



explanatory notes

The tables in this statistical annex present information on population health in WHO Member States and regions for the year 2003 (Annex Tables 1, 2a and 2b), under-five and neonatal causes of deaths for 2000–2003 (Annex Tables 3 and 4), selected national health accounts aggregates for 1998–2002 (Annex Tables 5 and 6), and selected indicators related to reproductive, maternal and newborn health (Annex Tables 7 and 8). These notes provide an overview of concepts, methods and data sources, together with references to more detailed documentation. It is hoped that careful scrutiny and use of the results will lead to progressively better measurement of core indicators of population health and health system financing.

The theme of *The World Health Report 2005* is maternal and child health. The latest estimates of under-five mortality and causes of death are now available, so special consideration is given both to estimates and to the empirical basis of under-five mortality and causes of death. Annex Table 3 on the estimated number and distribution of deaths by cause focuses on the deaths of children under the age of five years. For the first time, the estimated numbers of deaths for neonates by cause are being published (as Annex Table 4). Consequently, the table on estimated deaths by cause, sex and mortality stratum that appeared in earlier *World Health Reports* is not being published here.

Of the eight major goals set at the United Nations Millennium Summit in 2000, six relate directly to the health and well-being of women and children. These Millennium Development Goals (MDGs) reflect a thorough recognition by governments that improving the well-being of

individuals is a prerequisite to economic development. In order to monitor progress in achieving the MDGs as well as major childhood health initiatives, a reliable information base is critical.

It is essential for the United Nations to disseminate identical estimates on the MDGs, including under-five mortality, in order to enhance proper use of these figures in policy planning or in programme monitoring and evaluation. There is thus an urgent need to develop a system through which the United Nations speaks with a single voice and produces estimates that agree. Four specialized agencies – WHO, the United Nations Children's Fund (UNICEF), the United Nations Population Division, and the World Bank – organized a meeting on child mortality

(infant and under-five mortality rates) in May 2004. Meeting participants agreed on the following actions to further explore their joint activities to improve the estimation process on a regular basis: creation of a common database; discussion on the issues of the currently used methods and ways for improvement; and more focus on country capacity building and training to improve data availability and quality.

Accordingly, WHO and UNICEF produced a consistent set of under-five mortality rates by country for the period 1990–2003, which was used as the basis for estimation shown in Annex Tables 1 and 2a. It should be emphasized that such estimates may not be directly derived from reported data. Annex Table 2b summarizes the empirical basis for the estimation of under-five mortality by age group.

WHO is the primary organization to provide estimates on cause-specific mortality. A major problem has been the lack of accurate cause-specific mortality data from developing countries, especially those with higher levels of mortality. In collaboration with its regional offices, WHO headquarters collects cause-of-death data from its 192 Member States. An established agreement between headquarters and the regional offices ensures that there is no duplication of work at the country level to report data to WHO. The WHO Regional Offices for the Americas, Europe and the Eastern Mediterranean deploy simultaneous efforts to ensure that data are received in a regular and timely manner. Data from the African Region are virtually non-existent and account for the major difficulties in assessing the level of cause-specific mortality in that area.

The data submitted by Member States then become part of WHO's unique historical database on causes of death (WHO Mortality Database) which contains data as far back as 1950 (1). During 2000–2003 some 100 Member States provided vital registration data to WHO and captured approximately 18 million deaths. It should be noted, however, that more than two thirds of deaths in the world are not being reported.

These data gaps need to be filled both by stepping up efforts to work with countries and initiatives to obtain more recent mortality data and by collaborating with partners to promote better tools and investment in data collection and analysis. There is also a need for better harmonization of cause-specific mortality estimates within WHO, with other organizations in the United Nations system and with academic institutions.

In 2001, WHO established the Child Health Epidemiology Reference Group (CHERG) to help improve estimates of cause-specific mortality in childhood. This group of independent technical experts has developed and applied rigorous standards for the development of estimates related to the major causes of childhood deaths, and worked closely with WHO and UNICEF to incorporate their results into broader WHO child health estimates at global, regional and when possible country level. Further detail on CHERG methods and products is available elsewhere (2). The results of WHO collaboration with the CHERG and UNICEF are presented in Annex Tables 3 and 4.

These estimates have been reviewed, agreed upon and supported by the WHO Departments of Child and Adolescent Health and Development (CAH) and Measurement and Health Information Systems (MHI), the UNICEF Division of Policy and Planning (DPP) and an independent group of external experts. Initial WHO estimates and technical explanations were sent to Member States for comment. Comments or data provided in response were discussed with them and incorporated where possible. The estimates published here should, however, still be interpreted as the best estimates of WHO rather than the official viewpoint of Member States.

ANNEX TABLE 1

All estimates of population size and structure for 2003 are based on the demographic assessments prepared by the United Nations Population Division (3). These estimates refer to the de facto population, and not the de jure population in each Member State. The annual growth rate, the dependency ratio, the percentage of population aged 60 years and more, and the total fertility rate are obtained from the same United Nations Population Division database.

To assess overall levels of health achievement, it is crucial to develop the best possible assessment of the life table for each country. Life tables have been developed for all 192 Member States for 2003 starting with a systematic review of all available evidence from surveys, censuses, sample registration systems, population laboratories and vital registration on levels and trends in under-five and adult mortality rates. This review benefited greatly from a collaborative assessment of under-five mortality levels for 2003 by WHO and UNICEF. WHO uses a standard method to estimate and project life tables for all Member States using comparable data. This may lead to minor differences compared with official life tables prepared by Member States.

Life expectancy at birth, the probability of dying before five years of age (under-five mortality rate) and the probability of dying between 15 and 60 years of age (adult mortality rate) derive from life tables that WHO has estimated for each Member State. Procedures used to estimate the 2003 life table differed for Member States depending on the data availability to assess child and adult mortality. Because of increasing heterogeneity of patterns of adult and child mortality, WHO has developed a model life table system of two-parameter logit life tables, and with additional age-specific parameters to correct for systematic biases in the application of a two-parameter system, based on about 1800 life tables from vital registration judged to be of good quality (4). This system of model life tables has been used extensively in the development of life tables for those Member States without adequate vital registration and in projecting life tables to 2003 when the most recent data available are from earlier years. Estimates for 2003 have been revised to take into account new data received since publication of *The World Health Report 2004* for many Member States and may not be entirely comparable with those published in the previous reports. The methods used to construct life tables are summarized below and a full detailed overview has been published (4, 5).

For Member States with vital registration and sample vital registration systems, demographic techniques (Preston–Coale method, Brass Growth–Balance method, Generalized Growth–Balance method and Bennett–Horiuchi method) were first applied to assess the level of completeness of recorded mortality data in the population above five years of age and then those mortality rates were adjusted accordingly (6). Where vital registration data for 2003 were available, these were used directly to construct the life table. For other countries where the system provided a time series of annual life tables, the parameters (I_5 , I_{60}) were projected using a weighted regression model giving more weight to recent years (using an exponential weighting scheme such that the weight for each year t was 25% less than that for year $t+1$). For countries with a total population of less than 750 000 or where the root mean square error from the regression was greater than or equal to 0.011, a shorter-term trend was estimated by applying a weighting factor with 50% annual exponential decay. Projected values of the two life table parameters were then applied to a modified logit life table model, using the most recent national data as the standard, which allows the capture of the most recent age pattern, to predict the full life table for 2003.

