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REVISED 1990 ESTIMATES OF MATERNAL MORTALITY

A NEW APPROACH BY WHO AND UNICEF

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Executive summary

Reduction of maternal mortality is one of the WHO/UNICEF common goals for the health of women and children and one of the major goals of several recent international conferences. However, because measuring maternal mortality is difficult and complex, reliable estimates of the dimensions of the problem are not generally available and assessing progress towards the goal is difficult.

In order to address the information gap, WHO and UNICEF have developed new estimates using a dual strategy. This involves using available data wherever possible, adjusted to account for the common problems of under-reporting and misclassification of maternal deaths, and developing a simple model to predict values for countries with no reliable national data.

The estimates derived from this approach are considered to be more reliable than those based on earlier strategies. Moreover, the new approach permits the calculation of individual country data as well as regional and global totals.

The new approach has been used to recalculate maternal mortality for 1990 and thus provide a baseline estimate against which it will be possible to assess progress by the year 2000.

The results of the WHO/UNICEF study indicate that globally some 585,000 women died from pregnancy-related causes in 1990, 80,000 more than earlier estimates had suggested. Maternal mortality ratios are particularly high in sub-Saharan Africa.

Introduction

During the past decade, a number of international conferences have established goals related to the environment, population and development and health. The reduction of maternal mortality by half the 1990 levels by the year 2000 was a goal common to several such conferences including, in particular, the Nairobi Safe Motherhood Conference in 1987, the World Summit for Children (WSC) in 1990, the International Conference on Population and Development (ICPD) in 1994, and the Fourth World Conference on Women (FWCW) in 1995. Ascertaining progress towards the goal is, however, extremely difficult for two reasons: maternal mortality is difficult to measure; and the information available at country level does not generally permit the establishment of good baseline data.

In order to address these problems WHO and UNICEF have worked with Cynthia Stanton and Kenneth Hill of Johns Hopkins University to develop a new approach to estimating levels of maternal mortality in developing countries. The new approach has the dual objective of generating improved estimates for countries with inadequate or no national data on maternal mortality, while at the same time providing better estimates of maternal mortality in 1990 as a baseline against which to measure progress.

New estimates of maternal mortality

The results of the new approach indicate that globally, there are some 585,000 maternal deaths, 99% of them in developing countries. This is around 80,000 deaths more than earlier estimates have suggested and indicates a substantial underestimation of maternal mortality in the past.

In developing countries as a whole, maternal mortality ratios range from 190 per 100,000 live births in Latin America and the Caribbean to 870 per 100,000 in Africa. Extremely high ratios of over 1000 per 100,000 live births are found in Eastern and Western Africa (Table 1).

Why is it important to measure maternal mortality?

The incorporation of maternal mortality reduction into the goals of the international community reflect its importance as a measure of human and social development. Maternal mortality is a particularly sensitive indicator of inequity. Of all the indicators commonly used to compare levels of development between countries and regions, levels of maternal mortality show the widest disparities. Maternal mortality offers a litmus test of the status of women, their access to health care and the adequacy of the health care system in responding to their needs. Information about the levels and trends of maternal mortality is needed, therefore, not only for what it tells us about the risks of pregnancy and childbirth, but also for what it implies about women's health in general and, by extension, their social and economic status.

Why is maternal mortality difficult to measure?

It is extremely difficult to assess levels of maternal mortality at the national level. Doing so requires knowledge about deaths of women of reproductive age (15-49 years), the cause of death and also whether or not the woman was pregnant at the time of death or had recently been so. Yet few countries count births and deaths; even fewer register the cause of death; and

Table 1: Revised estimates of maternal mortality by United Nations regions (1990)

	Maternal mortality ratio (maternal deaths per 100,000 live births)	Number of maternal deaths	Lifetime risk of maternal death, 1 in:
World total	430	585 000	60
More developed regions *	27	4 000	1800
Less developed regions	480	582 000	48
Africa	870	235 000	16
Eastern Africa	1060	97 000	12
Middle Africa	950	31 000	14
Northern Africa	340	16 000	55
Southern Africa	260	3 600	75
Western Africa	1020	87 000	12
Asia *	390	323 000	65
Eastern Asia	95	24 000	410
South-central Asia	560	227 000	35
South-eastern Asia	440	56 000	55
Western Asia	320	16 000	55
Europe	36	3 200	1400
Eastern Europe	62	2 500	730
Northern Europe	11	140	4000
Southern Europe	14	220	4000
Western Europe	17	350	3200
Latin America & the Caribbean	190	23 000	130
Caribbean	400	3 200	75
Central America	140	4 700	170
South America	200	15 000	140
Northern America	11	500	3700
Oceania *	680	1 400	26
Australia-New Zealand	10	40	3600
Melanesia	810	1 400	21

