

# Maternal mortality: helping women off the road to death

One of the widest health disparities between rich and poor is in maternal mortality. There are, for example, more maternal deaths in India in the space of a week than there are in all of Europe in a whole year. The estimated half million such deaths that occur every year are all the more intolerable in that they are theoretically preventable with current technology. As part of its long-term programme in this field, with the support of the United Nations Fund for Population Activities, WHO convened an Interregional Meeting on the Prevention of Maternal Mortality in November 1985. The findings and conclusions of the 41 participants—health professionals, researchers and policy-makers from 26 countries and agencies—are already guiding the Organization's joint efforts with countries to help women off the road to maternal death.

**Every four hours, day in, day out, a jumbo jet crashes and all on board are killed. The 250 passengers are all women, most in the prime of life, some still in their teens. They are all either pregnant or recently delivered of a baby. Most of them have growing children at home, and families that depend on them.**

This shocking scenario, presented by Dr Malcolm Potts at the WHO Interregional Meeting on the Prevention of Maternal Mortality, highlights both the enormity of the problem and the extent to which it has been overlooked. If the 500 000 maternal deaths that are estimated to occur each year took place in such a concentrated and visible way, there would be an international outcry. But maternal deaths take place a few at a time, in poor countries, among poor women, and often in small villages. These deaths do not make headlines, they just leave behind motherless children, bereaved families, and health workers frustrated by their inability to prevent such deaths from happening again and again.

## The magnitude of maternal mortality

At the Interregional Meeting, numerous participants presented information from their studies

of maternal deaths, defined as deaths among women who are or have been pregnant during the previous 42 days. Maternal mortality rates (MMRs) at the national or local level are shown in Table 1.

Overall, Table 1 makes the point that maternal mortality in developing countries is quite high. With the exception of Cuba, Portugal and China (Shanghai), all the studies found MMRs above 50, and rates over 500 are not uncommon. This means that, *each time they become pregnant*, women in rural Bangladesh, for example, face a risk of dying that is at least 55 times higher than that faced by women in Portugal and 400 times higher than women in Scandinavia.

An obvious feature of this table is that national studies of maternal mortality in developing countries are rare. Few such countries have records of all births and deaths, and special studies of a whole country are difficult and expensive. On the other hand, special studies at the local level provide a great deal of important information. In some cases,

Based on the report of the Interregional Meeting on the Prevention of Maternal Mortality, November 1985, prepared by the Chief Rapporteur, Ms Deborah Maine, Senior Staff Associate, Center for Population and Family Health, Faculty of Medicine of Columbia University, New York, NY, USA. A limited number of copies of the full report and of the papers presented are available to professionally interested persons; please write to the Division of Family Health, World Health Organization, 1211 Geneva 27, Switzerland.

**Table 1. Maternal mortality rates\*: results of studies presented at the meeting**

Continent/country	Maternal mortality rate		Location
	national	local	
<b>AFRICA</b>			
Egypt		190	northern Egypt
		300	southern Egypt
Ethiopia		566	Addis Ababa
United Republic of Tanzania		370	four regions
<b>ASIA</b>			
Bangladesh		566	rural area
		833	rural area
China		13	urban Shanghai
		22	rural Shanghai
India		545	urban Anantapur
		874	rural Anantapur
Indonesia		718	Bali
Malaysia		70	Selangor State
Turkey		119	two rural areas
<b>EUROPE</b>			
Portugal	16		national
<b>LATIN AMERICA</b>			
Colombia		110	Cali
Cuba	31		national
Jamaica	106		national
Peru		73	Callao Province

\* Maternal deaths per 100 000 live births.

these studies supply the only data available on maternal deaths in a country, other than official estimates (which are notoriously low).

As Table 1 shows, there is considerable variation in reported maternal mortality rates. While some of this variation may be due to differences in study design, in general the patterns are those that one might expect. Countries with very high crude mortality rates (such as Bangladesh, Ethiopia and India) have higher MMRs than do those with lower crude mortality rates (e.g., China, Colombia, Cuba, Malaysia, Portugal and Turkey). Furthermore, within-country differences conform to other mortality patterns. For example, MMRs in China and India were shown to be lower in urban areas, where health services are more accessible, than in rural areas. Similarly, the MMR reported for a northern region of Egypt is lower than that for a region in the southern, less developed part of the country.

