortality. The need is stressed for a more positive approach to breast 
feeding in all countries.

Because of the high incidence and mortality of neonatal jaundice, 
the widespread use of a simple clinical device to gauge severity, such as the 
"icterometer", is recommended.

_Prevention and treatment of anaemia._ In view of the high incidence of 
aemia due to iron and folic acid deficiency, and the effects of severe 
aemia on mother and fetus, the Committee recommends that iron be made 
available routinely throughout pregnancy in developing countries, and that 
folic acid should also be given in some areas.

_Prevention against infectious diseases._ In many developing countries 
infections in pregnant women and in the neonate are still a major health 
problem, contributing significantly to maternal and perinatal mortality.

Smallpox infection of the pregnant woman carries a 70% risk of death 
of the mother. In areas endemic for smallpox, unprotected women should 
be immunized even during pregnancy, since the morbidity associated with 
vaccination during pregnancy is less serious than the danger of smallpox 
infection if they are left unprotected. The Committee also recommends the 
smallpox vaccination of all infants, with booster doses at intervals of 5 years.

Neonatal tetanus is particularly common among infants born outside 
hospitals or discharged on the first or second day of life. _In areas where, 
because of particular customs and beliefs, neonatal tetanus occurs frequently, 
health education programmes should put special emphasis on hygienic handling 
of the cord._ The Committee advises immunization of all infants with 
tetanus toxoid, followed by booster doses as necessary. Immunization 
with tetanus toxoid in the last months of pregnancy has been shown to 
protect the fetus from neonatal tetanus. Pregnant women should therefore 
be immunized.

In some developing countries, where tuberculosis still contributes to 
maternal and perinatal loss, _BCG vaccination of all newborns is desirable._

7. THE ROLE OF THE MIDWIFE

7.1 The midwife

The Committee considers that the midwife has an essential role in the 
planning, operation, and improvement of maternity and neonatal services 
in both developing and developed countries. It endorses the definition
given in the report of the WHO Expert Committee on The Midwife in Maternity Care.\footnote{\textit{Wld Hlth Org. techn. Rep. Ser.}, 1966, No. 331, p. 8.}

A midwife is a person who is qualified to practise midwifery. She is trained to give the necessary care and advice to women during pregnancy, labour and the postnatal period, to conduct normal deliveries on her own responsibility, and to care for the newly born infant. At all times she must be able to recognize the warning signs of abnormal or potentially abnormal conditions which necessitate referral to a doctor, and to carry out emergency measures in the absence of medical help. She may practise in hospitals, health units or domiciliary services. In any one of these situations she has an important task in health education within the family and the community. In some countries, her work extends into the fields of gynaecology, family planning and child care.

The extent of a midwife’s function and responsibility will depend on the area and system within which she is working and the availability of supportive medical and other services, which have already been well-documented in the above-mentioned report. The following items should be included in the scope of her activities.

7.1.1 Maternal care

1. General health education, including advice on nutrition, during all contacts with a mother and her family.

2. Complete or partial responsibility, at as early a stage as possible, for the prenatal care of the maximum number of women in normal pregnancy, including assessment of general health (syphilis, diabetes, anaemia, etc.).

3. Screening mothers for indications of high risk in pregnancy and for early recognition of any departure from normal, referring such women to the appropriate physician.

4. Conducting normal deliveries and, in case of complications, giving emergency care while immediately seeking medical help.

5. Management of the postnatal period, including instruction of the mother in the care of her baby, while encouraging breast feeding and providing family planning advice as required.

7.1.2 Infant care

1. Giving attention to the establishment and maintenance of respiration and body temperature.

2. Carrying out systematic examination of the newborn, including detection of obvious congenital anomalies, according to the midwife’s training and experience. Recording birth weight and other data.
(3) Taking steps to prevent infection.
(4) Notifying and registering the birth in accordance with the laws of the country.
(5) Ensuring the establishment of lactation or an adequate substitute.
(6) Surveillance of normal growth and development of the infant, and prompt referral to the doctor of any child who deviates from the normal.