**Australia, New Zealand and Japan have been excluded from the regional totals but are included in the total for developed countries.*
Figures may not add to totals due to rounding

fewer still systematically note pregnancy status on the death form. Broadly speaking, countries fall into one of three categories:-

1. Countries with no reliable system of vital registration where maternal deaths - like other vital events - go unrecorded;

2. Countries with relatively complete vital registration in terms of **numbers** of births and deaths but where **cause of death** is not adequately classified; cause of death is routinely reported for only 78 countries or areas, covering approximately 35% of the world's population.[1]

3. Countries with complete vital registration and good cause of death attribution - though even here, misclassification of maternal deaths can arise for a variety of reasons.

Where vital registration systems are absent or inadequate it is possible to estimate maternal mortality using survey techniques but these have a number of disadvantages including cost (see below). In general, high maternal mortality countries have neither adequate systems of vital registration nor the resources to rely on surveys instead.

How can maternal mortality be measured?

A variety of innovative methodologies has been devised to overcome the absence of data in countries with poor or non-existent vital registration. For example, maternal mortality can be measured by incorporating questions on pregnancy and deaths into large-scale household surveys. The disadvantage of such approaches is that they require large sample sizes and are extremely expensive and time consuming.[2]

A more cost-effective approach is the *Sisterhood Method*. This method adds on to existing household surveys a few simple questions about whether or not the sisters of the respondent are still alive. The advantage is that much smaller sample sizes are needed because each respondent can provide information on a number of sisters. The disadvantage is that the method does not provide a current estimate, but gives an idea of the level of maternal mortality roughly ten years earlier. Furthermore, the methodology was developed for use where there were strong cultural ties between siblings (usually sisters) and where siblings could be expected to be fully aware of the vital events in each other's lives. Where such cultural ties are less strong, the method is likely to be less effective and may underestimate pregnancy-related mortality. Indeed, evidence is emerging that the *Sisterhood Method* may miss a sizeable proportion of maternal deaths.[3]

The best way of measuring maternal mortality in the absence of vital registration is to identify and investigate the causes of all deaths of women of reproductive age – the *Reproductive Age Mortality Survey (RAMOS)*. This method has been applied in countries with good vital registration systems to calculate the extent of misclassification,[4] and in countries without vital registration of deaths, such as Jamaica and Guinea. Multiple sources of information – civil registers, health facility records, community leaders, religious authorities, undertakers, cemetery officials, schoolchildren – are used to identify all deaths.[5] Subsequently, interviews with household members and health care providers and facility record reviews are used to classify deaths as maternal or otherwise (verbal autopsy).

Although *RAMOS* studies are considered to be the "gold standard" for estimating maternal mortality they are also time consuming and complex to undertake, particularly on a large scale. Because of the difficulties and costs involved, only ten developing countries have carried out *RAMOS* or household studies to estimate maternal morality at the national level. As a result, other methods have to be devised to provide broad estimates of the extent of the problem.

How were these new estimates derived?

The new estimates were developed using a dual strategy: existing national maternal mortality estimates were adjusted to account for underreporting and misclassification; and a simple model was developed to predict values for countries with no data. The model uses two widely available independent variables – general fertility rates and proportion of births that are assisted by a trained person – to predict maternal mortality. The definition of 'trained person' used comprises doctors (specialized or not specialized) and persons with formally recognized midwifery skills, but excludes traditional birth attendants (TBAs), whether trained or not. The rationale is that TBAs generally cannot manage obstetric complications or perform lifesaving procedures needed to reduce maternal mortality.

