

## Assessing maternal mortality in developing countries

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According to the World Health Organization, about half a million women die each year due to pregnancy or childbirth [1]. Over half of these women are African (53% in 1995), while the rest are Asian (42%) and to a lesser extent Latin American (4%). Less than 1% of maternal deaths occur in Europe or North America (see table). In order to offset the variations linked to population size or birth rates, one usually refers to the maternal mortality ratio, which is the number of maternal deaths per hundred thousand live births. This measure makes it possible to compare death risks linked to childbirth in different regions or countries of the world (see table and figure). But what do these statistics actually reflect, and how are they generated? Indeed, the notion of maternal death is quite complex; it is difficult to define and as a result, difficult to use (see box 1).

### ◆ In the West, maternal deaths remain to a large extent underreported

Even in countries with complete vital registration, in which the cause of each death is specified by a physician, maternal deaths remain underreported to varying degrees in cause-of-death statistics. In order to assess errors and understand their causes, a study was conducted a decade ago in France on all the deaths of women of childbearing age (between 15 and 49) having occurred over a period of four consecutive months, regardless of their causes; in each case, the physician or hospital that had established the death certificate was interviewed with a view to determining the detailed circumstances of the person's death [2]. It appeared that

nearly half of the maternal deaths had not been reported as such on the death certificate, and if they had, they had not been subsequently registered under the right category: as a result, maternal deaths were underestimated by nearly 50%. In particular, some physicians had not mentioned on the certificate that the woman was pregnant or had recently given birth, either because they were unaware of it, or because they believed the pregnancy or birth was not linked to her death. Indeed, many doctors are unaware of the definition of maternal death according to the International Classification of Diseases, and do not realize that it covers such a wide variety of situations.

Unlike France, countries like Finland or New Zealand have high quality statistics on maternal death, but these are exceptions: in many developed countries, the quality of such statistics is average, and due to the lack of studies on the subject, we do not really know to what extent maternal death remains underreported.

**Table - Maternal mortality by world region in 1995, according to WHO**

Region	Number of maternal deaths	Maternal mortality ratio (1)
Africa	273,000	1,000
Asia	217,000	276
Latin America	22,000	190
Oceania	580	110
Europe	2,200	28
North America	490	11
<b>World total</b>	<b>515,270</b>	<b>400</b>

(1) Number of maternal deaths per 100,000 live births.  
Source: WHO, 2001.

\* INED.

For this reason, WHO adjusts the official statistics of developed countries by systematically increasing them by 50%, except in special cases like Finland, where the increase is only 3%, or, at the other end of the scale, France, for which WHO actually doubles the ratio (1).

### ◆ The surveys

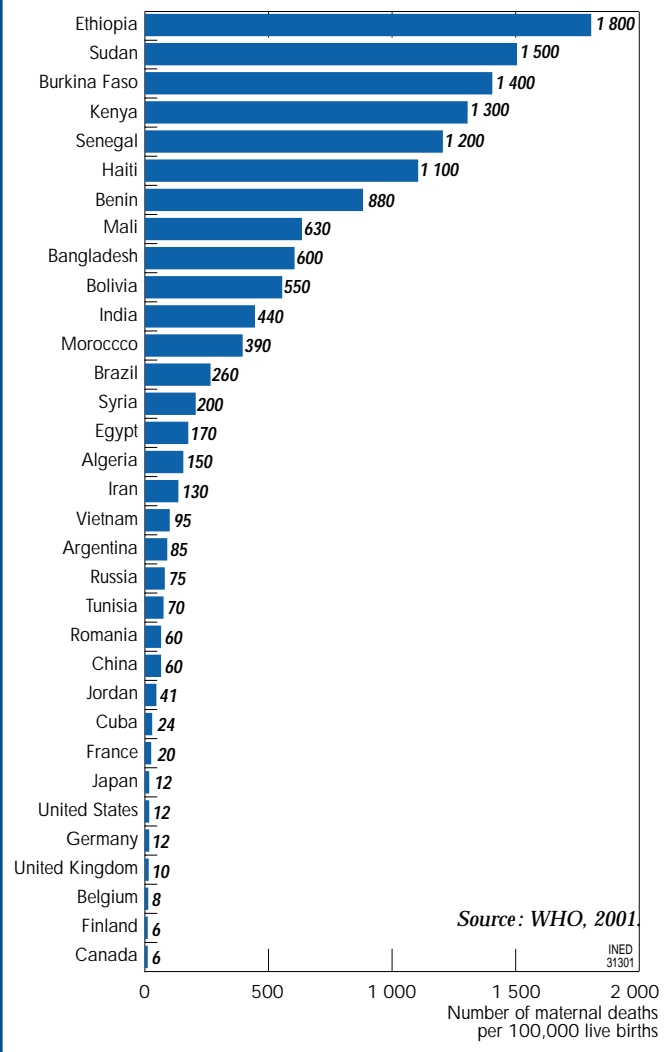
In some countries like Albania or Venezuela, all deaths are registered but the cause of death often remains unknown, since no physician was present at the time. In order to estimate in such countries the proportion of maternal deaths among the total number of deaths of women of childbearing age, WHO applies a model integrating various characteristics such as life expectancy at birth, per capita GNP, average level of education, sanitary and medical context, fertility rates, etc. The number of maternal deaths is then obtained by applying the proportion generated by the model to the number of deaths of women of childbearing age provided by the country's registration data.

