Statistical Annex

The tables in this technical annex present updated information on the burden of disease and summary measures of population health in WHO Member States and Regions for the year 2000. The material in these tables will be presented on an annual basis in each World health report. *As with any innovative approach, methods and data sources can be refined and improved. It is hoped that careful scrutiny and use of the results will lead to progressively better measurement of health attainment in the coming* World health reports. *All the main results are reported with uncertainty intervals in order to communicate to the user the plausible range of estimates for each country on each measure. Where data are presented by country, 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 reported here should still be interpreted as the best estimates of WHO rather than the official viewpoint of Member States.*

STATISTICAL ANNEX

EXPLANATORY NOTES

The tables in this technical annex present updated information on the burden of disease and summary measures of population health in WHO Member States and Regions for the year 2000. The work leading to these annex tables was undertaken mostly by the WHO Global Programme on Evidence for Health Policy and the Department of Health Financing and Stewardship in collaboration with counterparts from the Regional Offices of WHO. The material in these tables will be presented on an annual basis in each *World health report*. Working papers have been prepared which provide details on the concepts, methods and results that are only briefly mentioned here. The footnotes to these technical notes include a complete listing of the detailed working papers.

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ANNEX TABLE 1

To assess overall levels of health achievement, it is crucial to develop the best possible assessment of the life table for each country. New life tables have been developed for all 191 Member States 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 child mortality and adult mortality.[1] This review benefited greatly from the work undertaken on child mortality by UNICEF[2] and on general mortality by the United States Census Bureau[3] and the UN Population Division 2000 demographic assessment.[4] All estimates of population size and structure for 2000 are based on the 2000 demographic assessment prepared by the United nations Population Division.[4] These estimates refer to the de facto resident population, and not the de jure population in each Member State. To aid in demographic, cause of death and burden of disease analyses, the 191 Member States have been divided into 5 mortality strata on the basis of their level of child (5q0) and adult male mortality (45q15). The matrix defined by the six WHO Regions and the 5 mortality strata leads to 14 subregions, since not every mortality stratum is represented in every Re-

gion. These subregions are used in Tables 2 and 3 for presentation of results.

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 using a global standard, and with additional age-specific parameters to correct for systematic biases in the application of a two-parameter system.[5] 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 2000 when the most recent data available are from earlier years. Details on the data, methods and results by country of this life table analysis are available in the corresponding technical paper.[1] The World Health Organization uses a standard method to estimate and project life tables for all Member States with comparable data. This may lead to minor differences compared with official life tables prepared by Member States.

To capture the uncertainty due to sampling, indirect estimation technique or projection to 2000, a total of 1000 life tables have been developed for each Member State. Uncertainty bounds are reported in Annex Table 1 by giving key life table values at the 10th percentile and the 90th percentile. This uncertainty analysis was facilitated by the development of new methods and software tools.[6] In countries with a substantial HIV epidemic, recent estimates of the level and uncertainty range of the magnitude of the HIV epidemic have been incorporated into the life table uncertainty analysis.[7]

Annex Tables 2 and 3

Causes of death for the 14 subregions and the world have been estimated based on data from national vital registration systems that capture about 17 million deaths annually. In addition, information from sample registration systems, population laboratories and epidemiological analyses of specific conditions has been used to improve estimates of the cause of death patterns.[6-8] WHO is intensifying efforts with Member States to obtain and verify recent vital registration data on causes of death.

Cause of death data have been carefully analysed to take into account incomplete coverage of vital registration in countries and the likely differences in cause of death patterns that would be expected in the uncovered and often poorer sub-populations. Techniques to undertake this analysis have been developed based on the global burden of disease study[9] and further refined using a much more extensive database and more robust modelling techniques.[10]

Special attention has been paid to problems of misattribution or miscoding of causes of death in cardiovascular diseases, cancer, injuries and general ill-defined categories. A correction algorithm for reclassifying ill-defined cardiovascular codes has been developed.[11] Cancer mortality by site has been evaluated using both vital registration data and population-based cancer incidence registries. The latter have been analysed using a complete age, period cohort model of cancer survival in each region.[8]