7.1.3 Other functions
(1) Recording the demographic and health data of which the midwife has knowledge.
(2) Participation in other health activities within the community such as immunizations, cancer detection programmes, and family planning. Not only the technical aspect of family planning but also its psychological, social, and cultural aspects should be considered.
(3) Establishing contact with traditional birth attendants in order to train, guide, and supervise them.

Two specific questions were raised that were considered to be of special importance, namely, vaginal examinations and the administration of oxytocic drugs by midwives. The Committee considers that the midwife may administer oxytocic drugs in the prophylactic management of the third stage of labour no earlier than the birth of the anterior shoulder of a cephalic delivery or, alternatively, at any stage after delivery of the baby. Oxytocin to augment or induce labour should be given only in hospital on medical advice; the patient can, however, be managed by the midwife.

The midwife should be able to pass a vaginal speculum, inspect the cervix, and take a cervical smear in early pregnancy or in cancer screening programmes; she should not attempt a full pelvic examination.

7.2 The place of the auxiliary midwife
In many developing countries the auxiliary midwife performs in a simplified way many of the functions of the qualified midwife. Her activities include giving simple prenatal care, attending normal deliveries, giving postpartum and neonatal care, and imparting elementary health education and advice on family planning.

7.3 Traditional birth attendants
The Committee endorses the comments on the traditional birth attendant made in the report of the WHO Expert Committee on The Midwife in Maternity Care.\textsuperscript{1}

\textsuperscript{1} \textit{Wld Hlth Org. techn. Rep. Ser.}, 1966, No. 331, p. 16.
7.4 General conclusions

The midwife should have broad responsibility within the health team in developing countries. This should not be achieved at the expense of her primary function.

Each country should provide a simple manual of procedures as a guide for personnel working in isolated areas.

All those who attend women in childbirth should receive initial and in-service training, and be registered.

8. EDUCATIONAL NEEDS

Educational needs in the prevention of perinatal problems involve the father, the mother, the family, the school, and the community, as well as the health team.

A number of important general principles apply to the education of professional and auxiliary workers in the prevention of perinatal mortality and morbidity. The service needs of individual countries should determine the type of training and continuing education to be given to different categories of health workers, so that they are suitably prepared for their functions and responsibilities. It is essential that the teacher be taught to teach, and that suitable systems be provided to evaluate teaching programmes.

The content of the programmes should emphasize the team approach and the interaction between people and their environment. Personnel who may later lead a health team should have had the opportunity, during their training, to work as student members of such a team. In the same way, personnel who will be working in areas where facilities are limited should be given properly supervised training under similar field conditions. With the increased exchange of students and teachers between developed and developing countries, it has become important to include in teaching programmes the variation of health needs and disease patterns in different parts of the world. The importance of breast feeding for the survival of infants in developing countries, for example, should be included in all teaching programmes.

There is need for teaching aids of all types at all levels of education. These must be suited to local teaching requirements and should include different kinds of audio-visual aids, which are particularly valuable in teaching reproductive physiology and embryology.

Better books are needed; they should be brought up to date and contain material that is suitable for local conditions. Procedure manuals and check lists for procedures should be available at appropriate levels.
8.1 Medical education

The teachers responsible for educating members of the health team should be familiar with the social aspects of obstetrics and paediatrics and with local traditions, beliefs, and practices. Methods of instruction should be selected according to the educational objectives to be served, the group to be taught, and the situation in which the teaching is to take place. Such medical education should be responsive to the dynamic character of society, new developments in the biomedical sciences, and continually changing environmental influences on community health.

The broad concept of gynaecology and obstetrics as a discipline with important social aspects related to environmental and economic conditions has only recently been emphasized. The gynaecologist who has not been oriented to the social aspects of the discipline stands isolated from the woman’s environment and tends to think of a “case”, rather than the mother or the family, as the unit of study and care. Some of the obstacles to the re-orientation of gynaecologists to the social aspects of the subject are the heavy load of clinical work, shortage of staff, and the attractions of surgery. This description applies in general to those gynaecologists who teach, and largely accounts for the present situation, namely, that in most medical schools not enough emphasis is given to teaching the social aspects of gynaecology and obstetrics.