Other countries which do not have reliable statistics on causes of death — such as China, India, Egypt or Tunisia — launched, in the 1990s, *ad hoc* surveys aimed at assessing maternal mortality.

Other countries still, which have neither complete vital registration nor reliable cause-of-death statistics, like Brazil or Côte d'Ivoire, have not carried out specific studies on maternal mortality. However, other surveys, conducted among the general population, have provided the opportunity to ask questions related to this subject. These were addressed to women and concerned their sisters: how many sisters do they have? How many were born of the same mother? How old is each sister? If these sisters are deceased, at what age, since when, in what circumstances? In particular, was this death related to childbirth? Was the sister pregnant when she died, or had she given birth within the two months preceding her death? This approach, known as the "sisterhood method", by combining such information with the more classical information on births, makes it possible to directly calculate the maternal mortality ratio for various periods preceding the survey [3].

A last group of countries, which includes for example Bangladesh and Burkina Faso, offers no source of information whatsoever. In this case, WHO estimates the proportion of maternal deaths among the total number of deaths of women of childbearing age by using the above-mentioned model, and applies the proportion to the mortality estimates established for these countries by the UN. The results are far from reliable. But no more certain are the estimates obtained by WHO from survey data.

Figure — Maternal mortality in selected countries in 1995, according to WHO



### ◆ The case of Senegal

Senegal is one of the countries which, lacking complete vital registration and cause-of-death statistics, has applied the sisterhood method in order to assess the maternal mortality level. The questions pertaining to sisters were asked during a Demographic and Health Survey conducted in 1992-1993, with a sample of 6,310 women aged 15 to 49 [4]. These declared a total of 17,282 sisters, among whom 3,736 were deceased. Most of the latter had died in early childhood, often a long time before the survey. Only 167 deaths of women aged 15-49 had occurred within the last six years. Among these, no more than 70, or 42%, had died of maternal death. This goes to show that even in countries with high mortality rates, maternal death is a relatively rare occurrence, requiring large samples in order to measure its incidence. On the basis of this survey, the maternal mortality ratio in Senegal was estimated at 566 deaths

## Box 1

**Maternal death: a definition which is complex and difficult to use**

For purposes of comparison and evaluation, specialists refer to the notion of maternal death as defined by WHO: "death while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes" [7].

This is a very wide definition: for instance, if a woman dies during pregnancy or within 42 days after having given birth, and if it is thought that the pregnancy or delivery might have played a role, however limited, in her death, the latter is classified as a "maternal death". Thus, if a woman commits suicide after having given birth, the delivery may have been the cause of depression, or if not the cause, it could have been an aggravating factor; her death, in that case, is considered as a "maternal death". A distinction is usually established between these cases, termed "indirect maternal deaths", and cases of maternal death which are directly linked to childbirth, once again in reference to the International Classification of Diseases:

a direct maternal death is defined as a death "resulting from obstetric complications of the pregnant state (pregnancy, labour and puerperium), from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above";

an indirect maternal death is defined as a death "resulting from previous existing disease or disease that developed during pregnancy and which was not due to direct obstetric causes, but which was aggravated by physiologic effects of pregnancy" [7].

## Box 2

**Measuring maternal mortality in rural areas of Senegal**

Maternal mortality was evaluated among three rural populations of Senegal (in Bandafassi, Niakhar and Mlomp) using the same data collection method which provides both reliable estimates and the possibility of comparing results [5].

Demographic surveillance of the population of each of the above-mentioned sites has been ongoing for many years. Since a first census, when baseline information was collected, the villages have been visited on a regular basis, every quarter or every year. During each visit, the household members are checked against the previous list, which is then updated, and information on all the births, marriages, migrations, deaths (including their cause) having occurred in the interval is collected. As in many rural regions of Africa, a physician is rarely present at the time of death and few autopsies are carried out. In order to determine the causes of death, the deceased person's relatives are interviewed about the circumstances and the symptoms of the disease which preceded the event.

In addition to the information collected among family members, data is obtained from the registries of local hospitals or dispensaries if the person had died there or spent some time there before his/her death. The information thus collected is submitted independently to one or several physicians who then make a diagnosis.