A hospital MMR is the number of maternal deaths taking place in the hospital divided by the

number of live births taking place in the same institution during the same period of time. Such rates are not good indicators of the general risk of maternal death in developing countries. One reason is that most births do not take place in hospitals. On the other hand, because women who experience serious complications during delivery are more likely to try to reach a hospital, hospital MMRs are sometimes much higher than the rate in the population at large.

Nevertheless, there is valuable information to be gained from hospital studies. First of all, as described below, they are a major source of information on medical causes of death. Secondly, they tell us something about the functioning of the medical system as a whole. For example, among the hospital MMRs reported at the meeting were the following: Nepal, 398 per 100 000 live births; Nigeria, 1050; Pakistan, 170; Sudan, 305; and Vietnam, 576. In each of these studies, for every thousand women who delivered a live baby in hospital, at least one woman died, and in Nigeria the ratio was more than one for every 100. These rates tell us that something is wrong, because most women can be saved with prompt and adequate medical care.

As distressing as the rates in Table 1 are, some of them are probably still underestimates. Experience in both developed and developing countries has shown that maternal deaths are virtually always underreported.

In industrialized countries, almost all deaths come to the attention of medical and civil authorities. Even so, there is considerable underreporting of maternal deaths because the death certificate may not mention the fact that the woman had recently been pregnant. A recent study in the state of Washington, in the USA, found that maternal deaths were underreported by 100%.

Several of the studies presented at the meeting demonstrated the inadequacy of official statistics. In Jamaica, the official MMR was 48 per 100 000 live births, but a national study uncovered a rate of 102. In Egypt, two separate studies found maternal mortality rates of at least double the official rate of 90. Investigators in Colombia, India, Jamaica and Sudan all discovered substantial underreporting when death certificates were checked against hospital records.

In developing countries, another major reason for underreporting is that many deaths occur outside hospital. In a hospital study in Sudan, for example, the number of cases collected was certainly less than the actual number, as some cases were not reported and some women arrived at the outpatient department either dead or moribund and were immediately taken back by the relatives. Data

from Egypt, India, Indonesia, Malaysia and Turkey showed that large proportions of maternal deaths took place either at home or on the way to the hospital. These proportions ranged from 24% of deaths in Turkey to 82% in rural India. In Bangladesh, hospital staff were aware of only 4% of the maternal deaths discovered by researchers.

In general, the studies presented demonstrated that the larger the number of sources of data employed, the more maternal deaths are discovered. In India it was learned that even schoolchildren can be a valuable source of information on deaths that might otherwise be overlooked.

## The causes of maternal mortality

Dr Fathalla,<sup>1</sup> the meeting's Chairman, emphasized in his opening address that the causes of maternal deaths are complex. To do this, he described the case of Mrs X:

Mrs X died in hospital during labour. The attending physician certified that the death was from haemorrhage due to placenta praevia. The consulting obstetrician said that the haemorrhage might not have been fatal if Mrs X had not been anaemic owing to parasitic infection and malnutrition. There was also concern because Mrs X had only received 500 ml of whole blood, and because she died on the operating table while a caesarean section was being performed by a physician undergoing specialist training. The hospital administrator noted that Mrs X had not arrived at the hospital until four hours after the onset of severe bleeding, and that she had had several episodes of bleeding during the last month for which she did not seek medical attention. The sociologist observed that Mrs X was 39 years old, with seven previous pregnancies and five living children. She had never used contraceptives and the last pregnancy was unwanted. In addition, she was poor, illiterate and lived in a rural area.

Why did Mrs X die, and how could her death have been prevented? Dr Fathalla pointed out that there were a number of points at which Mrs X could have been helped off the road to death. In order to identify these, and to design and implement effective programmes, the various kinds of causes need to be understood.

### Medical factors

There is considerable variation in ways of classifying medical causes of death. For example, a wom-

an who bleeds to death when her uterus ruptures may be listed as dying from either haemorrhage or ruptured uterus. Nevertheless, the final "causes" of maternal deaths—those diagnosed and recorded by medical personnel—are remarkably consistent throughout the developing world.