For all Member States, other data available for child mortality, such as surveys and censuses, were assessed and adjusted to estimate the probable trend over the past few decades in order to predict the child mortality in 2003. A standard approach to predicting child mortality was employed to obtain the estimates for 2003 (see Annex Table 2a for more details) (7). Those estimates are, on the one hand, used to replace the under-five mortality rate in life tables of the countries that have a vital registration or sample vital registration system, but with incomplete registration of numbers of deaths under the age of five years. On the other hand, for countries without exploitable vital registration systems, which are mainly those with high mortality, the predicted under-five mortality rates are used as one of the inputs to the modified logit system. Adult mortality rates were derived from either surveys or censuses where available; otherwise the most likely corresponding level of adult mortality was estimated based on regression models of child versus adult mortality as observed in the set of approximately 1800 life tables. These estimated child and adult mortality rates were then applied to a global standard, defined as the average of all the life tables, using the modified logit model to derive the estimates for 2003.

It should be noted that the logit model life table system using the global standard does not capture high HIV/AIDS epidemic patterns, because the observed underlying life tables do not come from countries with the epidemic. Similarly, war deaths are not captured because vital registration systems often break down in periods of war (8). For these reasons, for affected countries, mortality without deaths attributable to HIV/AIDS and war was estimated and separate estimates of deaths caused by HIV/AIDS and war in 2003 were added.

The main results in Annex Table 1 are reported with uncertainty intervals in order to communicate to the user the plausible range of estimates for each country on each measure. For the countries with vital registration data projected using time series regression models on the parameters of the logit life table system, uncertainty around the regression coefficients has been accounted for by taking 1000 draws of the parameters using the regression estimates and variance covariance matrix of the estimators. For each of the draws, a new life table was calculated. In cases where additional sources of information provided plausible ranges around under-five and adult mortality rates the 1000 draws were constrained such that each life table produced estimates within these specified ranges. The range of 1000 life tables produced by these multiple draws reflects some of the uncertainty around the projected trends in mortality, notably the imprecise quantification of systematic changes in the logit parameters over the time period captured in available vital registration data.

For Member States where complete death registrations were available for the year 2003 and projections were not used, the life table uncertainty reflects the event count uncertainty, approximated by the Poisson distribution, in the estimated age-specific death rates arising from the observation of a finite number of deaths in a fixed time interval of one year.

For countries that did not have time series data on mortality by age and sex, the following steps were undertaken. First, point estimates and ranges around under-five and adult mortality rates for males and females were developed on a country-by-country basis (5). In the modified logit life table system described (4), values on these two parameters may be used to identify a range of different life tables in relation to a global standard life table. Using the Monte Carlo simulation methods, 1000 random life tables were generated by drawing samples from normal distributions around these inputs with variances defined according to ranges of uncertainty. In countries where

uncertainty around under-five and adult mortality rates was considerable because of a paucity of survey or surveillance information, wide distributions were sampled but the results were constrained based on estimates of the maximum and minimum plausible values for the point estimates.

For 55 countries, mainly in sub-Saharan Africa, estimates of life tables were made by constructing counterfactual life tables excluding the mortality impact of the HIV/AIDS epidemic and then combining these life tables with exogenous estimates of the excess mortality rates attributable to HIV/AIDS. The estimates were based on back-calculation models developed as part of collaborative efforts between WHO and the Joint United Nations Programme on HIV/AIDS (UNAIDS) to derive country-level epidemiological estimates for HIV/AIDS. In countries with substantial numbers of war deaths, estimates of their uncertainty range were also incorporated into the life table uncertainty analysis.

ANNEX TABLE 2A

Estimates of child mortality are regularly published by various international organizations, including WHO. Footnotes are used to explain the underlying methodology and sometimes include information on the availability of empirical data that underlie the estimates. More frequently, however, the reader of the tables is not informed about the source of information. In the current set of tables WHO has made a first attempt to share a brief summary of the underlying empirical information. This should allow the reader to obtain an idea of how much the estimate is based on real data versus assumptions. At this point the tables do not include an assessment of the quality of the data. The estimation process does take the quality of the empirical data into account.

In the context of the Millennium Development Goals (MDGs), particular attention is paid to the measurement of progress towards reaching Goal 4, “to reduce by two thirds the mortality rate among children under five between 1990 and 2015”. At country level this implies government commitment not only to implement initiatives to improve child health but also to set up a reliable system to monitor such progress. Such a system, if implemented, should be able to provide the number of deaths of children under five years of age by sex, age and cause. However, countries with high levels of child mortality are those where there is very little information or none at all, especially on trends.

Annex Table 2a presents the sources and results of information on under-five mortality rates during the last 25 years which are available at WHO. All efforts were made to ensure completeness and accuracy of the information presented, but the table does not intend to be exhaustive. Data collection efforts are summarized for three periods: 1980–1989, 1990–1999 and 2000–2003. Only data collected in the most recent period provide new information on the trend in child mortality in the new millennium. In all other cases, the estimates for the MDGs are drawn entirely from projections based on trends derived from empirical data points prior to the year 2000.

There are four primary sources of empirical under-five mortality data: vital registration (VR), sample registration system (SRS), surveys and censuses. The vital registration or sample registration system provides numbers of deaths by age and sex obtained by direct observation and reporting of individual deaths. These are prospectively collected data. In the case of a survey or a census, the empirical data are based on retrospective data. Interviews with mostly the mother or caregiver or head of household provide information on the survival history of children in the household.

This may be through gathering mortality information for a specific period prior to the census or survey interview, through a birth history or through questions on children ever born and children still alive (“indirect” Brass questions) (9).

The sources of information as listed in the Annex Table 2a were used to derive the estimated trends and projections of rates for under-five-year-olds for the year 2003 shown in both Annex Tables 1 and 2a. A standard approach to predicting the most recent child mortality was employed to ensure comparability between countries and may lead to minor differences compared with official statistics prepared by Member States (7). For each country, estimates of under-five mortality rate are derived from weighted least squares regression of under-five mortality rate on their reference dates. Explanatory variables include date, as well as those that capture rates of change of under-five mortality across periods of time. The weights assigned to each data point reflect its quality or consistency with all other data points. In other cases, additional sources were used as inputs in the standard regression model.

Vital registration can be considered as the gold standard for the collection of mortality data, as it allows the registration of deaths by age and sex. Vital registration systems with high levels of completeness are commonplace in developed countries. Although several developing countries are improving their vital registration systems, in many other countries – especially countries with high levels of mortality – such a system is non-existent. Another source of mortality data is the sample vital registration system which assesses vital events at the national level from information collected in sample areas. These two sources, in principle, provide data on a regular yearly basis.

The column “VR/SRS” in Annex Table 2a – vital registration/sample registration system shows the number of years of data from either system available at WHO. In the absence of a prospective data collection system in a country, household surveys will provide direct or indirect estimates of the level of under-five mortality, primarily using birth history questionnaires in which mothers are asked to provide information about their children, those still living as well as those who did not survive. Similarly, census questionnaires may include a module on mortality, which may refer to recent deaths in the household or use “indirect” Brass questions to estimate child mortality. It should be noted that one single survey or census can generate more than one estimate of under-five mortality for different periods of time. However, the “Survey/Census” column of Annex Table 2a shows the number of the surveys or censuses available at WHO. Furthermore, when a survey was carried over from one year to the next, only the starting year was taken into account.

It is worth noting the efforts of WHO regional offices in collecting vital registration data from Member States. International agencies such as the United Nations and UNICEF also maintain historical databases on under-five mortality rates, which have been generously shared and incorporated in our analyses. Other sources of information include data from national censuses or surveys, or from specialist surveys such as the Demographic and Health Survey (DHS) undertaken by ORC Macro and the Multiple Indicator Cluster Survey (MICS) conducted by UNICEF. Finally, national statistical documents such as statistical yearbooks, reports from specialized agencies and periodical paper findings were also incorporated into the database.