Maternal mortality estimates for individual countries fall into five groups:

A ***Developed countries with complete vital registration systems and relatively good attribution of cause of death*** – For these countries the maternal mortality ratio is the reported number adjusted by a factor of 1.5 to account for the well-known problem of misclassification of maternal deaths.[6]

B ***Developing countries with good death registration but poor or non-existent attribution of cause of death*** – The model is used to predict the proportion of deaths of women of reproductive age that are maternal. This proportion is then applied to the deaths of women of reproductive age actually registered to obtain the number of maternal deaths and the maternal mortality ratio.

C ***Countries with RAMOS type estimates of maternal mortality*** – The maternal mortality ratio derived from the *RAMOS* study is used directly without any adjustments.

D ***Countries with Sisterhood estimates of maternal mortality*** – Several recent studies have found that the *Sisterhood Method* under-estimates total female adult mortality, and presumably, maternal mortality as well.[7] However, the sisterhood method, in addition to providing an estimate of maternal mortality, also provides estimates of the **proportion** of all deaths of women of reproductive age that are maternal.[8] Therefore, for these countries, this **observed proportion** was applied to the total number of deaths of women of reproductive age generated by the United Nations Population Division's population projections (1994 Revision) for the year 1990 since these are believed to be better estimates of female adult mortality.

E ***Countries with no estimates of maternal mortality*** – For countries without accurate information on numbers of deaths and without direct or indirect estimates of maternal mortality, the model is used to predict the proportion maternal of all deaths of women of reproductive age and this proportion is applied to the 1990 United Nations projections of adult female deaths to derive the maternal mortality ratio.

How do these revised estimates differ from previous estimates of maternal mortality?

The maternal mortality ratios derived from this new approach differ from earlier estimates, both in terms of global numbers of maternal deaths, and in terms of the regional breakdowns. In particular, estimates for Africa are generally much higher whereas those for Asia and Latin America as a whole are broadly comparable with the earlier figures (Table 2).

The earlier global and regional estimates of maternal mortality were developed by WHO using a much cruder model based on female life expectancy. Although they were generally well accepted and used by the international health community they suffered from a major weakness. Because the model was greatly simplified and not very robust, WHO was unable to issue the individual country estimates from which the regional and global totals were calculated. Thus the model could not be used to provide an approximation of the level of maternal mortality in an individual country.[9]

These new estimates differ – in some cases considerably - from official figures or from figures derived from other sources such as *Sisterhood* studies. For example, the figures quoted for

Table 2: New regional estimates compared with previous estimates

UN Region	Maternal mortality ratio (Maternal deaths per 100 000 live births) OLD ESTIMATES	**Maternal mortality ratio (Maternal deaths per 100 000 live births) NEW ESTIMATES**	Maternal deaths (000s) OLD ESTIMATES	**Maternal deaths (000s) NEW ESTIMATES**
World total	370	**430**	509	**585**
More developed regions*	26	**27**	4	**4**
Less developed regions	420	**480**	505	**582**
Africa	630	**870**	169	**235**
Eastern Africa	680	**1060**	60	**97**
Middle Africa	710	**950**	21	**31**
Northern Africa	360	**340**	17	**16**
Southern Africa	270	**260**	4	**3.6**
Western Africa	760	**1020**	66	**87**
Asia*	380	**390**	310	**323**
Eastern Asia	120	**95**	30	**24**
South-central Asia	(570) ***	**560**	(224) ***	**227**
South-eastern Asia	340	**440**	42	**56**
Western Asia	280	**320**	12	**16**
Europe	(23) ***	**36**	(1) ***	**3.2**
Latin America & the Caribbean	200	**190**	25	**23**
Caribbean	260	**400**	2	**3.2**
Central America	160	**140**	6	**4.7**
South America	220	**200**	17	**15**
North America	12	**11**	1	**0.5**
Oceania**	600	**680**	1	**1.4**

** excluding Japan)*
*** excluding Australia and New Zealand*
**** Direct comparisons are not possible because of the redistribution of parts of the former USSR between the two regions.*
Figures may not add to totals due to rounding.

developed countries are based on official figures inflated by a factor of 1.5 to account for misclassification of maternal deaths. As already noted, this new approach results in systematically higher estimates of maternal mortality than *Sisterhood* studies due to the fact that the *Sisterhood* estimates appear to underestimate adult female mortality and have been adjusted accordingly.

What can the new estimates be used for?