Maternal deaths are usually divided into three categories: "direct" obstetric deaths; "indirect" obstetric deaths; and unrelated deaths. Direct obstetric deaths are those resulting from complications of pregnancy, delivery or their management. Indirect obstetric deaths are the result of the aggravation of some existing condition (such as hepatitis or heart disease) by pregnancy or delivery.

In developing countries, as the studies presented at the meeting confirmed, direct deaths constitute 50–98% of all maternal deaths, and haemorrhage, infection and toxæmia together make up at least half of all maternal deaths in 11 of the 13 countries for which this information was provided. In a few studies, some other condition was listed as one of the three leading causes of death. Most often, this other condition was illegal induced abortion but in two cases it was embolism. Ruptured uterus, hepatitis, anaemia and obstructed labour were each cited once as one of the three leading causes of maternal deaths.

The major medical causes of maternal deaths in developing countries are thus already known, but these diagnoses are usually just the last stretch of the road to death.

### Health service factors

The fact that medical causes of death are not the whole story emerged clearly from the meeting's discussions of avoidable maternal deaths. The medical records of women who had died had been analysed in nine countries in order to identify factors that contributed to their deaths. The investigators found that 63–80% of direct maternal deaths, and 88–98% of all maternal deaths, could probably have been avoided with proper handling. In a number of cases, the researchers specifically stated that they had evaluated the avoidability of deaths not by standards of care under the best of circumstances, but by standards realistic under the circumstances prevailing in that country at the time. For example, in Turkey, 51% of maternal deaths were judged to be avoidable within the existing health system, and another 24% avoidable with an improved health

<sup>1</sup> At the time Dr M.F. Fathalla was Dean, School of Medicine, Assiut University, Egypt. He is now Responsible Officer for Research and Development, Special Programme of Research, Development and Research Training in Human Reproduction, WHO, Geneva, Switzerland.



Imagine a jumbo jet crashing every four hours somewhere in the world. All 250 passengers on board are women in their prime. There are no survivors. This is the magnitude of maternal mortality.

Photo Camera Press©/Len Sirman Press.

system. In most cases, investigators identified more than one avoidable factor that contributed to each death.

*Deficient medical treatment of complications* was often an important factor. Mistaken or inadequate action by medical personnel was judged to be a contributing factor in between 11% and 47% of maternal deaths in the developing countries studied.

*Lack of essential supplies and trained personnel* in medical facilities was also mentioned frequently as a contributing factor. In United Republic of Tanzania, lack of blood for transfusions, drugs and equipment was a factor in more than half of the deaths studied. In Jamaica, only 6 of the 18 hospital deaths from haemorrhage took place in hospitals that had a blood bank.

*Lack of access to maternity services* is another crucial step on the road to death. The studies in Cuba, Egypt, Indonesia, Jamaica, Turkey and United Republic of Tanzania demonstrated that maternal mortality rates are increased in areas where access to a hospital is difficult, and where women are likely to arrive at the hospital, if at all, in a serious condition. In Nepal, for example, 32% of women who died in the hospital arrived in very poor condition, and another 17% arrived unconscious.

*Lack of prenatal care* was frequently mentioned as a contributing factor. For example, in Portugal, more than half of the women who died had not received prenatal care, compared with one-third of women in the country as a whole. In Nigeria, in all age-parity groups, MMRs were drastically lower among women who had had prenatal care than

among those who had not, although "the risks of teenage pregnancy and high parity were still very evident". Some data, however, indicated that more research is needed on the role of prenatal care. For example, in Viet Nam "very few adverse events were found at antenatal visits". Furthermore, the community-based study of maternal mortality in Addis Ababa illustrates the point that "antenatal care and selection of high-risk women are not an end in themselves". All three women in the Ethiopian study who died of haemorrhage had had prenatal care, but had delivered at home. This shows that women must be convinced of the benefit of referral and that, above all, services must be accessible.

Another problem in interpreting data on prenatal care is the difficulty of distinguishing the well-known effects of poverty on maternal health from the effects of lack of prenatal care. In Nepal, for example, only 34% of illiterate women had prenatal care, compared with 91% of women with a college education.