Annex Table 3 provides estimates of the burden of disease using disability-adjusted life years (DALYs) as a measure of the health gap in the world in 2000. DALYs along with healthy life expectancy are summary measures of population health.[12,13] One DALY can be thought of as one lost year of "healthy" life and the burden of disease as a measurement of the gap between the current health of a population and an ideal situation where everyone in the population lives into old age in full health. DALYs for a disease or health condition are calculated as the sum of the years of life lost due to premature mortality (YLL) in the population and the years lost due to disability (YLD) for incident cases of the health condition. For a review of the development of the DALY and recent advances in the measure-

ment of the burden of disease, see Murray & Lopez.[14] For a more comprehensive review of the conceptual and other issues underlying summary measures of population health, see Murray et al.[13] DALYs for 2000 have been estimated based on cause of death information for each Region and regional assessments of the epidemiology of major disabling conditions. For this report, burden of disease estimates have been updated for many of the cause categories included in the Global Burden of Disease 2000 study, based on the wealth of data on major diseases and injuries available to WHO technical programmes and through collaboration with scientists worldwide.[15] Examples are the extensive data sets on tuberculosis, maternal conditions, injuries, diabetes, cancer, and sexually transmitted infections. These data, together with new and revised estimates of deaths by cause, age and sex, for all Member States, have been used to develop internally consistent estimates of incidence, prevalence, duration and DALYs for over 130 major causes, for 14 sub-regions of the world.

Annex Table 4

Annex Table 4 reports the average level of population health for WHO Member States in terms of healthy life expectancy. Based on more than 15 years of work, WHO introduced disability-adjusted life expectancy (DALE) as a summary measure of the level of health attained by populations in *The World Health Report 2000*.[16,17] To better reflect the inclusion of all states of health in the calculation of healthy life expectancy, the name of the indicator used to measure healthy life expectancy has been changed from disability-adjusted life expectancy (DALE) to health-adjusted life expectancy (HALE). HALE is based on life expectancy at birth (see Annex Table 1) but includes an adjustment for *time spent in poor health*. It is most easily understood as the equivalent number of years in full health that a newborn can expect to live based on current rates of ill-health and mortality.

The measurement of *time spent in poor health* is based on combining condition-specific estimates from the Global Burden of Disease 2000 study with estimates of the prevalence of different health states by age and sex derived from health surveys carried out by WHO.[18] Representative household surveys are being undertaken in approximately 70 countries using a new instrument based on the International Classification of Functioning, Disability and Health,[19] which seeks information from a representative sample of respondents on their current states of health according to 7 core domains.[20] These domains were identified from an extensive review of the currently available health status measurement instruments.

Analyses of over 50 national health surveys for the calculation of healthy life expectancy in *The World Health Report 2000* identified severe limitations in the comparability of self-reported health status data from different populations, even when identical survey instruments and methods are used.[17,21] To overcome this problem, the WHO survey instrument uses performance tests and vignettes to calibrate self-reported health on selected domains such as cognition, mobility and vision. WHO is developing several statistical methods for correcting biases in self-reported health using these data, based on the hierarchical ordered probit (HOPIT) model.[22] The calibrated responses are used to estimate the true prevalence of different states of health by age and sex.

The uncertainty ranges for healthy life expectancy given in Annex Table 4 are based on the 10th percentile and 90th percentile of the relevant uncertainty distributions.[23] The ranges thus define 80% uncertainty intervals around the estimates. HALE uncertainty is a function of the uncertainty in age-specific mortality measurement for each country, of the uncertainty in burden of disease based estimates of country-level disability prevalence, and of uncertainty in the health state prevalences derived from health surveys.

Healthy life expectancy estimates for Member States for the year 2000 are not directly comparable with those published in last year's World Health Report for 1999 as they incorporate new epidemiological information, new data from health surveys, and new information on mortality rates, as well as improvements in methods.

The new evidence from the WHO Multi-country Household Survey Study has resulted in an overall increase in severity-weighted prevalences, an increase for females relative to males, and hence to a reduction in HALE estimates. This has affected all Member States and at the global level, reduced HALE at birth from the previous estimate of 56.8 years in 1999 to the current estimate of 56.0 years for the year 2000. For some Member States, there have also been changes in HALE estimates due to new information provided on age-specific mortality rates.

Annex Table 5

National Health Accounts are designed to be a policy relevant, comprehensive, consistent, timely and standardized instrument that traces the levels and trends of consumption of health goods and services (the expenditure approach), the value added created by service and manufacturing industries producing these commodities (the production approach) and the incomes generated by this process as well as the taxes, mandatory contributions, premiums and direct payments that fund the system (the income approach). The current developmental stage of WHO's tentative summary National Health Accounts leans more towards a measurement of the financing flows.

The estimates shown are *measured* expenditure and order of magnitude only. All estimates are preliminary.

As in every systems accounting build-up, the "first round data" are likely to be substantially modified in subsequent stages of the accounting development process. The very first estimates for 1997 have been thoroughly revised in light of statistics and other data made accessible after the completion of *The World Health Report 2000*.