This new approach is primarily intended to be of use in countries with no estimates of maternal mortality or where there is concern about the adequacy of officially reported estimates. The intention was to draw attention to the existence and likely dimensions of the problem of maternal mortality. The estimates should be taken as indicating orders of magnitude rather than precise estimates and are not necessarily what governments consider most appropriate. The results for each country should serve as a stimulus to action and to help mobilize national and external resources to this end. The nature of such action will be determined in large measure by the social and economic conditions of the country but must include increasing access to high quality care during pregnancy and childbirth for all women.

What should these estimates NOT be used for?

The standard errors associated with the predicted maternal mortality ratios are very large. They cannot, therefore, be used to monitor trends on a year to year basis, but may be used to monitor changes over the decade. The figures pertain to the year 1990 and should be seen as a recalculation of the earlier 1991 revision rather than as indicative of trends since then.

What other methods are available for monitoring trends?

Where current vital registration systems underestimate maternal mortality due to misclassification of maternal deaths, there is room for improvement through the establishment of a system of confidential inquiries which not only result in better estimation of the dimensions of the problem but also, insofar as they identify the causes of misclassification and analyse the management of each case, lead directly to improvements in case management and reductions in "substandard care".[10]

For monitoring progress towards the year 2000 goals, UNICEF and WHO propose *process* indicators which describe the causal pathways leading to maternal deaths and examine the coverage and quality of services for the management of obstetric complications.[11] Process indicators can help to identify the most appropriate mix of interventions and to assess progress towards improved coverage and quality of care.

UNICEF and WHO are currently developing guidelines on the use of such process indicators at country level. The use of process indicators does not imply the abandonment of efforts to measure impact - that is maternal mortality ratios. However, it is unrealistic to expect that all countries will be able to establish the kind of ongoing monitoring systems needed for a regular appraisal of maternal mortality. Nor would it be appropriate to direct scarce resources to such an undertaking at the expense of programmes to deal with the problem at its source.

Inter-agency collaboration

These new maternal mortality figures will be used by all the agencies of the United Nations system in their work, including the United Nations Population Fund (UNFPA), the United Nations Development Programme (UNDP), the United Nations Population Division and Statistical Division, and The World Bank. The new approach was developed by Cynthia Stanton and Kenneth Hill of Johns Hopkins University. A detailed description of the methodology will be issued separately.[12] The work was guided throughout by an informal advisory group comprising these UN agencies as well as non-governmental organizations working to reduce maternal mortality, notably the Population Council, Family Health International, MotherCare, Columbia University School of Public Health, the London School of Hygiene and Tropical Medicine, and the Dugald Baird Centre for Women's Health. WHO and UNICEF wish to express their gratitude to all the individuals whose time and commitment contributed greatly to the process.

What are the next steps?

Despite its limitations in terms of monitoring, this approach represents a substantial improvement on earlier efforts to estimate maternal mortality at regional and global levels, but more particularly at national level. At regular intervals, WHO and UNICEF will update and expand the data set and re-estimate maternal mortality.

The use of such strategies to estimate maternal mortality is a short-term solution to the problem of measurement. In the long term, accurate information about maternal mortality is dependent on improvements in vital registration systems and their incorporation into all national health information systems. This must be the ultimate objective of all national authorities and of multilateral and bilateral development agencies.

References

[1] World Health Organization. Cause of death statistics and vital rates, civil registration systems and alternative sources of information. *World Health Statistics Annual 1993.*

[2] For example, a sample of nearly 10,000 pregnancies in Addis Ababa, Ethiopia, yielded 45 deaths and an estimated maternal mortality ratio of 480. At the 95% level of significance this gives a sampling error of around 30%, that is, the ratio could lie between 370 and 660. (Source: Kwast BE et al. Epidemiology of maternal mortality in Addis Ababa: a community-based study. *Ethiopian Medical Journal*, 1985, 23:7-16)

[3] Shahidullah , M. (1995) The Sisterhood Method of estimating maternal mortality: the Matlab experience. *Studies in Family Planning* 26:2:101-106

Stanton, C. et al. (1996) *Modelling maternal mortality in the developing world* (forthcoming)

[4] See for example, Bouvier-Colle et al. Reasons for the underreporting of maternal mortality in France, as indicated by a survey of all deaths of women of childbearing age. *International Journal of Epidemiology* 1991, 20:717-721