The Committee emphasizes that “perinatal medicine” is a very suitable field for integrated teaching, with joint contributions by departments of gynaecology, paediatrics, pathology, and community health, as well as medicine, surgery, anaesthesiology, and radiology. The teaching of human reproduction should also be integrated with that of growth and development when given during the pre-clinical part of the course. In this way students will obtain a broad view of the health needs of mothers and children.

The relative contents of undergraduate and postgraduate medical curricula will depend on the stage at which the practitioner is expected to practise obstetrics or paediatrics. All students should have training in social and clinical gynaecology, obstetrics, and neonatal paediatrics. Ideally, anyone who intends to do practical obstetrics at the medical officer/family doctor level should have an adequate postgraduate course in obstetrics, gynaecology, and neonatal paediatrics while resident in an approved hospital. In countries where such postgraduate training is not yet required it is essential that the basic technical skills, e.g., simple forceps delivery, manual removal of placenta, neonatal resuscitation, and exchange transfusion be taught at the undergraduate level.

Continuing, postgraduate, or refresher education is essential for those concerned with the care of mothers and babies. Not only must such training be provided, but means must be found to make it possible for practitioners to attend such courses every 3 to 5 years.
Specialist training. In countries where specialist training is offered the following points should be taken into consideration. Courses in obstetrics and gynaecology should include not only social obstetrics and reproductive physiology, but also adequate training in neonatal paediatrics. Similarly, specialist neonatal paediatricians should have obstetric experience. The specialist paediatrician should have adequate practical experience in neonatal medicine, including intensive care.

The need for perinatal physiologists and pathologists to cover the period between fetal and neonatal life is becoming increasingly recognized. The Committee recommends that those responsible for specialist training in pathology bear in mind the shortage of experts in the perinatal field.

Anaesthetic specialists have an important part to play in the perinatal period and are essential members of the team for both service and teaching.

Continuing education for specialists is also emphasized in view of the rapid progress of medicine.

8.2 Education in midwifery and nursing

The fight against perinatal mortality and morbidity calls not only for the professional knowledge and technical competence of nurses, midwives, and auxiliary midwives but requires especially that they shall be health educators with a lively social sense, able to work closely with the whole medico-social team.

8.2.1 Midwives

The standards for entry to midwifery training differ from country to country but, in principle, should not be less than those required for nurses and school-teachers. The training requirements of midwives vary according to local needs and the availability of other health workers. Where practice demands extra skills, these must be included in their training programmes. The Committee endorses the views on training expressed in the report of the WHO Expert Committee on The Midwife in Maternity Care.¹

Practical experience and instruction are of utmost importance, both in maternity wards and in a community similar to the one in which the midwives will work when qualified.

This enables them to work under conditions that exist outside the hospital setting, gives them an insight into the conditions of the mother’s home, and broadens their understanding of total community care and their place within the health team.

Special subjects. The following subjects, already recommended for inclusion in midwifery training programmes, should receive greater attention in view of the changing pattern of maternity care: methods and significance of health education; nutrition; psychological preparation for childbirth; the emotional needs of mother and baby; local customs, beliefs, and practices relating to childbearing; and preparation for supervision and administration.

Family planning, infertility, and population dynamics. In countries where the midwife is to participate in the provision of family planning services, this subject must be taught during her midwifery training and in special courses as necessary. Besides field work, these courses could include instruction in family health and population dynamics, human reproduction and its psychological aspects, and methods of family planning and their implications.

Care of the newborn. More practical instruction should be given in the resuscitation and supervision of the newborn, including a detailed introduction to symptomatology. The problems of hygiene and the dangers of infection must be carefully studied. All teaching should be specially oriented to the importance of breast feeding, particularly in the developing countries. Where the midwife is to be responsible for the health of young children, she should receive special preparation in this field.

Continuing education. Midwives need the stimulus of post-registration and refresher courses, to encourage them to keep up-to-date in their specialty.

These courses may be in the form of lectures, study-days, discussions, and demonstrations arranged by individual hospitals, health administrations, or professional organizations. In some countries refresher courses at regular intervals are obligatory for all practising midwives; legislation to this effect should be introduced in as many countries as possible.