ANNEX TABLE 2B

Whereas Annex Table 2a presents the estimates on under-five mortality rates, Annex Table 2b presents an empirical basis of detailed age-specific mortality rates directly obtained from the most readily available sources on the subject, namely,

Demographic and Health Survey (DHS) and vital registration (VR). In addition to the familiar breakdown of infants under the age of one year into neonatal (0–27 days) and postneonatal (28 days–11 months) periods (10), the latter age group was further divided into two intervals, 28 days–5 months and 6–11 months. Similarly, the child period between the first and fifth birthday was divided into 12–23 and 24–59 months. The table here summarizes the definitions of the age breakdown.

The mortality rates presented in Annex Table 2b are expressed as the probability of dying during each period, for those who have survived until the beginning of that period. Therefore the totals are not equivalent to the sum of the rates of the component age groups.

From DHS raw data sets, UNICEF collaborated in re-analysing them to compute detailed age-specific death rates, following the DHS approach, using synthetic cohort probabilities of death (11). In order to obtain sufficient robustness in the estimates, these represent the period of five years prior to the surveys. No adjustments have been made for reporting issues such as heaping in these calculations.

VR data reported by Member States (1) are the other source where age-specific mortality can be computed, although the current under-one mortality age split that WHO requests does not allow detail within the postneonatal mortality rate. Thus, only neonatal and postneonatal mortality rates are presented in Annex Table 2b. For these two rates, we applied the following formula based on live births (12):

Neonatal mortality rate = neonatal deaths / live births

Postneonatal mortality rate = postneonatal deaths / (live births – neonatal deaths)

For the other age groups, we applied a standard formula from the abridged lifetable:

$${}_nq_x = \frac{{}_nM_x}{1 + n(1 - {}_na_x) {}_nM_x}$$

where

${}_nq_x$ is the probability of dying between exact ages x and $x+n$;

n is the interval of the age group expressed in years;

x is the exact age at the beginning of the age group;

${}_nM_x$ is the age-specific death rate of the age group between x and $x+n$; and

${}_na_x$ is the fraction of last age interval of life.

In this table we relied as much as possible on empirical data; for the denominators (live births and population of age-specific death rates) national data were given priority, otherwise the estimates from the United Nations Population Division were used (3).

Comparisons across countries should be made with great caution as the results are not directly comparable since the method of calculation varies depending on sources and there are different degrees of completeness of vital registration data submitted by Member States.

Those DHS and VR data that can be supplemented by other sources of information would serve as the basis of the analysis between the age groups, by country or by region. This insight into the level of mortality would possibly lead to identification of some cause-specific pattern for a better understanding of the epidemiological transition within childhood mortality.

Definition		Interval ^a
0.	Under-five	0–4 years
1.	Infant	0–11 months
1.1	Neonatal	0–27 days
1.2	Postneonatal	28 days–11 months
1.2.1	Early postneonatal	28 days–5 months
1.2.2	Late postneonatal	6–11 months
2.	Child	1–4 years
2.1	Toddler	12–23 months
2.2	Early childhood	24–59 months

^a The upper limit of the interval refers to completed days, months or years.

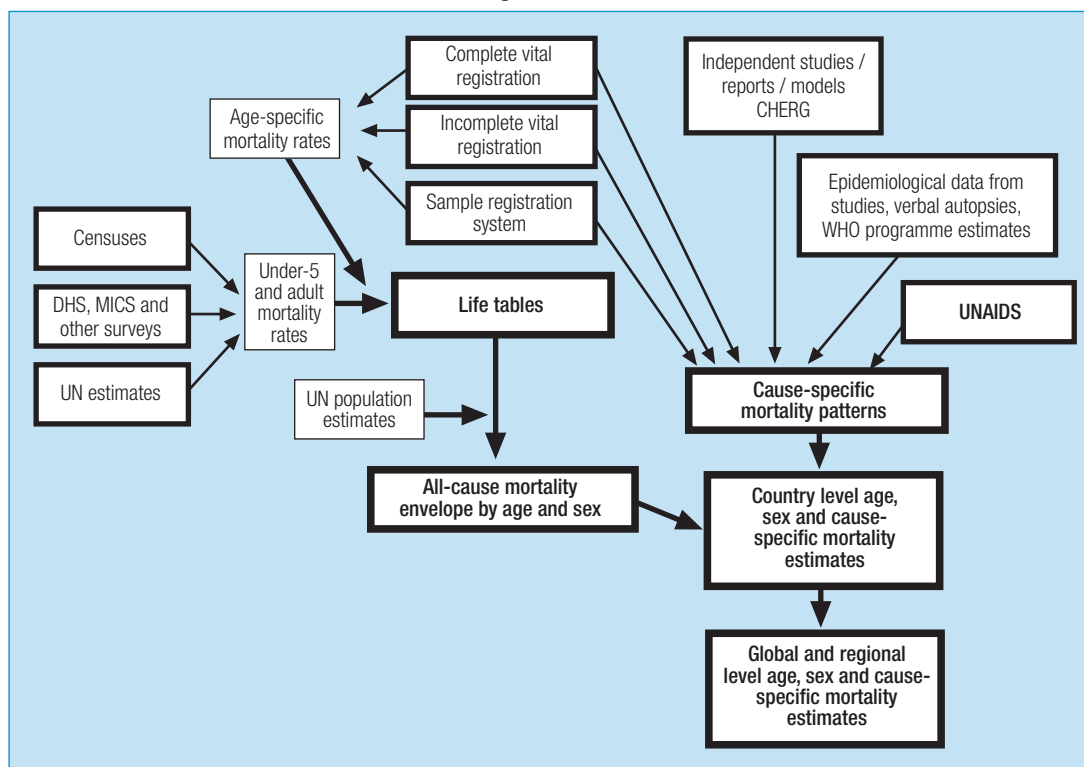
ANNEX TABLE 3

Before estimating the number of deaths for individual causes, the first step is to obtain an estimated number of deaths from all causes combined, which will constitute an “envelope” to make sure that the sum of all cause-specific mortality does not exceed the estimated number of deaths in each country. The envelope itself is derived from the mortality rates from abridged life tables (4, 5) and applying them to the population estimates obtained from the United Nations Population Division (3). The current mortality envelope was based on the joint work by WHO and UNICEF for the period 1990–2003.

Countries with a sound vital registration system (VR) with a relatively high coverage would capture the representative pattern of causes of death at the national level. In addition to the levels of coverage, it is important to analyse carefully the quality of the coding practices which should follow the rules of the International Statistical Classification of Diseases and Related Health Problems (ICD) (6, 8, 10). In some countries, improper completion of death certificates or systematic biases in diagnosis are quite frequent.

For 72 countries where the VR coverage is over 85%, WHO considers VR as the gold standard and uses the pattern directly derived from VR, after adjusting for the ill-defined categories (e.g. ICD-9 Chapter XVI, ICD-10 Chapter XVIII; unspecified cardiovascular diseases; cancers of unknown sites; unspecified external causes) and checking cause-specific trends for the most recent years available. When estimating death rates for very small countries whereby a small change in the number of deaths substantially affects the overall cause-of-death pattern, an average of the last three years of data from their VR is used to avoid spurious trends. In the absence of a

Data and methods used for estimating under-five causes of death



complete VR system for obtaining cause-of-death information, sample registration systems are now implemented in a few countries such as China and India to obtain representative cause-of-death patterns (8).