### **Reproductive factors**

For decades it has been known that certain groups of women—very young women, those aged 35 or older, and women who have already borne four or more children—are at especially high risk of dying during pregnancy and delivery. Many of the studies presented at the meeting confirmed this.

*Maternal age.* Data showing higher MMRs among women aged 35 or older were presented for eight developing countries. In six of the studies

that provided the data to make this comparison, women aged 35–39 were from 85% to 461% more likely to die from a given pregnancy than women aged 20–24 (relative risks, 1.83–5.61). One study, a case/control study in United Republic of Tanzania, did not show this expected relationship.

The same studies that showed an excess of deaths among older women showed an excess among women younger than 20, with the exception of Cuba. Increased risks of death were especially pronounced in Ethiopia, Indonesia and Portugal. Again, the Tanzanian study did not show any differences by age between women who died and those who did not.

*Parity.* Although information on parity is more difficult to obtain than information on age, several studies also confirmed the increased risk of death associated with having many children. In Jamaica, compared with women having their second child, those having their fifth through ninth births were 43% more likely to die. In Portugal, women having their fifth birth were three times as likely to die as women having their second, while women having their sixth or later birth were at even greater risk.

The importance of these data is that the practice of family planning could prevent a great many deaths of women of unfavourable age or parity.

*Unwanted pregnancy.* Of course, given the high overall rates of maternal death in poor countries, the impact of family planning would be important if unwanted pregnancies were averted at any age or parity. This point is vividly illustrated by data from the governorate of Menoufia in Egypt and the island of Bali in Indonesia. When similar studies were done in both places, a striking difference was found in maternal mortality rates. In Bali there were 718 deaths per 100 000 live births, compared with 190 in Menoufia: 278% higher. However, when the risk of childbearing was expressed in another way—as maternal deaths per 100 000 married women aged 15–49—the difference was greatly reduced. In Bali, there were 69 deaths per 100 000 women, compared with 45 in Menoufia: an excess of only 53%. The reason for this seeming paradox is that fertility rates are much lower in Bali than in Menoufia, largely owing to the use of family planning.

Illegal induced abortion is a major killer of women, as the studies presented at the meeting amply demonstrated. It was responsible for 7–50% of maternal deaths, the median being 15%. As high as these percentages are, many of them are underestimates because women who have illegal abortions are reluctant to seek formal medical help. In Ethiopia, for example, four of the six women who died on the way to hospital had had an illegal

induced abortion. Reluctance or inability to get medical care results in a selective underreporting of abortion deaths. In India, 11% of hospital deaths were due to abortion, compared with 17% of deaths at home in rural areas. Clearly, since induced abortions occur in cases of unwanted pregnancy, family planning could substantially reduce the number of deaths from this cause.

Finally, unwanted pregnancy contributes to maternal deaths in ways which are not yet understood. The Ethiopian study found that women who had an unwanted pregnancy were less likely than other women to seek prenatal care. In addition, two deaths of pregnant women by poisoning were attributed to unwanted pregnancy.

### **Socioeconomic factors**

Socioeconomic factors undoubtedly play a large role in maternal deaths, but how and why are still obscure. What is known is that poverty is clearly a high-risk factor. It is also known that poor women are less likely to have formal education than wealthy women, and are less likely to be in good health and to seek (or receive) medical care. Which of these factors are causes and which are effects, and how can this vicious circle be broken? Much more research needs to be done to answer these questions.

The kinds of questions raised above are also relevant to health problems such as infant mortality. But another (and even less well studied) aspect of socioeconomic status has special importance in maternal deaths, and that is the status of women. As papers presented by the Egyptian and Nigerian participants emphasized, “in almost all societies in the past, and in many societies in the present, women are a socially disadvantaged group . . . The status of women affects their nutrition, reproductive behaviour, utilization of health care services and vulnerability to harmful traditional practices”. The ramifications of the status of women are so far-reaching that it may be that “nothing will really change in so far as maternal mortality is concerned until attitudes towards women change and people are sufficiently motivated to improve their living conditions”.