8.2.2 Auxiliary midwives

The Committee endorses the views on training and registration of auxiliary midwives expressed in the report of the WHO Expert Committee on The Midwife in Maternity Care. The training of the auxiliary midwife should be similar to that of the midwife, but simpler and more practical. It is essential that she be aware of the normal developments in pregnancy, labour, and the neonatal period, so that she can immediately recognize any deviation and refer the patient to a more qualified worker.

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8.2.3 Traditional birth attendants

Traditional birth attendants should be subject to registration, and provision made for their training and supervision. They should be supplied with midwifery bags and other equipment provided by health services, on completion of their basic training. Their instruction should emphasize cleanliness, especially in cord dressing and eye care, and teach practical criteria by which to judge complications, so that they know when to call for qualified assistance.

8.2.4 Education of nurses in paediatrics

Recognizing that in many developed countries nurses who are not midwives play an important part in neonatal care, and that intensive neonatal care is becoming increasingly complex, the Committee emphasizes the importance of training nurses in neonatal paediatrics by means of basic nursing courses and post-basic courses in paediatric nursing.

Special post-basic courses in neonatal intensive care may also be provided.

8.3 Health education

As the WHO Expert Committee on Planning and Evaluation of Health Education Services has stated: ¹

The focus of health education is on people and on action. In general, its aims are to persuade people to adopt and sustain healthful life practices, to use judiciously and wisely the health services available to them, and to take their own decisions, both individually and collectively, to improve their health status and environment.

Throughout this report, the Committee emphasizes health education as an important component of perinatal care in both developed and developing countries. The prevention of perinatal problems through MCH programmes organized as part of basic health services, and the application of new skills and knowledge in meeting priority needs of high-risk groups of mothers and infants, require awareness and support on the part of professional and lay people.

Because of the multifactorial nature of perinatal problems, health education programmes must be based on a knowledge of local factors and problems, and be adapted to local culture and level of development. The method of health education is as important as its substance. Person-to-person communication, small group discussions and demonstrations, mass media, women's clubs, and extension programmes should be used as much as possible for health education purposes.

Health education of professional and lay people is needed in order to encourage premarital examinations; registration of marriages; prenatal care early in pregnancy; registration of births and deaths; the development of health and social legislation; the study of local patterns and causes of perinatal mortality and morbidity; the establishment of minimum standards of care; and the organization and operation of maternal and child health services on a community basis to meet general needs, as well as the special needs of high-risk groups, and to make proper use of available services.

If health education is to contribute effectively to the prevention of perinatal problems, it should be offered not only in the prenatal period but also in childhood and adolescence (see section 6.1).

Those mothers most in need of care and general advice are the least likely to seek it. Intensive and continuing individual and group health-education programmes, based on a knowledge of inhibitory factors, should thus be directed especially to this category of high-risk mothers.

Health workers should take every opportunity of contact with families to instruct the mother in personal hygiene; teach her to recognize early signs of pregnancy complications and to appreciate their significance; teach the management of lactation, nutrition, proper feeding and dietary practices, and methods of food preparation; and advise regarding social problems, family planning, supportive services, and genetic counselling.

Infants with perinatal problems, especially the premature, must often be kept in hospital for a longer period than average. This provides an excellent opportunity to instruct and supervise mothers in the management and feeding of their infants. In follow-up care, health and nutrition education can be given during home visits, during which theoretical teaching can be adapted to actual circumstances in order to minimize future risks.

There is a constant need to evaluate health education services in order to adapt them to the priority needs, objectives, policies, and resources of the health programmes of particular countries or regions. This should be done with the co-operation and co-ordination of education authorities and other workers concerned.

9. DEFINITIONS

The Committee considered the existing definitions relating to perinatal mortality, and noted that in many ways these had become inadequate. It is recommended, therefore, that WHO review these definitions in order to adapt them to present and future requirements throughout the world. The Committee suggests that, in carrying out this review, attention be given to the following aspects.
Live births. The following definition of "live birth" is given in the *International Classification of Diseases*: ¹

Live birth is the complete expulsion or extraction from its mother of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached; each product of such a birth is considered live born.