In many countries, however, VR systems are only operating in specific areas (selected provinces or urban/rural areas) and there are virtually none in the majority of countries with high child mortality. Estimates on cause-of-death patterns should be based on both limited sets of available data and extensive use of models.

Since areas not covered by the VR system are often rural and marginalized regions with a lower socioeconomic status than the covered ones, mortality patterns in both areas are likely to be different. A statistical model to make such an inference has been developed (13), based on the historical VR data for selected countries since 1950 that register at least 95% of all deaths. Although a few developing countries are included, most countries reporting complete VR data to WHO are from developed regions and the countries included are mostly in the WHO European Region and the Region of the Americas.

This model assumes that the broader cause-of-death pattern in high-mortality countries would follow the historical health transitions previously observed in the current high-income and middle-income countries in the absence of major epidemics, natural disasters and war. Conditional on the values for all-cause mortality and income per capita, the model predicts the cause-of-death pattern for the three broader cause categories: communicable diseases; noncommunicable diseases; and external causes (injuries). This model was applied for assigning the under-five mortality envelope to the three broader causes in many high-mortality countries where no reliable information on cause-of-death patterns is available. Information drawn from neighbouring countries within the same region was also used to check the plausibility of model outputs (8).

Once the allocation of the all-cause under-five mortality envelope into the three broader causes is done, the final step is to obtain the distribution of deaths from individual diseases or external causes within each of the three broad groups. For communicable diseases, from which the majority of children under five years of age die, estimates on specific diseases from the Child Health Epidemiology Reference Group (CHERG) (2), WHO technical programmes and UNAIDS are taken into account when making final estimates. The results of this joint work were then incorporated into the all-cause under-five mortality envelope, including deaths from remaining communicable and noncommunicable diseases, and injuries representing 10% and 3% of global deaths, respectively. Because 2000 was the baseline year for the calculation of the estimates of the majority of the cause distribution, except for HIV/AIDS which is updated annually, cause-of-death distribution for 2000 was applied to the average under-five mortality envelope for 2000–2003 to obtain the average annual number of deaths from each cause.

The recent WHO work on neonatal mortality provided a sub-envelope of deaths during the neonatal period out of the total under-five mortality envelope (14). Deaths attributable to HIV/AIDS were allocated based on annual mortality estimates produced by UNAIDS and WHO (15). For pneumonia, diarrhoea, malaria, and measles, the CHERG estimates derived from single-cause models (16–18), as well as estimates from WHO technical programmes (19) and other published literature, were then triangulated with the results of the multi-cause proportional mortality model, which takes into account the major causes of death simultaneously (20), to produce the new set of cause-specific mortality proportions.

Estimates of mortality due to acute lower respiratory infections (ARI), which correspond mainly to pneumonia deaths, were based on the relationship between ARI proportional mortality and all-cause mortality among children under-five years of age. Forty-nine observations were included in the final analysis, which consisted in the fitting of a log-linear curve for ARI proportional mortality against total under-five mortality (18). There was a high degree of consistency at country level between results from this single-proportional model and those from the multi-cause proportional model (20).

The estimated number of deaths from diarrhoea varies substantially, ranging from 1.6 million (16) to 2.6 million total deaths (21). The CHERG single-cause model used to estimate deaths attributable to diarrhoeal diseases included 77 observations. Results of this model (16) were triangulated with the results of the multi-cause proportional model (20) as well as with other available estimates published in the literature (21, 22).

Malaria mortality in sub-Saharan Africa was estimated from an innovative method based on sub-regional mapping of intensity of malaria transmission and risks for dying from malaria (17, 23). The literature review identified 31 studies from 14 countries in middle Africa and 17 studies and reports from four countries in southern Africa. Estimated malaria mortality among children under five years old in sub-Saharan Africa in the year 2000 was between 700 000 and 900 000 deaths. Nearly all malaria deaths occurred in populations exposed to high-intensity transmission in middle Africa. For regions outside Africa, the outputs from the multi-cause model were used to derive the proportion of under-five deaths from malaria (20).

There was a wide discrepancy between CHERG and WHO programme estimates for under-five deaths attributable to measles (19, 20). It was suggested that the CHERG multi-cause model may underestimate causes representing only a small proportion of deaths, and that WHO's natural history model based on incidence, vaccine coverage and case-fatality rate may overestimate measles deaths, because of its reliance on inputs on case-fatality rates of questionable validity (24). WHO convened an expert panel on this issue, resulting in a comparison of the two estimates for the 20 countries with largest absolute discrepancies. Efforts to improve the estimation methodology for measles mortality are ongoing, and WHO has adopted an interim estimate of about 400 000 annual deaths, or 4% of total deaths of children under five years of age worldwide.

In the majority of countries, no further adjustments were made; since some estimates of each cause have been done separately from the multi-cause model, however, the sum of each individual cause could exceed the envelope for a very few countries. In such cases, thorough review of the estimates of each individual cause has been undertaken to resolve the "envelope" violation. Adjustments of the estimated number of deaths by cause were made within the plausible ranges estimated for each cause.

ANNEX TABLE 4

For the first time, WHO is publishing a table on the annual number of deaths by cause for neonates for the period 2000–2003. Neonatal deaths, deaths among live births (0–27 days) may be subdivided into early neonatal deaths (0–6 days) and late neonatal deaths (7–27 days). Annex Table 4 shows only the total neonatal deaths by cause, with no distinction of early or late neonatal deaths.

The total estimated number of deaths of neonates has been derived from the envelope of under-five mortality as described above. Where vital registration (VR) data exist, countries reporting data to WHO sometimes include neonatal deaths; this ac-

counts for only 82 countries. For countries where no such information exists, modelling techniques have been used.

Less than 3% of the world's neonatal deaths occur in countries with VR data that are reliable for cause-of-death analysis. Population-based information in high-mortality settings is often dependent on verbal autopsy tools of variable quality. The Child Health Epidemiology Reference Group (CHERG) undertook an extensive exercise to derive global estimates for programme-relevant causes of neonatal death, including pre-term birth, asphyxia, severe infection, neonatal tetanus, diarrhoea, and other causes comprising specific but less prevalent causes (e.g. jaundice). These estimates were compared with existing high quality data such as those from confidential enquiries and found to match closely.

For low-mortality countries, an analysis was performed using VR data from 45 countries with full VR coverage (cumulative sample size of $N = 96\,797$). For high-mortality countries, studies were identified through extensive systematic searches, and a meta-analysis was performed after applying inclusion criteria and using standard case definitions (56 studies, cumulative sample size of $N = 13\,685$). Multinomial models were developed to estimate simultaneously the distribution of seven causes of death by country. The inputs, methods and results are described in detail elsewhere (25).

Issues surrounding uncertainties in cause of death

All estimates reported in Annex Tables 3 and 4 have uncertainty associated with them. WHO and its technical partners have developed measures of uncertainty for many of the disease-specific or cause-specific estimates that form the basis for their estimates. However, the specific procedures used for the individual cause estimates are not identical and therefore do not produce measures of uncertainty that are comparable across diseases. Rather than reporting measures of uncertainty for different diseases or causes that are uncomparable, it was decided that no measure of uncertainty would be used for this year's report.

WHO, UNICEF and their partners have begun developing a common approach and metric of uncertainty that can be used in future estimates of causes of death. The process builds on previous work by various groups and organizations and will produce a set of guidelines and standards for calculating uncertainty associated with an estimate that will be comparable across cause and estimation methods. More details on the various approaches to quantifying uncertainty can be found in some of the work that has been done on disease-specific estimates (17, 23, 26).