In order to study in more detail maternal mortality and its causes, a round of additional data collection was organized in the three sites in 1997 and 1998; the aim was to check whether all the maternal deaths that had occurred during the last ten years had been captured by the survey and to determine the detailed cause(s) of each maternal death. To this end, a physician (re-)interviewed the relatives of each woman who had died at the age of 15-49, from whatever cause, to obtain precise information concerning her illness and the circumstances of her death.

per 100,000 live births between 1986 and 1992.

Although the samples were rather small and despite the fact that the survey method, unfortunately, is highly dependent on the memory of the respondents as well as on the surveyors' level of training, there is no evidence that the figure of 500 to 600 maternal deaths per 100,000 live births is far removed from reality. Nonetheless, WHO considers this order of magnitude underestimates the actual maternal mortality ratio in this country, and prefers to use a variant of the sisterhood method which yields an estimate twice as high as

the first, of 1,200 deaths per 100,000 live births. The principle of this variant, applied by WHO to all countries having carried out sisterhood surveys, consists in simply deriving from the surveys the proportion of maternal deaths among all deaths of women of child-bearing age (42% in Senegal, for example), and in applying this proportion to the UN's mortality estimates for the given country. Is this new assessment any more accurate than the first? Fortunately, Senegal has three population and health observatories located in rural areas — in Mlomp (Casamance), Niakhar (near

Dakar), and Bandafassi (in the southeast) — which can provide accurate evaluations of local demographic and health situations. The health situations vary considerably between locations: the situation in Bandafassi is worse than average for the country, in Mlomp it is better than average and in Niakhar it is intermediary; this diversity accurately reflects observable differences between the country's rural areas. Around 1990, the maternal mortality ratios measured with precision in the three observatories (see box 2) ranged from 436 to 826 deaths per 100,000 live births [5]. WHO's estimate for all of Senegal — based on the above-mentioned variant of the sisterhood method — of 1,200 deaths per 100,000 live births thus seems excessive, especially if one accounts for the fact that this estimate is a national average which includes cities (about 40% of the country's population), where maternal mortality ratios are lower than in the countryside. The crude national estimate obtained with the original sisterhood method and yielding the figure of 566 maternal deaths per 100,000 live births, seems to correspond more accurately to the findings of the observatories. By preferring the variant, WHO overestimates maternal mortality ratios in the country as a whole. The reasons motivating WHO's choice of this method remain obscure, and one may question the relevance of organizing large-scale surveys, if their results are to be ignored.

### ◆ What measures can be taken to reduce maternal mortality ratios?

As things stand today, increasing the precision of maternal mortality ratios might seem secondary. Indeed, in Senegal, whether we have 500, 1,000 or 1,500 maternal deaths per 100,000 live births, the figures are clearly very high. The real priority, in that case, would be to find ways of reducing maternal mortality. Two different strategies are possible, and no consensus concerning the matter has as yet been found. The first strategy consists in ensuring that all pregnant women have a prenatal visit, in order to identify the women who risk complications and direct them to appropriate facilities, and in enabling all women to give birth in a maternity clinic attended by a midwife or skilled health worker. The second approach underscores the need to build more emergency care units and hospitals with operating rooms for caesarean sections, to recruit more surgeons and organize efficient evacuation methods for women whose delivery proves complicated. The first strategy was the more popular ten to fifteen years ago, but it has since then been criticized and the second is now preferred. The reason for this preference is that all pregnant women run a risk, and that the vast majority of women diagnosed with "high risk pregnancy" will

in fact give birth normally, while on the other hand, most of the women who do end up developing dangerous complications do not show any warning symptoms ahead of time [6]. Both strategies are complementary and should be developed simultaneously; however, given the very high maternal mortality ratios and the country's limited means, one of these two approaches seems to have priority. Indeed, the proportions of women who have given birth in maternity hospitals differ significantly between the three population observatories (99% in Mlomp, 15% in Niakhar and 3% in Bandafassi), as well as the distance from a hospital where caesarean sections can be carried out (about 50 km for Mlomp and Niakhar and 250 km for Bandafassi) and consequently the possibility of carrying out emergency evacuations of women with delivery complications. Maternal mortality ratios can even double from one site to another, and these variations seem to be more closely linked to the emergency evacuation possibilities than to the proportion of women having given birth in maternity wards: this shows that the presence of a skilled attendant at delivery is not in itself as important as it may seem at first [5].

Thus, efficient strategies to reduce maternal mortality in the future can only be determined with the help of precise data. In order to develop effective policies in this field, it is necessary to improve our knowledge of the true facts.

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(1) WHO assessed the French ratio at 20 maternal deaths per 100,000 live births in 1995, thus situating France well behind its European neighbours, whose ratios were about twice as low. The differences are in fact probably much smaller, and France and the UK have probably now had the same ratio of 12 or 13 per 100,000 live births for several years.