### **Action to prevent maternal deaths**

The papers presented and the plenary sessions strongly indicated that a major new initiative to prevent maternal deaths should be mounted—and was in fact overdue. Furthermore, there was agree-

ment that much could be accomplished. The remaining question, then, was how best to begin. Recommendations for action at a number of levels—policy, programme, training and research—had been prepared during two intensive days of working group sessions, and were discussed in the plenary session.

### ***Policy initiatives***

In order for there to be a concerted and effective effort to reduce maternal deaths in developing countries, maternal mortality must be given high priority. As with all areas of action, initiatives need to be taken at a number of levels—starting at the global level, with WHO helping to set policy and coordinate actions and resources.

It was strongly recommended that the Member States of WHO should designate maternal mortality as one of the global indicators of "health for all by the year 2000". Furthermore, WHO should help draw the attention of Member States to the greatly elevated risk of death faced by women in high-risk groups if they become pregnant.

While WHO can lead the global effort to reduce maternal deaths, the effectiveness of this effort depends mostly on national governments. To begin with, governments must make maternal mortality a priority public health issue, and should review their policies and programmes with an eye to preventing maternal deaths. Policy reviews should cover such issues as removing obstacles to family planning, e.g., taxes on and other barriers to using or importing contraceptives.

Professional societies too have a role to play. In order to lower maternal mortality in poor countries, services must be spread more widely and innovative programmes must be tried and assessed. This will not be possible without the strong leadership of professional societies such as medical associations, both internationally and nationally.

### ***Programme initiatives***

It is clear from the persistence of high rates of maternal mortality and morbidity that current programmes are not adequate. Progress will require bold and determined new thinking and effort. Programmes should rest on the axiom that all services should be provided at the most peripheral level of the health care system consistent with efficacy.

The design of services should be guided by what has been learned from studies such as those presented at the meeting. For example, in many countries most deliveries and many maternal deaths take

place outside hospitals. Furthermore, a sizeable proportion of serious complications cannot be predicted beforehand. Therefore, while efforts must be made to upgrade hospital care and to refer high-risk women as early as possible, services need to be designed to reduce the distance between pregnant women and the care they require.

A variety of approaches are possible. Women who are likely to have complications can be sent to maternity waiting homes. These are facilities where pregnant women can come in the last week of pregnancy, stay while they await delivery, and have either a supervised normal delivery or prompt transfer to a medical facility if complications arise. Experience with waiting homes in Colombia, Chile, Cuba, Uganda and Malawi has shown that they can be successful and need not be expensive, as the community can provide much of the labour and supplies.

However, in the large proportion of cases in which complications cannot be predicted, more effective means of treating complications must be made available at the first referral level, including the establishment of more basic obstetric facilities. These need not be new facilities. Health centres could be upgraded to provide essential maternal health services: vacuum extraction deliveries; blood transfusions; simple general and/or local anaesthesia; caesarean section; suction curettage for incomplete abortion; insertion of intrauterine devices; and tubal ligation and vasectomy.

Promising approaches were suggested for each of the major causes of death.

*Haemorrhage.* Postpartum haemorrhage is difficult to predict and there is often little time or opportunity to transport the woman to a hospital for blood transfusion. Therefore, any trained person who is considered capable of doing a delivery should be trained to handle this life-threatening complication through the use of oxytocic drugs (which contract the uterus and its blood vessels), manual removal of the placenta, and then administration of broad-spectrum antibiotics. In addition, the use of plasma expanders at health centres that cannot provide transfusions should be explored.

Antepartum haemorrhage can be predicted when there is third-trimester bleeding with placenta praevia. In these cases, early referral to a facility where blood transfusion and caesarean section are available is crucial. However, in many cases antepartum haemorrhage cannot be predicted. Therefore, there is an urgent need to shorten the distance between the place of delivery and a facility where emergency care can be provided. In addition to upgrading peripheral health facilities, attention must be paid

to the key role of transportation. An effort should be made to make all kinds of government vehicles available in emergencies, rather than relying on scarce (or non-existent) health department vehicles alone.

*Infection.* Deaths from infection can be greatly reduced (as they have been in China) through cleanliness during delivery. Providing traditional birth attendants (TBAs) with delivery kits is one way to encourage asepsis. Adding antibiotics to these kits, for use in cases of prolonged labour or premature rupture of the membranes, could prevent many maternal deaths in areas where physicians are scarce.