[5] See, for example, Walker, GJ et al Maternal mortality in Jamaica *Lancet* 1986, 1(8479):486-488

[6] The 1.5 adjustment factor is based on evidence from several studies. See, for example, Bouvier-Colle et al. op.cit. and Atrash, HK et al. (1995) Maternal mortality in developed countries: Not just a concern of the past. *Obstetrics and Gynecology* 86:700-705

[7] See Shahidullah, and Stanton, et al, op. cit

Table 3: Country estimates of maternal mortality, lifetime risk and numbers of maternal deaths (1990)

	Maternal mortality ratio (Maternal deaths per 100,000 live births)	Number of maternal deaths	Lifetime risk of maternal death, 1 in:	**Category of estimate**
Afghanistan	1700	13 000	7	**E**
Albania	65	50	430	**A**
Algeria	160	1 200	120	**E**
Angola	1500	7 200	8	**E**
Antigua/Barbuda*				
Argentina	100	690	290	**B**
Armenia	50	40	640	**A**
Australia	9	25	4900	**A**
Austria	10	10	5600	**A**
Azerbaijan	22	40	1400	**A**
Bahamas	100	5	400	**E**
Bahrain	60	10	360	**E**
Bangladesh	850	33 000	21	**E**
Barbados	43	5	1100	**E**
Belarus	37	50	1300	**A**
Belgium	10	10	5200	**A**
Belize*				
Benin	990	2 300	12	**E**
Bhutan	1600	980	9	**E**
Bolivia	650	1 600	26	**D**
Bosnia and Herzegovina*				
Botswana	250	120	65	**E**
Brazil	220	8 400	130	**E**
British Virgin Islands*				
Brunei Darussalam	60	5	430	**B**
Bulgaria	27	30	1800	**A**
Burkina Faso	930	4 000	14	**E**
Burundi	1300	3 400	9	**E**
Cambodia	900	3 600	17	**E**

** For these countries it was not possible to calculate maternal mortality ratios using this methodology due to absence of independent variables.*

Table 3: Country estimates of maternal mortality, lifetime risk and numbers of maternal deaths (1990)

	Maternal mortality ratio (Maternal deaths per 100,000 live births)	Number of maternal deaths	Lifetime risk of maternal death, 1 in:	**Category of estimate**
Cameroon	550	2 600	26	**E**
Canada	6	25	7700	**A**
Cape Verde*				
Central African Republic	700	850	21	**E**
Chad	1500	3 700	9	**E**
Chile	65	200	490	**B**
China	95	22 000	400	**C**
Colombia	100	800	300	**E**
Comoros	950	260	12	**E**
Congo	890	890	15	**E**
Cook Islands*				
Costa Rica	55	45	420	**B**
Cote d'Ivoire	810	4 900	14	**E**
Croatia*				
Cuba	95	170	490	**B**
Cyprus	5	5	6900	**E**
Czech Republic	15	20	2900	**A**
Dem. People's Rep. of Korea	70	370	500	**E**
Denmark	9	5	5800	**A**
Djibouti	570	110	24	**E**
Dominica*				
Dominican Republic	110	220	230	**E**
East Timor*				
Ecuador	150	460	150	**E**
Egypt	170	3 100	120	**C**
El Salvador	300	530	65	**D**
Equatorial Guinea	820	130	17	**E**
Eritrea	1400	1 900	10	**E**
Estonia	41	10	1100	**A**
Ethiopia	1400	33 000	9	**E**

** For these countries it was not possible to calculate maternal mortality ratios using this methodology due to absence of independent variables.*

Table 3: Country estimates of maternal mortality, lifetime risk and numbers of maternal deaths (1990)

	Maternal mortality ratio (Maternal deaths per 100,000 live births)	Number of maternal deaths	Lifetime risk of maternal death, 1 in:	**Category of estimate**
Fiji	90	15	300	**E**
Finland	11	5	4200	**A**
France	15	110	3100	**A**
French Polynesia*				
Gabon	500	210	32	**E**
Gambia	1100	460	13	**E**
Georgia	33	30	1100	**A**
Germany	22	190	2700	**A**
Ghana	740	4 800	18	**E**
Greece	10	10	5600	**A**
Grenada*				
Guadaloupe*				
Guam*				
Guatemala	200	730	75	**E**
Guinea	1600	4 700	7	**D**
Guinea-Bissau	910	380	16	**C**
Guyana*				
Haiti	1000	2 300	17	**E**
Honduras	220	410	75	**C**
Hong Kong	7	5	9200	**A**
Hungary	30	35	1500	**A**
Iceland	0	0	0	**A**
India	570	147 000	37	**E**
Indonesia	650	31 000	41	**E**
Iran (Islamic Republic of)	120	2 700	130	**C**
Iraq	310	2 200	46	**E**
Ireland	10	5	3800	**A**
Israel	7	5	4000	**A**
Italy	12	65	5300	**A**
Jamaica	120	65	280	**C**