ANNEX TABLE 5

National health accounts (NHA) are a synthesis of the financing and spending flows recorded in the operation of a health system, with the potential to monitor all transactions from funding sources to the distribution of benefits across geographical, demographic, socioeconomic and epidemiological dimensions. NHA are related to the macroeconomic and macrosocial accounts whose methodological approach they borrow.

Annex Table 5 provides the best figures that were available to WHO up to December 2004 for each of its 192 Member States. Any subsequent updates will be made available on the WHO NHA website at <http://www.who.int/nha/en/>. Although more and more countries collect health expenditure data, only about 95 either produce full national health accounts (some of them have done so only once) or report expenditure on health to OECD. Nationally and internationally available information has been identified and compiled for each country. Standard accounting estimation and ex-

trapolation techniques have been used to provide time series. A policy-relevant breakdown of the data (for example, general government/private expenditure) is also provided. Each year draft templates are sent to ministers of health seeking comments and their assistance in obtaining additional information should that be necessary. The constructive responses from ministries and other government agencies such as statistical offices have provided valuable information for the NHA estimates reported here. WHO staff at headquarters and in regional and country offices participated in this process.

An important methodological contribution to producing national health accounts is available in the *Guide to producing national health accounts with special applications for low-income and middle-income countries* (27). This guide is based on the Organisation for Economic Co-operation and Development (OECD) *System of health accounts* (28). Both documents were built on the principles of the *United Nations System of national accounts* (commonly referred to as SNA93) (29).

The principal international references used to produce the tables are the International Monetary Fund (IMF) *Government finance statistics yearbook, 2003* (30), *International financial statistics yearbook, 2003* (31) and *International financial statistics* (November 2004) (32); the Asian Development Bank *Key indicators 2004* (33); *OECD health data 2004* (34) and *International development statistics* (35); and the United Nations *National accounts statistics: main aggregates and detailed tables, 2001* (36). The organizations charged with producing these reports facilitated the supply of advance copies to WHO and gave additional related information, and their contributions are acknowledged here with gratitude.

National sources include: national health accounts reports, public expenditure reports, statistical yearbooks and other periodicals, budgetary documents, national accounts reports, statistical data on official web sites, central bank reports, non-governmental organization reports, academic studies, and reports and data provided by central statistical offices, ministries of health, ministries of finance and economic development, planning offices, and professional and trade associations.

Annex Table 5 provides both updated and revised figures for 1998–2002. Figures have been updated when new information that changes the original estimates has become available (e.g. for India, details of expenditure on social security, private insurance, by firms and by other ministries became available this year which led to a revision of the ratios published in *The World Health Report 2004*). This includes benchmarking revisions, whereby an occasional wholesale revision is made by a country owing to a change in methodology, when a more extensive NHA effort is undertaken, or when shifting the main denominator from the *System of national accounts* 1968 version (SNA68) to SNA93. This category includes benchmarking revisions, whereby an occasional wholesale revision is made by a country owing to a change in methodology, when a more extensive NHA effort is undertaken, or when shifting the main denominator from the *System of national accounts* 1968 version (SNA68) to SNA93.

Total expenditure on health has been defined as the sum of general government health expenditure (GGHE, commonly called public expenditure on health), and private health expenditure (PvtHE). All estimates are calculated in millions of national currency units (million NCU) in current prices. The estimates are presented as ratios to gross domestic product (GDP), to total health expenditure (THE), to total general

government expenditure (GGE), to general government health expenditure (GGHE), or to total private health expenditure (PvtHE).

GDP is the value of all goods and services provided in a country by residents and non-residents without regard to their allocation among domestic and foreign claims. This (with small adjustments) corresponds to the total sum of expenditure (consumption and investment) of the private and government agents of the economy during the reference year. The United Nations *National accounts statistics: main aggregates and detailed tables, 2001 (36)*, Table 1.1, was the main source of GDP estimates. Updated 2002 unpublished figures were obtained for most countries. For most Member countries of the OECD, the macroeconomic accounts have been imported from the OECD health data 2004 (34). Updates for some countries (e.g. Australia) that had not yet been transmitted to the OECD were provided by the country. For non-OECD countries, collaborative arrangements between WHO and the United Nations Statistics Division and the Economic Commission for Europe of the United Nations have permitted the receipt of advance information on 2002. For Lebanon and the United Arab Emirates, United Nations Economic and Social Commission for Western Asia data were used. Likewise, the estimates for Liberia, Nauru and Somalia originate from the web site of the United Nations Statistical Department (UNSTAT).

When United Nations data were unavailable, GDP data reported by the IMF (*International financial statistics*, November 2004) have been used. Unpublished data from the IMF Research Department were used for Palau and Suriname. In cases where none of the preceding institutions reported updated GDP information, national series were used. This covers Andorra, Djibouti, Cape Verde, Cook Islands, Georgia, Jamaica, Jordan, the Federated States of Micronesia, Niue, Pakistan, the Russian Federation, Solomon Islands, Sudan, Tonga and Yemen. Figures for Afghanistan, Kiribati, Myanmar, Samoa and Tuvalu were obtained from the Asian Development Bank. The estimates for Comoros, the Democratic Republic of the Congo, the Democratic People's Republic of Korea, Eritrea, Ghana, Guinea, Mauritania, Timor-Leste and Zimbabwe originate from the World Bank (WDI). Estimates for Benin, Cameroon, Côte d'Ivoire, Equatorial Guinea, Gabon, Guinea Bissau, Mali, Niger, Senegal and Togo originate from the Banque des Etats de l'Afrique Centrale (BEAC). Those for Antigua and Barbuda, Barbados and Grenada are taken from the Caribbean Community Secretariat (CARICOM).

The data for China exclude estimates for Hong Kong Special Administrative Region and Macao Special Administrative Region. The public expenditure on health data for Jordan includes contributions from United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA) to Palestinian refugees residing in Jordanian territories. The 1998 health expenditure data for Serbia and Montenegro included the provinces of Kosovo and Metohia; for 1999 to 2002 the data excluded these territories placed under the administration of the United Nations.

General government expenditure (GGE) includes consolidated direct outlays and indirect outlays (for example, subsidies to producers, transfers to households), including capital, of all levels of government (central/federal, provincial/regional/state/district, and municipal/local authorities), social security institutions, autonomous bodies, and other extrabudgetary funds. *OECD health data 2004* and *National accounts of OECD countries: detailed tables 1991/2002, 2004 edition, Volume II*, Table 12, supplies information on GGE for 26 OECD Member countries (37). The IMF *Government finance statistics yearbook* supplies GGE, and IMF *International financial statistics* reports central government disbursement figures. These are complemented by data for local/municipal governments (as well as some social security payments for health

data received from the IMF). Several other public finance audits, executed budgets, budget plans, statistical yearbooks, web sites, World Bank and Regional Development Bank reports, and academic studies have been consulted to verify general government expenditure. During the consultative process, national authorities had the opportunity to review the GGE figures for their countries.

GGHE comprises the outlays earmarked for the enhancement of the health status of the population and/or the distribution of medical care goods and services among population by the following financing agents:

- central/federal, state/provincial/regional, and local/municipal authorities;
- extrabudgetary agencies, principally social security schemes;
- parastatals' direct expenditure on health care.

All three can be financed through domestic funds or through external resources (mainly grants passing through the governments or loans channelled through the federal budget).

The figures for social security and extrabudgetary expenditure on health include purchases of health goods and services by schemes that are mandatory and controlled by government. A major hurdle has been the need to verify that no double counting occurs and that no cash benefits for sickness and/or loss of employment are included in the estimates, as these are classified as income maintenance expenditure.