*Toxaemia.* Only good prenatal and medical care can prevent the majority of deaths from this cause. However, sedatives for treatment of severe toxæmia should be made available at the primary care level.

*Unwanted pregnancy.* As the studies presented at the meeting showed, unwanted pregnancy contributes to maternal mortality in a number of ways - e.g., in the number of births to women in high-risk groups and the number of pregnancies per woman. The most dramatic way in which unwanted pregnancies contribute to maternal deaths is through illegal induced abortion. Because these pregnancies are, by definition, unwanted, this is an area in which primary prevention holds great promise.

Family planning is the first line of defence against illegal abortion, and education about avoiding unwanted pregnancies should be provided in schools, at all levels of the health care system, and during all contacts with pregnant and recently delivered women. Special attention should be paid to counselling women who are being treated for complications of abortion, in order to help them avoid repeated unwanted pregnancies and abortions. Furthermore, whatever the accepted indications for legal abortion in a country (and there are usually some), this service should be made widely available, rather than being available only to wealthy women in urban areas.

*Obstructed labour.* While there are certain groups of women who are at especially high risk of obstructed labour (e.g., women of small stature, women having their first birth, and women having their sixth or later birth), in many cases this complication is not predictable. So, again, access to emergency services is essential. In the case of obstructed labour, much could be accomplished by educating TBAs to be prompt in sending women who are not making satisfactory progress in labour to a facility where they can get medical care, such as a caesarean section.

*Anaemia.* Depending on the cause of anaemia in a particular region, iron and folate supplements, malaria prophylaxis and/or treatment, and treatment of hookworm disease and schistosomiasis should be provided to pregnant women at the primary care level.

*Tetanus.* In addition to being a major killer of newborns, tetanus is a common cause of maternal deaths in some areas (Bangladesh, India, Indonesia). The administration of tetanus toxoid to all women, especially pregnant women, should be a high priority.

### **Training initiatives**

To implement programmes successfully, training is crucial. Some of the needs for training are the following.

*Traditional birth attendants.* TBAs are often the first (if not the only) health care workers with whom pregnant women in poor countries have contact. Therefore, it is essential that they be made as effective as possible through training, supervision and support.

A major role of TBAs should be referral—assuming, of course, that there are health care facilities to which women can be referred. Topics suggested for TBA training in referral include: recognition of risk factors (e.g., age, parity, poor obstetric history, bleeding during pregnancy); detection of anaemia; recognition of infection, prolonged labour and excessive blood loss; and referral to a source of legal abortion.

TBAs should also be given the training and supplies to prevent or treat complications whenever possible. Preventive measures include use of antiseptic techniques in delivery, administration of drugs to reduce anaemia, and provision of contraceptives. Treatment skills could include first aid for treatment of haemorrhage (application of pressure, elevation of limbs, use of oxytocic drugs) and safe removal of retained placenta.

*Health centres.* If health centres are to fulfil their potential in preventing maternal deaths, centre personnel need the training and supplies to be effective. Suggested areas for training include: recognition of blood pressure abnormalities and anaemia; use of antibiotics, intramuscular iron supplements, oxytocic drugs and plasma expanders; and repair of lacerations. In areas where there is no physician available to perform life-saving caesarean sections, the feasibility of teaching trained midwives to do this operation should be explored.

*Referral hospitals.* As the studies of avoidable deaths demonstrated, hospital personnel need additional training in treatment of serious complica-



A traditional birth attendant examines a mother-to-be. No matter how good the care at primary health level, a certain proportion of women will die of unforeseeable complications during delivery if the health centre or hospital is too far away.

tions. For example, it was suggested that special teams of health care personnel be established for coping with haemorrhage and eclampsia. Personnel in these facilities need to have banked blood available, and to be able to manage such catastrophic events as uterine rupture.

### **Research initiatives**

Three broad types of research were discussed: research on appropriate technology for preventing maternal deaths; health systems research on innovative programmes; and epidemiological research on the incidence and causes of maternal deaths.

*Appropriate technology research.* A wide variety of appropriate technology issues were suggested for future research. These included such important topics as: simple, inexpensive methods for detecting and measuring anaemia; durable tubing for vacuum extractors; appropriate plasma expanders for use at health centres; and the content of delivery kits for TBAs.