** For these countries it was not possible to calculate maternal mortality ratios using this methodology due to absence of independent variables.*

Table 3: Country estimates of maternal mortality, lifetime risk and numbers of maternal deaths (1990)

	Maternal mortality ratio (Maternal deaths per 100,000 live births)	Number of maternal deaths	Lifetime risk of maternal death, 1 in:	**Category of estimate**
Japan	18	230	2900	**A**
Jordan	150	260	95	**E**
Kazakstan	80	300	370	**A**
Kenya	650	7 000	20	**E**
Kiribati*				
Kuwait	29	15	820	**E**
Kyrgyzstan	110	150	190	**A**
Lao People's Dem. Republic	650	1 200	19	**C**
Latvia	40	15	1100	**A**
Lebanon	300	220	85	**E**
Lesotho	610	420	26	**E**
Liberia	560	690	22	**E**
Libyan Arab Jamahiriya	220	430	55	**E**
Lithuania	36	20	1200	**A**
Luxembourg	0	0	0	**A**
Madagascar	490	2 800	27	**D**
Malawi	560	2 700	20	**D**
Malaysia	80	440	270	**B**
Maldives*				
Mali	1200	5 700	10	**E**
Malta	0	0	0	**A**
Marshall Islands*				
Martinique*				
Mauritania	930	750	16	**E**
Mauritius	120	25	300	**B**
Mexico	110	2 700	220	**B**
Micronesia Federal States*				
Mongolia	65	45	310	**B**
Montserrat*				
Morocco	610	4 500	33	**D**

** For these countries it was not possible to calculate maternal mortality ratios using this methodology due to absence of independent variables.*

Table 3: Country estimates of maternal mortality, lifetime risk and numbers of maternal deaths (1990)

	Maternal mortality ratio (Maternal deaths per 100,000 live births)	Number of maternal deaths	Lifetime risk of maternal death, 1 in:	**Category of estimate**
Mozambique	1500	9 800	9	**E**
Myanmar	580	8 100	33	**E**
Namibia	370	190	42	**D**
Nepal	1500	11 000	10	**E**
Netherlands	12	25	4300	**A**
Netherlands Antilles*				
New Caledonia*				
New Zealand	25	15	1600	**A**
Nicaragua	160	250	100	**C**
Niger	1200	5 100	9	**D**
Nigeria	1000	44 000	13	**E**
Norway	6	5	7300	**A**
Oman	190	150	60	**E**
Pakistan	340	18 000	38	**E**
Palau*				
Panama	55	35	510	**B**
Papua New Guinea	930	1 200	17	**E**
Paraguay	160	240	120	**E**
Peru	280	1 700	85	**E**
Philippines	280	5 400	75	**D**
Poland	19	100	2200	**A**
Portugal	15	20	3500	**A**
Puerto Rico*				
Qatar*				
Republic of Korea	130	900	380	**B**
Republic of Moldova	60	50	580	**A**
Reunion*				
Romania	130	410	340	**A**
Russian Federation	75	1 500	620	**A**
Rwanda	1300	4 000	9	**E**

** For these countries it was not possible to calculate maternal mortality ratios using this methodology due to absence of independent variables.*

Table 3: Country estimates of maternal mortality, lifetime risk and numbers of maternal deaths (1990)