All health expenditures include final consumption, subsidies to producers, and transfers to households (chiefly reimbursements for medical and pharmaceutical bills). General government health expenditures include both recurrent and investment expenditures (including capital transfers) made during the year. The classification of the functions of government, promoted by the United Nations, IMF, OECD and other institutions, sets the boundaries. In many instances, the data contained in the publications are limited to those supplied by ministries of health. Expenditure on health, however, should include expenditure where the primary intent is to improve health regardless of the implementing entity. An effort has been made to obtain data on health expenditure by other ministries, the armed forces, prisons, schools, universities and others, to ensure that all resources accounting for health expenditures are included.

Variations in the boundaries used in the original sources were adjusted to allow a standardized definition. For example, in some countries THE includes expenditure on environmental health, training of health personnel and health research activities whereas others treat these expenses as memorandum items. Inclusion of these have sometimes led to a ratio of THE to GDP that is higher than previously reported, as in case of Togo. Some countries report expenditure on health by parastatal institutions as public whereas others include them as private. Many countries following the OECD *System of health accounts* framework treat environmental health, training and health research as memorandum items. In the tables reported here, the principles outlined in the *Guide to producing national health accounts with special applications for low-income and middle-income countries* (27) were followed.

OECD health data 2004 supplies GGHE and PvtHE entries for its Member countries, with some gaps mainly for the year 2002. The data for 2002 for Japan and Turkey have been projected by WHO and others such as Australia and the Netherlands provided data directly to WHO to fill these gaps. A larger number of health expenditure reports from non-OECD countries were available than in previous years which allowed a more complete estimation than in recent *World health reports*. The IMF *Government finance statistics* reports central government expenditure on health for over 120 countries, and

regional government outlays and local government outlays on health for a third of these countries. The entries are not continuous time series for all countries, but the document serves as an indicator that a reporting system exists in those countries allowing a thorough search to be conducted for the relevant national publications. In some cases expenditures reported under the government finance classification were limited to those of the ministry of health rather than all expenditures on health regardless of ministry. In such cases, wherever possible, other series were used to supplement that source. Government finance data, together with statistical yearbooks, public finance reports, and analyses reporting on the implementation of health policies, have led to GGHE estimates for most WHO Member States. Information on Brunei Darussalam, for example, was accessed from national sources, but also from an International Medical Foundation of Japan data compendium (38). This source provided a means for double checking health budget data for seven countries.

Private expenditure on health has been defined as the sum of expenditures by the following entities:

- Prepaid plans and risk-pooling arrangements: the outlays of private and private social (with no government control over payment rates and participating providers but with broad guidelines from government) insurance schemes, commercial and non-profit (mutual) insurance schemes, health maintenance organizations, and other agents managing prepaid medical and paramedical benefits (including the operating costs of these schemes).
- Firms' expenditure on health: outlays by public and private enterprises for medical care and health-enhancing benefits other than payment to social security.
- Non-profit institutions serving mainly households: resources used to purchase health goods and services by entities whose status does not permit them to be a source of income, profit or other financial gain for the units that establish, control or finance them. This includes funding from internal and external sources.
- Household out-of-pocket spending: the direct outlays of households, including gratuities and in-kind payments made to health practitioners and suppliers of pharmaceuticals, therapeutic appliances, and other goods and services, whose primary intent is to contribute to the restoration or to the enhancement of the health status of individuals or population groups. This includes household payments to public services, non-profit institutions or nongovernmental organizations and non-reimbursable cost sharing, deductibles, copayments and fee-for-service. It excludes payments made by enterprises which deliver medical and paramedical benefits, mandated by law or not, to their employees and payments for overseas treatment.

Most of the information on private health expenditures comes from NHA reports, statistical yearbooks and other periodicals, statistical data on official web sites, reports of nongovernmental organizations, household expenditure surveys, academic studies, and relevant reports and data provided by central statistical offices, ministries of health, professional and trade associations and planning councils (eg. for Qatar's out-of-pocket expenditures). For most OECD Member countries they are obtained from *OECD health data 2004*. Standard extrapolation and estimation techniques were used to obtain the figures for missing years.

Information on external resources was received by courtesy of the Development Action Committee of the OECD (DAC/OECD). Some Member States explicitly monitor the external resources entering their health system, information that has been used

to validate or amend the order of magnitude derived from the DAC entries which often related to commitments rather than disbursements.

External resources appearing in Annex Table 5 are those entering the system as a financing source, i.e. all external resources whether passing through governments or private entities are included. On the other hand, other institutions and entities under the public or private health expenditures are financing agents. Financing agents include institutions that pool health resources collected from different sources that pay directly for health care from their own resources.

Several quality checks have been used to assess the validity of the data. For example, estimated health expenditure has been compared against in-patient care expenditure, pharmaceutical expenditure data and other records (including programme administration) to ensure that the outlays for which details have been compiled constitute the bulk of the government/private expenditure on health. The estimates obtained are thus plausible in terms of systems' descriptions. For countries where there is a severe scarcity of information (such as Afghanistan, Democratic People's Republic of Korea, Equatorial Guinea, Gabon, Guinea Bissau, Libya, Sao Tome and Principe, Somalia, Sudan and Turkmenistan), indirect estimating methods were used. WHO intends to introduce a grading system in future publications reporting NHA data, after consultation with partners, showing the extent to which data have had to be estimated.

The aggregate governmental health expenditure data have also been compared with total GGE, providing an additional source of verification. It is possible that the GGHE and, therefore, the figures for total health expenditure, may be an underestimate in the cases where it is not possible to obtain data for local government, nongovernmental organizations and insurance expenditures.

ANNEX TABLE 6

Annex Table 6 presents total expenditure on health and general government expenditure on health in per capita terms. The methodology and sources to derive THE and GGHE have been discussed in the notes to Annex Table 5. Ratios are represented in per capita terms by dividing the expenditure figures by population figures. These per capita figures are expressed first in US dollars at an average exchange rate, or the observed annual average number of units at which a currency is traded in the banking system. They are also presented in international dollar estimates, derived by dividing per capita values in local currency units by an estimate of their purchasing power parity (PPP) compared to US dollars, i.e. a rate or measure that minimizes the consequences of differences in price levels existing between countries.

OECD health data 2004 is the major source for population estimates for the 30 OECD Member countries, just as it is for other health expenditure and macroeconomic variables. All estimates of population size and structure, other than for OECD countries, are based on demographic assessments prepared by the United Nations Population Division (3). This report uses the estimates referred to as the de facto population, and not the de jure population, in each Member State. An exception was made for Serbia and Montenegro for 2001 and 2002, because expenditure figures excluded the provinces of Kosovo and Metohia which became territories under the administration of the United Nations. Population figures for Serbia and Montenegro, excluding Kosovo and Metohia, were obtained from the *Statistical pocket book 2004*, Serbia and Montenegro (39), thus ensuring that the basis for the numerator and denominator is consistent.

Three quarters of the exchange rates (average official rate for the year) have been obtained from the IMF's *International financial statistics*, November 2004. Where information was lacking, available data from the United Nations, the World Bank, the Asian Development Bank and donor reports were used. The euro:US dollar rate has been applied for Andorra, Monaco and San Marino. The New Zealand dollar:US dollar rate has been applied for Niue. The Australian dollar:US dollar rate has been applied for Nauru and Palau. The exchange rate regime in the Islamic Republic of Iran changed in March 2002 from multiple exchange rates to a managed floating exchange rate. This year the inter-bank market rate has been used, replacing the lower pre-2002 official exchange rate series used in the previous *World Health Reports*. Ecuador dollarized its economy in 2000, and the entire dataset has been recalculated in dollar terms for the five-year period reported.