*Health services research.* Evaluating service delivery systems, especially innovative ones, is crucial if scarce resources are to be used effectively. Promising topics for health services research include: appropriate therapy for anaemia, such as new iron preparations; the use of prophylactic antibiotics in cases of prolonged labour; the role of maternity villages; and the delegation of basic obstetric functions such as caesarean section and suction curettage to a more peripheral level.

*Epidemiological research.* Both for shaping policy and for designing programmes, it is important that more research be done on maternal mortality and morbidity rates, and on their causes. It was recommended that all Member States of WHO should, no later than 1995, be able to provide reliable estimates of their MMRs. Also by 1995, Member States should have begun research on the underlying causes of maternal deaths.

Four types of information on maternal mortality should be sought. First is the absolute number of deaths. As the studies presented at the meeting showed, obtaining this information is not easy. Nevertheless, even incomplete counts can sometimes be useful for policy purposes—e.g., when a small developing country is found to have more maternal deaths a year than a very large developed country.

Secondly, countries should collect information on the rate of maternal mortality. As was shown above, hospital studies are not a good method for determining MMRs in developing countries.

The third type of information countries should gather is data on the characteristics of women who die. These are especially valuable when compared with information on women who do not die. Case-control studies are a relatively inexpensive way to accomplish this.

Lastly, data are needed on the causes of maternal deaths: clinical, health services, reproductive, and socioeconomic factors. Priority should be given to research on the risk factors that have the greatest

**Table 2. The suitability of data sources and methods for obtaining selected information on maternal mortality (Key: 1=best, 2=satisfactory, 3=poor, 4=not appropriate, UNK=unknown)**

Data source/method	Information sought				
	No. of deaths	Maternal mortality rates	Characteristics of the deceased women	Medical causes	Other causes (social, etc.)
<i>Vital statistics</i>					
Routinely classified maternal deaths	2	2	3	3	3
Birth-death record linkage	1	1	2	1	2
Investigate all deaths of women aged 15-49	1+	1	1	1	1
<i>Hospital records</i>					
Maternal deaths in obstetrics/gynaecology service	2	3	1	2	3
Maternal deaths in all services	2	3	1	2	3
Case-control studies	4	4	1	2	2
Obstetrician/gynaecologist peer review	4	4	1	1	2
<i>Health worker interviews</i>					
Obstetricians/gynaecologists	3	3	2	2+	2
All health workers (MCH/family planning)	3	3	2	2+	2
<i>Community studies</i>					
Identify/investigate deaths of women aged 15-49	2	2	1	1-2	1
Prospective monitoring of pregnant women up to 6 weeks after end of pregnancy	1	1	1	1-2	1-2
Household survey	2	2	1	2	1-2
Discussions with groups of knowledgeable/local people	UNK	4	UNK	UNK	2
Case-control studies	4	4	1	2	1-2
<i>Confidential inquiries</i>					
Vital statistics	3	4	1	1	2
Multiple data sources	1	4	1	1	2
<i>Indirect demographic methods</i>					
	UNK	UNK	4	4	4

relevance for improving the provision and use of health services.

The participants considered that it would be useful for WHO to draw up a document describing research methods that can provide these kinds of data, and the circumstances under which each method is most and least useful (see Table 2). If necessary, new, low-cost methods for doing research on maternal health should be developed. WHO should also consider providing training courses on study design.

Finally, it was recommended that countries should begin collecting data on maternal morbidity. Most countries have no idea of the magnitude of this problem, although it can be assumed to be large. For example, a study in India found that for each woman who died a maternal death, there were 18 who survived with severe (and sometimes per-

manent) complications. An effort should be made to take advantage of existing opportunities to gather morbidity data, e.g., during contraceptive prevalence surveys.

\*

In her closing address, Dr Angèle Petros-Barvazian, Director of WHO's Division of Family Health, said that the meeting should be seen as "the end of the beginning". The actions recommended would now have to be carried out by WHO in its broadest sense—not just headquarters but the regional offices, Member States, and professional and nongovernmental organizations. Only with commitment on the part of all involved could women be helped off the road to maternal death.