Public expenditure on health comprises the current and capital outlays of territorial government (central/federal authorities, regional/provincial/state authorities, and local/municipal authorities) plus social security schemes whose affiliation is compulsory for a sizeable share of the population and extrabudgetary funds earmarked for health services delivery or financing. They include grants and loans provided by international agencies, other national authorities and sometimes commercial banks.

Private expenditure on health comprises private insurance schemes and prepaid medical care plans, services delivered or financed by enterprises (other than contributions to social security and prepaid plans), mandated or not, outlays by nongovernmental organizations and non-profit institutions serving mainly households, out-of-pocket payments, and other privately funded schemes not elsewhere classified, including investment outlays.

The intended *Social security funding* of health expenditure is that of contributions by employers and employees at the exclusion of government transfer payments and subsidies to Social Security institutions which are tax funded flows; this netting-out has only been partly attained in the present state of health accounting.

The *External resources* contribution to health systems financing is mostly directed towards public programmes but includes transfers towards private programmes whose magnitude could not be documented. The ratios of traceable external resources below 0.05% of public expenditure on health, as well as a few entries known to be positive but without quantitative evidence, are shown as "…".

A share of *Tax-funded outlays* is directed in some countries towards the prepayment of loans contracted for health, which could not always be separated from direct expenditure on health services delivery and administration.

For the purpose of Annex Table 5, other private prepaid health plans that are not strictly based on risk-related contracts have been added to *Private insurance* as another form of risk pooling. Zeros in that column do not necessarily indicate the absence of such financial intermediaries and may only mean that, in the absence of data, this form of financing is lumped with out-of-pocket outlays. In cases of suspected positive entries without quantitative evidence, "…" has been used.

Out-of-pocket (OOP) disbursements include, to the extent possible, deductibles and co-payments under social security and other prepaid schemes, other costs incurred by households net of reimbursements under a private or public prepaid arrangement, and other private pre-paid plans.

When no information is available for *Private insurance, Nongovernmental organizations* (NGOs) and/or *Enterprise outlays on health service*, the lacunae inflate the OOPs. Private insurance and OOPs do not necessarily add up to Private expenditure on health.

Exchange rates are the average observed rates at which currencies are traded by the banking system, expressed in US dollars. International dollar estimates are derived by dividing local currency units by an estimate of their purchasing power parity (PPP) compared to US$. PPPs are the rates of currency conversion that equalise the purchasing power of different currencies by eliminating the differences in price levels between countries.

The GDP levels for the OECD countries follow the new Standard National Accounts (SNA93) and those originating from the United Nations and the IMF incorporate SNA93 time series whenever Member States' statistical agencies moved to the new concepts and definitions. For non-OECD countries, where there were differences between the United Nations, the IMF and the World Bank, the reported number reflects the most plausible trend.

For statistical purposes, the data for China do not include those for the Hong Kong Special Administrative Region and the Macao Special Administrative Region. For Jordan, data for territory under occupation since 1967 by Israel is excluded.

Sources of data

Health Expenditure (Public, Private, Social Security, Tax-funded, External, Private Insurance, Out-of-pocket): WHO NHA data files based on *OECD Health Data 2001*; National Health Expenditure accounts in several Member States; IMF *Government Financial Statistics*; United Nations *National Accounts*, Tables 2.1 and 2.5 extended through 1998; World Bank *Development Indicators*; national *Statistical Yearbooks* and other reports containing estimates consistent with the principles underlying the data lifted from the sources quoted; household surveys; WHO secretariat estimates and correspondence with officials in Member States.

GDP: United Nations *National Accounts*, IMF *International Financial Statistics*, World Bank *World Development Indicators*, OECD *National Accounts*.

General Government Expenditures: United Nations *National Accounts*, Table 1.4 extended to 1998; OECD *National Accounts*, vol. II tables 5 and 6; IMF *International Financial Statistics*, central government disbursements grossed up to include regional and local authorities where possible.

Exchange rates: IMF *International Financial Statistics*. Purchasing power parities (PPPs) were estimated using methods similar to those used by the World Bank. PPPs were based

on price comparison studies for 1996 where they existed. For other countries they were estimated using the GDP per capita in US dollars, UN post adjustment multipliers, and other geographical dummy variables. Forward projections were made to 1998 using the real GDP growth rate with the adjustment for US inflation using the US GDP deflators.

[1] Lopez AD, Ahmad O, Guillot M, Inoue M, Ferguson B (2001). *Life tables for 191 countries for 2000: data, methods, results.* Geneva, World Health Organization (GPE Discussion Paper No. 40).