For OECD Member countries, the OECD PPP has been used to calculate international dollars. For countries that are part of the UNECE but are not members of OECD, the UNECE PPPs are used. The Spanish euro, French euro, and Italian euro rates have been used for Andorra, Monaco and San Marino, respectively. For other countries international dollars have been estimated by WHO using methods similar to those used by the World Bank.

ANNEX TABLE 7

In an effort to strengthen collaboration and minimize the reporting burden, WHO and UNICEF jointly collect information through a standard questionnaire (the Joint Reporting Form on Vaccine Preventable Diseases) from all Member States. The content of the Joint Reporting Form was developed through a consensus process among staff from UNICEF, WHO, and selected ministries of health. Information collected in the Joint Reporting Form constitute the major source of information for the following indicators.

Information on immunization coverage is used for a variety of purposes: to monitor the performance of immunization services at local, national and international levels; to guide polio eradication, measles control, and neonatal tetanus elimination; to identify areas of weak system performance that may require extra resources and focused attention; and as one consideration when deciding whether to introduce a new vaccine. Country estimates of national immunization coverage are reported in the Joint Reporting Form. Additionally, since 2000 WHO and UNICEF have conducted a review of data available on national immunization coverage to determine the most likely true level of immunization coverage. Based on the data available, consideration of potential biases, and contributions from local experts, the most likely true level of immunization coverage is determined. For BCG, DTP3, Measles, HepB3 and PAB WHO/UNICEF estimates are presented; for Hib3, yellow fever and TT2+ country estimates are presented.

Newborns immunized with BCG in 2003 (%)

A total of 157 Member States have BCG in their national infant vaccination schedule and coverage estimates has been provided only for them. BCG coverage is often used to reflect the proportion of children who are protected against the severe forms of tuberculosis during the first year of life, and also as an indicator of access to health services.

1-year-olds immunized with 3 doses of DTP in 2003 (%)

DTP vaccine is given universally in all Member States, sometimes in combination with other antigens. DTP3 coverage data are used to indicate the proportion of children

protected against diphtheria, pertussis and tetanus, and to indicate performance of immunization services and the health system in general. DTP3 figures are also compared with DTP1 or BCG to assess “drop-out” rates – an indicator of the quality of services and managerial capacity at peripheral levels.

Children under 2 years immunized with 1 dose of measles in 2003 (%)

Measles vaccine is given universally in all member states, sometimes in combination with other antigens. Measles coverage is one of the selected critical indicators to monitor the progress towards the achievement of the Millennium Development Goal 4, to reduce child mortality.

1-year-olds immunized with 3 doses of hepatitis B in 2003 (%)

Hepatitis B vaccination is recommended universally but only 147 member states had introduced hepatitis B vaccine in routine infant immunization by the end of 2003. HepB3 coverage data are critical to estimate the impact of the vaccine on chronic infection with hepatitis B and its deadly sequelae (hepatoma and cirrhosis).

1-year-olds immunized with 3 doses of Hib vaccine in 2003 (%)

WHO recommends that *Haemophilus influenzae* type b vaccine (Hib) should be included in routine infant immunization services, as appropriate, given epidemiological evidence of disease burden and national capacities and priorities. As of 2003, 87 countries had included it in national routine infant immunization schedule and two in part of the country.

1-year-olds immunized with yellow fever vaccine in 2003 (%)

WHO recommends that yellow fever vaccine be introduced in countries at risk for outbreaks. These include 31 Member States in the African Region, two Member States in the eastern Mediterranean Region, and 11 in the Region of the Americas. Some 21 Member States have introduced yellow fever vaccine in the national routine immunization schedule and seven have introduced it in high risk areas.

Districts achieving at least 80% DTP3 coverage in 2003 (%)

A district is defined here as a third administrative level. In 2002 at the Special Session of the United Nations General Assembly on Children, the nations of the world committed themselves to achieving the following goal: by 2010 or sooner all countries will have routine immunization coverage at 90% nationally with at least 80% coverage in every district.

Children born in 2003 protected against tetanus by vaccination of their mothers with tetanus toxoid (PAB) (%)

Estimates for protection at birth (PAB) are available for a subset of countries where neonatal tetanus has not yet been eliminated. The data reflect the proportion of mothers protected against tetanus at the moment of child delivery through immunization. This may include protective doses received during campaigns or during previous pregnancies.

Pregnant women immunized with two or more doses of tetanus toxoid in 2003 (%)

Tetanus toxoid (TT) administered to women of childbearing age (including pregnant women) protects against both maternal and neonatal tetanus. In the absence of previous tetanus immunization, at least two doses TT (TT2+) are needed to provide protection. WHO recommends that TT2+ be calculated as the proportion of pregnant women having received the second or superior dose of tetanus toxoid in a given year. The data provided are as reported by Member States, of which 110 have TT in the national immunization schedule.

Number of diseases covered by routine immunization before 24 months in 2003

This describes the number of antigens included in the national immunization schedule for children aged less than 24 months in 2003.

Was a second opportunity for measles immunization provided?

The critical strategy to achieve measles mortality reduction is to provide a second vaccine opportunity. A country should have implemented a two-dose routine measles schedule and/or within the last four years have conducted a national immunization campaign achieving more than 90% coverage of children aged less than five years.

Vitamin A distribution linked with routine immunization in 2003

WHO recommends vitamin A supplementation with measles vaccine in countries where vitamin A deficiency is a problem. The data presented in the table do not include vitamin A distributed through campaigns.

Number of wild polio cases reported in 2004

Number of wild polio cases reported for 2004 as of 25 January 2005.

Country polio eradication status in 2004

In 1988, the polio eradication initiative was launched. By the end of 2004, three WHO regions were certified as polio free (the Region of the Americas, and the European and Western Pacific Regions). Only six countries remained polio endemic, four countries re-established transmission (where circulation of imported poliovirus occurred for a period greater than six months) and seven countries reported importation of wild polio virus.

Use of auto-disable syringes in 2003

In 1999 WHO, UNICEF and the United Nations Population Fund (UNFPA) published a joint statement on the use of auto-disable syringes in immunization services, urging that all countries should use only auto-disable syringes for immunization. By the end of 2003, 46 Member States reported exclusive auto-disable syringe use for immunization and 51 countries reported partial use.

Use of vaccine of assured quality in 2003 (40)

The National Regulatory Authority independently controls the quality of the vaccine in accordance with the six regulatory functions defined by WHO (in WHO Technical Report Series, No. 822, 1992). There are no unresolved confirmed reports of quality problems.

Total routine vaccine spending financed using government funds in 2003 (%)

The percentage of all vaccine expenditure in 2003 that was financed using national public funds. In the majority of cases, this excludes any external private and public financing provided to national government for immunization services and used to purchase vaccines, except in the case of countries receiving direct budget support. The data can however include grant portion of development bank loan funds used to purchase vaccines.

ANNEX TABLE 8

Contraceptive prevalence rate (modern methods)

The contraceptive prevalence rate for modern methods is the percentage of women who are practising, or whose sexual partners are practising, any form of contraception. It is measured for married women aged between 15 and 49 years. Modern contraceptive methods include female and male sterilization, injectable or oral hormones, intrauterine devices, diaphragms, spermicides, and condoms. Data sources include Demographic and Health Surveys (ORC Macro and national statistical offices), and *World Contraceptive Use 2003* (41).