The Committee was concerned that the signs of life birth in the above definition require the inclusion as live births of very early and patently non-viable fetuses, who may show one or more of the definite signs of life, after such procedures as therapeutic termination of pregnancy in the early weeks. The Committee believes that the desire to avoid this situation leads to the definition being far from strictly applied, and suggests that WHO should introduce a viability criterion into the definition so that very immature fetuses surviving for very short periods are excluded, even though they show one or more of the transitory "signs of life". A viability criterion of 500 g would, in the Committee's opinion, be appropriate. Nevertheless, in the very remote event that an infant who fails otherwise to satisfy this new, live-birth criterion survives for a specified time, e.g., one hour or more, it should be recorded as a live birth.

Fetal deaths. The long-standing WHO subdivision of live births is as follows:

- Less than 20 completed weeks of gestation ........................................... Group I
- 20 completed weeks of gestation but less than 28 ................................. Group II
- 28 completed weeks of gestation and over .......................................... Group III
- Gestation period not classifiable in groups I, II, and III ..................... Group IV

This tabulation was recommended also for fetal deaths, as "early", "intermediate", and "late" fetal deaths, according to the same periods of gestation as those used for live births.²

The Committee considers this subdivision to be impracticable owing to the difficulty of determining gestational age, due partly to lack of accurate dating of the last menstrual period. These difficulties are greatest when birth occurs between 20 and 30 weeks. Only rarely is the duration of pregnancy accurately known at this stage of gestation, and there is little expectation that better data will become available in future. The Committee suggests the following subdivision, according to birth weight, for both live births and fetal deaths:

<table>
<thead>
<tr>
<th>Group</th>
<th>Live birth</th>
<th>Fetal death</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Up to and including 500 g</td>
<td>Up to and including 500 g (early fetal death)</td>
</tr>
<tr>
<td>II</td>
<td>Over 500 g, up to and including 1000 g</td>
<td>Over 500 g, up to and including 1000 g (intermediate fetal death)</td>
</tr>
<tr>
<td>III</td>
<td>Over 1000 g</td>
<td>Over 1000 g (late fetal death)</td>
</tr>
</tbody>
</table>

The weight divisions at 500 and 1000 g correspond approximately to gestational ages of 20 and 28 weeks.

*Perinatal mortality ratio.* The Committee suggests that the perinatal mortality ratio be defined as: "Late fetal and early neonatal deaths weighing over 1000 g at birth expressed as a ratio per 1000 live births weighing over 1000 g at birth". This definition will give results very similar to current perinatal mortality ratios using the earlier definition. It will, however, allow for improvement in standards of reporting throughout the world, owing to the adoption of defined lower limits and to the application of similar standards to both live births and fetal deaths.

The Committee endorses the recommendations of the WHO Expert Committee on Public Health Aspects of Low Birth Weight that "birth registration should be as complete as possible and that, as soon as is practicable, birth weight be added to the official birth certificate used in each country" and that "all countries and anyone (for example, in hospitals, domiciliary services, etc.) with interest in the statistical aspects of this subject collect and study the birth weights in 500 g weight groups". Commenting on the suggestion of the above-mentioned Expert Committee that the first interval be 0–1000 g, this Committee advises tabulations for both live births and fetal deaths as follows:

- Up to and including 500 g
- Over 500 g, up to and including 1000 g
- Over 1000 g, up to and including 1500 g
- Over 1500 g, up to and including 2000 g
- Over 2000 g, up to and including 2500 g
- Over 2500 g, up to and including 3000 g, etc.

Within particular countries gestational age, in days calculated from the first day of the last menstrual period, and body length may be used in addition to weight, particularly for research purposes.

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1 See "viability criterion" above.