[2] Hill K, Rohini PO, Mahy M, Jones G (1999). *Trends in child mortality in the developing world: 1960 to 1996*. New York, UNICEF.

[3] United States Bureau of the Census: International database available at http://www.census.gov/ipc/www/idbnew.html

[4] *World population prospects: the 2000 revision* (2001). New York , United Nations.

[5] Murray CJL, Ferguson B, Lopez AD, Guillot M, Salomon JA, Ahmad O (2001). *Modified-logit life table system: principles, empirical validation and application*. Geneva, World Health Organization (GPE Discussion Paper No. 39).

[6] Murray CJL, Salomon JA (1998). Modeling the impact of global tuberculosis control strategies. *Proceedings of the National Academy of Science of the USA*, 95(23): 13881–13886.

[7] Salomon JA, Murray CJL (2001). Modelling HIV/AIDS epidemics in sub-Saharan Africa using seroprevalence data from antenatal clinics. *Bulletin of the World Health Organization* 79(7): 596–607.

[8] Mathers CD, Murray CJL, Lopez AD, Boschi-Pinto C (2001). *Cancer incidence, mortality and survival by site for 14 regions of the world*. Geneva, World Health Organization (GPE Discussion Paper No. 13).

[9] Murray CJL, Lopez AD, eds (1996). *The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries and risk factors in 1990 and projected to 2020*. Cambridge, MA, Harvard School of Public Health on behalf of the World Health Organization and the World Bank (Global Burden of Disease and Injury Series, Vol. 1).

[10] Salomon JA, Murray CJL (2000). *The epidemiological transition revisited: new compositional models for mortality by age, sex and cause*. Geneva, World Health Organization (GPE Discussion Paper No. 11, revised edition).

[11] Lozano R, Murray CJL, Lopez AD, Satoh T (2001). *Miscoding and misclassification of ischaemic heart disease mortality*. Geneva, World Health Organization (GPE Discussion Paper No. 12).

[12] Murray CJL, Salomon JA, Mathers CD (2000). A critical examination of summary measures of population health. *Bulletin of the World Health Organization*, 78: 981–994.

[13] Murray CJL, Salomon JA, Mathers CD, Lopez AD, eds (forthcoming in 2002). *Summary measures of population health: concepts, ethics, measurement and applications.* Geneva, World Health Organization.

[14] Murray CJL, Lopez AD (2000). Progress and directions in refining the global burden of disease approach: response to Williams. *Health Economics*, 9: 69–82.

[15] Murray CJL, Lopez AD, Mathers CD, Stein C (2001). *The Global Burden of Disease 2000 project: aims, methods and data sources*. Geneva, World Health Organization (GPE Discussion Paper No. 36).

[16] World Health Organization (2000). *The World Health Report 2000 – Health systems: improving performance.* Geneva, World Health Organization.

[17] Mathers CD, Sadana R, Salomon JA, Murray CJL, Lopez AD (2001). Healthy life expectancy in 191 countries, 1999. *Lancet*, 357(9269): 1685–1691.

[18] Mathers CD, Murray CJL, Lopez AD, Salomon JA, Sadana R, Tandon A, Üstün TB, Chatterji S. (2001). *Estimates of healthy life expectancy for 191 countries in the year 2000: methods and results*. Geneva, World Health Organization (GPE discussion paper No. 38).

[19] World Health Organization (2001). *International classification of functioning, disability and health (ICF)*. Geneva, World Health Organization.

[20] Üstün TB, Chatterji S, Villanueva M, Bendib L, Sadana R, Valentine N, Mathers CD, Ortiz J, Tandon A, Salomon J, Yang C, Xie Wan J, Murray CJL. *WHO Multi-country Household Survey Study on Health and Responsiveness, 2000-2001* (2001). Geneva, World Health Organization (GPE discussion paper No. 37).

[21] Sadana R, Mathers CD, Lopez AD, Murray CJL (2000). *Comparative analysis of more than 50 household surveys on health status*. Geneva, World Health Organization (GPE Discussion Paper No. 15).

[22] Murray CJL, Tandon A, Salomon JA, Mathers CD (2000). *Enhancing cross-population comparability of survey results*. Geneva, World Health Organization (GPE Discussion Paper No. 35).

[23] Salomon JA, Murray CJL, Mathers CD(2000). *Methods for life expectancy and healthy life expectancy uncertainty analysis*. Geneva, World Health Organization (GPE Discussion Paper No. 10).