Antenatal care use

Based on recent research findings, WHO recommends a minimum of four antenatal visits at specific times for all pregnant women. The table provides the most recent statistics on the number of antenatal care contacts for women during their last pregnancy in the five years prior to the most recent survey conducted in that country. The proportion of women who had one or more antenatal care contacts, as well as the proportion of women who had four or more visits during their last pregnancy are given.

For most countries, the main sources of information on antenatal care use are household surveys. Data sources include Demographic and Health Surveys (ORC Macro and national statistical offices), Reproductive Health Surveys (Centers for Disease Control), Multiple Indicator Cluster Surveys (UNICEF), Pan-Arab Maternal and Child Health Surveys (PAPCHILD), Gulf Fertility Surveys, Fertility and Family Surveys (ECE), national surveys, data files of the United Nations Population Division, and from the 2004 Global Estimates Geneva, Monitoring and Evaluation, Department of Reproductive Health and Research, World Health Organization, 2004.

Proportion of births attended by skilled personnel

International agreement on the definition of a skilled attendant has been reached. A skilled attendant is an accredited health professional – such as a midwife, doctor or nurse – who has been educated and trained to proficiency in the skills needed to manage normal (uncomplicated) pregnancies, childbirth and the immediate postnatal period, and in the identification, management and referral of complications in women and newborns (42). Traditional birth attendants, trained or not, are excluded from the category of skilled attendant at birth.

For most countries, the main sources of information on childbirth care are from household surveys. Data sources include Demographic and Health Surveys (ORC Macro and national statistical offices), Reproductive Health Surveys (Centers for Disease Control), Multiple Indicator Cluster Surveys (UNICEF), Pan-Arab Maternal and Child Health Surveys (PAPCHILD), Gulf Fertility Surveys, Fertility and Family Surveys (ECE),

national surveys, data files of the United Nations Population Division, and from the 2004 Global Estimates Geneva, Monitoring and Evaluation, Department of Reproductive Health and Research, World Health Organization, 2004.

The use of various sources that use different definitions of a skilled attendant, however, makes the comparability of the data across countries and within countries at different times difficult. Although WHO has defined the specific competencies that the skilled attendant should have, there have been no systematic efforts to ensure that the groups classified under the heading of skilled attendant actually have them.

Proportion of births at a health facility

The table presents the proportion of births that occurred in health facilities. The term health facility includes any hospital or clinic in the public or private sector. Sources are as for the proportion of births attended by skilled personnel.

Proportion of births by caesarean section

The table presents the proportion of women who had a caesarean section in their last birth. For most countries, the main sources of information on childbirth care are from household surveys, originating from similar sources to those for the proportion of births attended by skilled personnel.

Number of midwives and number of births

The table gives, by country, the total number of midwives and the yearly number of births. Data on human resources in countries are often difficult to obtain, incomplete and unreliable. The main sources of data are the WHO Global Atlas, Human Resources for Health, WHO EURO Health for All Database, and from Population Division (DESA) United Nations Population Division.

Maternal mortality ratio

The inclusion of maternal mortality reduction in the Millennium Development Goals stimulated an increase in the attention paid to the issue and created additional demands for information. WHO, UNICEF and UNFPA undertook a process to produce global and national estimates of maternal mortality ratio (MMR) for the year 2000, the results of which are published in this table. The Tenth Revision of the *International Classification of Diseases (ICD-10)* (10) defines a maternal death as *the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes*. The MMR is the most commonly used measure of maternal mortality, and it is defined as the number of maternal deaths during a given time period per 100 000 live births during the same time period. This is a measure of the risk of death once a woman has become pregnant. Maternal mortality is difficult to measure, particularly in settings where deaths are not comprehensively reported through the vital registration system and where there is no medical certification of cause of death. Moreover, even where overall levels of maternal mortality are high, maternal deaths are nonetheless relatively rare events and thus prone to measurement error. As a result, all existing estimates of maternal mortality are subject to greater or lesser degrees of uncertainty. Approaches used for obtaining data on levels of maternal mortality in this table vary considerably in terms of methodology, source of data and precision of results. The main approaches are household surveys (including sisterhood surveys), censuses, Reproductive Age Mortality Studies (RAMOS) and statistical modelling.

Neonatal, early neonatal and stillbirth mortality rates

Events related to birth, death, and the perinatal period, as well as the reporting and statistics amenable to international comparison and to reporting requirements for the data from which they are derived, are defined in the chapter on “Standards and reporting requirements related to fetal, perinatal, neonatal and infant mortality” of the *International statistical classification of diseases and related health problems – 10th revision* (ICD-10). Some key issues specifically relevant to neonatal and perinatal mortalities are highlighted below.

The legal requirements for registration of fetal deaths and live births vary from country to country and even within countries. If possible, all fetuses and infants weighing at least 500 g at birth, whether alive or dead, should be included in the statistics. The inclusion of fetuses and infants weighing between 500 g and 1000 g in national statistics is recommended both because of its inherent value and because it improves the coverage of reporting at 1000 g and over. In statistics for international comparison, both the numerator and the denominator of all rates should be restricted to fetuses and infants weighing 1000 g or more. Published ratios and rates should always specify the denominator, i.e. live births or total births (live births plus fetal deaths).

Key issues specifically relevant to neonatal and perinatal mortalities include the following:

- *Perinatal mortality* is death in the perinatal period which includes late pregnancy, birth and the first week of life, and thus includes stillbirths and early neonatal mortality. *Perinatal mortality rates* are calculated per 1000 *total* births (live and stillbirths).
- *Neonatal mortality* relates to the death of live-born infants during the neonatal period, which begins with birth and covers the first four weeks of life. The neonatal period may be subdivided into the early neonatal period, which is the first week of life (and is also part of the perinatal period), and the late neonatal period, which is from the second to the fourth week of life. *Neonatal mortality rates* are calculated per 1000 live births.
- *Early neonatal mortality* relates to the death of live-born infants during the first week of life, which is also part of the perinatal period. *Early neonatal mortality rates* are calculated per 1000 live births.
- *Stillbirth mortality* relates to the fetus of 28 weeks (10) gestation that at birth shows no sign of life. *Stillbirth mortality rates* are calculated per 1000 total births (live and stillbirths).

Data for the estimates originated from survey and registration data. The most frequently available early mortality data are for neonatal deaths. The neonatal mortality rate also provides a reliable national survey or registration rate that can be used to derive estimates of the earlier mortality, if required. For only 5% of births, no neonatal mortality data at national level could be identified, as this data was available for 83% of countries and 95% of births. Data for 81% of births (87 countries) came from surveys. Data originating from civil registration were available for 72 countries, or 37% of all countries, which nevertheless only covers 14% of births. Early neonatal mortality and stillbirth data were available for 73% and 53% of countries respectively, covering 76% and 40% of births respectively.

Estimates for countries for which neonatal mortality data were not available were calculated using WHO under-five mortality estimates and applying a regression formula corrected for deaths due to AIDS; early neonatal mortality rates were estimated from

the neonatal mortality by regression; and stillbirths were estimated relying on the relationship between early neonatal mortality and stillbirths in 14 mortality regions.

The estimates so derived relate mostly to the second half of the 1990s or the early years of the 21st century. In order to project year-specific mortality estimates, the ratio between WHO's estimated under-five mortality rate for the year 2000 and the under-five mortality rate of each country's estimation dataset was calculated. To obtain the early mortality estimates for the year 2000 this ratio was used to adjust the rates provided by surveys or vital registration data or regression. With this adjustment the distribution of age at death within the overall WHO estimated under-five mortality envelope was maintained.

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