	Maternal mortality ratio (Maternal deaths per 100,000 live births)	Number of maternal deaths	Lifetime risk of maternal death, 1 in:	**Category of estimate**
Saint Kitts/Nevis*				
Saint Lucia*				
Saint Vincent/Grenadines*				
Samoa	35	5	500	**E**
Sao Tome/Principe				**D**
Saudi Arabia	130	730	95	**E**
Senegal	1200	3 900	11	**D**
Seychelles*				
Sierra Leone	1800	3 600	7	**E**
Singapore	10	5	4900	**A**
Slovakia*				
Slovenia	13	5	4000	**A**
Solomon Islands*				
Somalia	1600	7 000	7	**E**
South Africa	230	2 700	85	**E**
Spain	7	30	9200	**A**
Sri Lanka	140	520	230	**B**
Sudan	660	6 600	21	**E**
Suriname*				
Swaziland	560	160	29	**E**
Sweden	7	10	6000	**A**
Switzerland	6	5	8700	**A**
Syrian Arab Republic	180	950	75	**C**
Tajikistan	130	270	120	**A**
TFYR Macedonia*				
Thailand	200	2 300	180	**E**
Togo	640	1 000	20	**E**
Tonga*				
Trinidad and Tobago	90	25	360	**B**
Tunisia	170	380	140	**E**

** For these countries it was not possible to calculate maternal mortality ratios using this methodology due to absence of independent variables.*

Table 3: Country estimates of maternal mortality, lifetime risk and numbers of maternal deaths (1990)

	Maternal mortality ratio (Maternal deaths per 100,000 live births)	Number of maternal deaths	Lifetime risk of maternal death, 1 in:	**Category of estimate**
Turkey	180	2 900	130	**C**
Turkmenistan	55	70	350	**A**
Turks/Caicos Islands*				
Tuvalu*				
Uganda	1200	11 000	10	**E**
Ukraine	50	320	930	**A**
United Arab Emirates	26	10	730	**E**
United Kingdom	9	70	5100	**A**
United Rep. of Tanzania	770	8 700	18	**E**
United States of America	12	480	3500	**A**
Uruguay	85	45	410	**B**
Uzbekistan	55	380	370	**A**
Vanuatu	280	15	60	**E**
Venezuela	120	680	200	**B**
Viet Nam	160	3 300	130	**E**
Yemen	1400	8 100	8	**E**
Yugoslavia*				
Zaire	870	16 000	14	**E**
Zambia	940	3 500	14	**E**
Zimbabwe	570	2 300	28	**E**

** For these countries it was not possible to calculate maternal mortality ratios using this methodology due to absence of independent variables.*

Table 4: Estimates of maternal mortality by WHO regions (1990)

	Maternal mortality ratio (maternal deaths per 100,000 live births)	Number of maternal deaths
Regional Office for Africa (AFRO)	940	213 000
Regional Office for the Americas (AMRO)	140	23 000
Regional Office for the Eastern Mediterranean (EMRO)	440	68 000
Regional Office for Europe (EURO)	59	7 000
Regional Office for South-East Asia (SEARO)	610	235 000
Regional Office for the Western Pacific (WPRO)	120	39 000
WORLD TOTAL	430	585 000

Table 5: Estimates of maternal mortality by UNICEF regions (1990)

	Maternal mortality ratio (maternal deaths per 100,000 live births)	Number of maternal deaths
Eastern and Southern Africa (ESARO)	980	108 000
Western and Central Africa (WCARO)	980	111 000
Middle East and North Africa (MENA)	320	32 000
South Asia (ROSA)	610	224 000
East Asia and the Pacific (EAPRO)	210	80 000
Latin America and the Caribbean (TACRO)	190	22 000
Central and Eastern Europe and the Newly Independent States (CEE-NIS)	95	7 000
Developed countries	17	2 000
WORLD TOTAL	430	585 000

Figures may not add to totals because of rounding.

[8] Insofar as the *Sisterhood Method* identifies **all** pregnancy-related deaths which may include some due to fortuitous or accidental causes, it may over-estimate maternal mortality. However, the method is likely to miss some early maternal deaths such as those related to abortion or ectopic pregnancy. It has been assumed that the two biases cancel out.

[9] In 1992 the individual country estimates were inadvertently issued in the 1992 Human Development Report but were never officially used by any UN agency.

[10] United Kingdom, Department of Health. Report on confidential enquiries into maternal deaths in England and Wales 1982-1984. HMSO 1989.

[11] UNICEF and WHO (1996) *Maternal mortality: Guidelines for monitoring progress.* Second edition. (forthcoming)

[12] Stanton, C et al. (1996) *Op. cit.*