Cause of death. The standard death certificate is not suitable for the
death of a fetus or early neonate, which involves a complex physiological
interaction with the maternal environment. The Committee advises a
special perinatal death certificate, permitting the separate entry of signi-
ficant maternal factors during pregnancy and labour, of conditions in the
fetus or neonate including post mortem findings, and of such data as
time of birth or death, birth weight, and gestational age. The International
Classification of Diseases should provide the means of identifying both
maternal and fetal conditions, and associations between them should be
demonstrated by multiple condition analysis.

Early neonatal deaths. The Committee endorses the conventional use
of the term "early neonatal death" as referring to "death occurring in the
first week of life". However, greater precision is needed in defining time
intervals, particularly the seven-day period used in early neonatal deaths.
The Committee recommends defining the seven-day period in terms of the
hours that elapse between birth and death; the early neonatal period
would thus be defined as extending up to, but not including, the moment
when the infant becomes 168 hours of age, and the first day as up to, but
not including, the moment when the infant becomes 24 hours of age.

10. EVALUATION

Perinatal mortality and morbidity are a world problem requiring
universal procedures of evaluation and detailed sample studies. Universal
procedures should be developed progressively as follows:

1. Registration of all births
2. Registration of perinatal deaths
3. Add birth weight to both (1) and (2)
4. Perinatal death certificate with demographic data and certain
   information about the course and complications of pregnancy, and autopsy
data
5. Similar data to be collected for live births

Development of data collection in this way permits continuous assess-
ment of the extent of perinatal mortality and morbidity, in order to identify
changes, and possible decreases, in response to the introduction of new
services. All concerned with the planning of teaching, research, and
health services need such information in order to measure the effectiveness
of the services provided in meeting stated objectives, and to identify remain-
ing problems.
Evaluation obviously requires at least the reporting of all births and perinatal deaths, and their annual tabulation at the community, regional, or national level. Other sensitive indicators of perinatal problems may also be monitored where possible, such as maternal mortality, pregnancy in women under fifteen years of age, low birth weight, intrapartum infection, infection of the newborn, and obvious birth trauma.

Statistics may be very misleading when limited to information collected only from the population of a hospital; slight changes in the characteristics of the population served by that hospital may markedly affect the observed perinatal mortality and morbidity.

In order to improve reporting, the Committee suggests that WHO continue to assist countries in developing and improving reporting systems and, if necessary, set these up as pilot projects or model reporting areas on a regional or community basis.

Assessment of perinatal problems could be improved by more frequent fetal and neonatal autopsies and examinations of the placenta; by the tabulation of causes of death to identify prevalence and change; and by clinico-pathological conferences on a community-wide basis to discuss problems observed in perinatal mortality and morbidity.

Periodic assessment of the use of the services and facilities provided, and of the characteristics of the population seeking them, would help to determine whether the service is efficient and whether it reaches women in greatest need, i.e., those at high risk. The principle of a unique identification number for the health record of each individual should be considered in countries where this is now practicable. This will facilitate continuity of care and the gathering of information for research purposes, particularly in those mothers and children needing long-term follow-up or family studies.

11. RESEARCH NEEDS

Despite the extensive information reviewed by the Committee, there are many important gaps both in basic scientific knowledge and in knowledge of the way in which socio-economic and epidemiological factors affect perinatal mortality, morbidity, and long-term sequelae. In the opinion of the Committee, research is required in the following areas:

1) The mechanism by which socio-economic factors act as a cause of perinatal mortality, morbidity, and low birth weight.

2) The influence of maternal nutritional state and anaemia on birth weight and pregnancy outcome.

3) The mechanism of the effect of high parity, and the influence of child spacing, on perinatal mortality.
(4) The relation of birth weight to known gestational age in different ethnic groups and different countries.

(5) The effects of maternal epidemiological factors on pregnancy outcome in different countries.

(6) Epidemiological studies on congenital malformations and twinning, including geographical distribution, type of hereditary transmission, and environmental influences.

(7) Long-term effects of readily available pregnancy termination programmes on reproductive efficiency.

(8) Studies, corrected for social class, of the effect of work in pregnancy.

(9) The influence of oral contraceptives on subsequent reproductive performance.

(10) The effect of mental stress, before and during pregnancy, on pregnancy outcome.

(11) The influence of psychoprophylaxis on pregnancy outcome.

(12) The relationship between maternal cardiac output and cardiac volume, and pregnancy outcome, especially as regards prematurity and low birth weight.

(13) The incidence of iso-immunization factors in developing countries.

(14) Protective schemes for the rarer blood group incompatibilities.

(15) The causes of unexplained neonatal jaundice in developing countries.

(16) The significance of abnormal haemoglobins for pregnancy outcome.

(17) The effect of hypoxia on cerebral development and coagulation factors.

(18) The mechanism of the onset of labour at term, pre-term, and post-term.

(19) Factors influencing fetal growth and development in relation to utero-placental function.

(20) Evaluation of the best time to deliver a high-risk fetus.


(22) The best time to clamp the cord at delivery.

(23) The place of oxygenation and extracorporeal circulation in the neonatal care of babies of very low birth weight.

(24) Operational research aimed at a better and more economical use of skills and manpower in maternal and child care.
(25) Developing countries have special needs for equipment and methods that are cheap and effective. These include the development of:

(a) simple screening techniques, such as paper strip tests for biochemical levels in blood and urine and simple bacteriological tests;
(b) simple forms for recording basic prenatal and neonatal data at the level of the health centre;
(c) a rugged, accurate, portable scale to weigh babies (400–5000 g);
(d) a simple, cheap laryngoscope for neonatal resuscitation;
(e) a basic midwifery bag and contents;
(f) suitable teaching aids.

12. CONCLUSIONS AND RECOMMENDATIONS

This report has demonstrated the great need for increasing attention to perinatal problems and their prevention. The findings and recommendations of the Committee on aspects of services, standards of care, definitions, statistical requirements, education, and research relevant to the prevention of perinatal mortality and morbidity are mentioned throughout the report. The Committee wishes to stress in particular the following points.

Considering that the health of children is of vital concern to all nations, it is imperative that the best possible care be provided for the fetus in utero and during birth, for the newborn in the crucial first days of life, and for the child at all stages of subsequent development.

Recognizing the biological continuity of the mother and conceptus, and the principle of the continuum of reproduction, growth, and development from birth, through childhood and adolescence, to childbearing, the Committee emphasizes that a good standard of health in childhood and the preconceptional and childbearing periods is a prerequisite for the successful outcome of pregnancy. It therefore considers it desirable that comprehensive health services, including maternal and child health services, be planned and organized in order to improve the health, development, and education of children so that they reach parenthood with healthy bodies and sound minds, well informed about the principles of healthful living, family life, and reproduction. Care should be taken to ensure greater flexibility in the allocation of resources, so that these services can be directed towards those individuals or groups whose obstetric and perinatal risks are known to be highest.

Many specific recommendations on the prevention of perinatal mortality and morbidity are italicized in the report. In particular, the Committee recommends the following:
(1) Planning and organizing integrated health services for the expectant mother and her child in order to provide proper continuity of care.

(2) Increased co-operation between gynaecologists, midwives, nurses, paediatricians, and public health authorities in planning, supervising, and evaluating services and teaching, as well as in evaluating the quality of care.

(3) Greater efforts to ensure that obstetric, neonatal, and family planning services are used more frequently by those whose need is greatest.

(4) Since the provision of qualified, comprehensive care for all mothers and children is a counsel of perfection, as an interim measure every mother should receive some health care in pregnancy, assistance during delivery and subsequent care for herself and her baby. Urgent steps should be taken to provide better care by more qualified personnel as soon as possible.

(5) Since mothers in many countries are in the care of traditional birth attendants, it is essential that the latter receive appropriate training and supervision and be registered.

(6) WHO should review ways in which it can expedite a complete and uniform system, whereby all live births and perinatal deaths in different countries throughout the world can be registered, and at the same time simple, comparable, demographic data be gathered, attention being given to the facilities available within each country. Only in this way can proper international and national evaluation of progress be made.

(7) WHO should consider the establishment of a central registry for data on congenital malformations, for those countries that can provide meaningful information.

(8) In view of the anticipated rapid increase in knowledge of perinatal problems, WHO should review, from time to time, world changes and progress in this important field.

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