Annex A: Data and methods

For *The world health report 2002*, WHO developed a new framework for quantifying deaths and burden of disease caused by risk factors, with an emphasis on improving the comparability of the estimates *(1)*. Different risk factors have very different epidemiological traditions, particularly with regard to defining "hazardous" exposure, the strength of evidence on causality, and the availability of epidemiological research on exposure and outcomes. Moreover, classical risk factor research has treated exposures as dichotomous, with individuals either exposed or not exposed, and with exposure defined according to a threshold value that is often arbitrary. Recent evidence for such continuous exposures as cholesterol, blood pressure and body mass index suggests that such arbitrarily defined thresholds are inappropriate because hazard functions for these risks change continuously across the entire range of measured exposure levels, with no obvious threshold *(e.g., 28)*.

The risk factor burden was calculated for *The world health report 2002* as the reduction in disease burden that would be expected under the risk factor exposure scenario that minimizes risk *(29, 30)*. Fractions of disease burden attributable to a risk factor were calculated based on a comparison of disease burden observed under the current distribution of exposure by age, sex and region, with that expected if a counterfactual distribution of exposure had applied. To improve comparability across risk factors, a counterfactual distribution was defined for each risk factor as the population distribution of exposure that would lead to the lowest levels of disease burden. This counterfactual exposure is assumed to have applied in the reference year and in all previous years.

For this update of global estimates of mortality and burden of disease attributable to 24 global risk factors, the methods developed for *The world health report 2002* were applied, with updated inputs on exposure distributions for 2004 and, in some cases, updated estimates of the magnitude of the hazards associated with specific risk exposures. These revisions are documented below. Two new risk factors were included for the first time in this update: suboptimal breastfeeding and higher-than-optimal blood glucose. Regional-level estimates of mortality and DALYs for specific diseases and injuries for 2004 were from a recent WHO update of global burden of disease estimates *(2)*. For some risk factors – including fruit and vegetable intake, occupation risk factors, child sexual abuse and unsafe health-care injections – revised estimates of exposure distributions were not available, and disease- and injury-specific population attributable fractions (PAFs) calculated for the year 2000 were assumed also to apply in 2004.

A1.1 Estimating population attributable fractions

To calculate the difference in population health under the counterfactual scenario, the PAF is first calculated. PAF is defined as:

$$PAF = \frac{\int_{x=0}^{m} RR(x)P(x)dx - \int_{x=0}^{m} RR(x)P'(x)dx}{\int_{x=0}^{m} RR(x)P(x)dx} \qquad (1)$$

where $RR(x)$ = relative risk at each exposure level, $P(x)$ = proportion of population at each exposure level, $P'(x)$ = counterfactual proportion of population at each exposure level, and m = maximum exposure level *(31)*.

For risk factors where the exposure is dichotomous (exposed, not exposed), and the counterfactual scenario is no exposure, equation 1 reduces to equation 2:

$$PAF = P \cdot (RR - 1) / [P \cdot (RR - 1) + 1] \qquad (2)$$

where P = prevalence of exposure, and RR = relative risk for exposed versus non-exposed.

Once the fraction of a disease (or injury) that is attributed to a risk factor has been established, the attributable mortality or burden is simply the product of the total death or DALY estimates for the disease and the attributable fraction. For most diseases, the same attributable fraction is applied to fatal (YLL) and non-fatal (YLD) burden estimates.

Choice of counterfactual

Analysis using counterfactual exposure distributions requires comparing the current distributions of exposure to risk factors with some alternative

distribution. We used the theoretical minimum risk distribution – that is, the distribution of exposure that would yield the lowest population risk – in analyses for this report *(29)*. The theoretical minimum exposure distribution may be zero in some cases because zero exposure reflects minimum risk (e.g. no smoking). For some risk factors, zero exposure is an inappropriate choice because these are physiologically impossible (e.g. body mass index and cholesterol). For these risk factors, the lowest levels observed in specific populations and epidemiological studies were used in choosing the theoretical minimum.

In the case of tobacco, for example, the counterfactual exposure distribution that gives minimum-risk would be that 100% of the population were life-long non-smokers; whereas, for overweight and obesity, it would be a narrow distribution of body mass index centred around an optimal level (e.g. mean 21 (standard deviation 1) kg/m^2), and so on. The theoretical minimum risk exposure distributions for the risk factors quantified here are listed in Table A1.

Joint effects of risk factors

We also calculated the fraction of mortality attributed to the combined effects of these risk factors. Among those people exposed to multiple risk factors, disease-specific deaths may be caused by the simultaneous effects of multiple exposures, and hence can be prevented by reducing exposure to any of the risks. For example, some deaths from ischaemic heart disease may be prevented by reducing blood pressure or by reducing cholesterol. As a result of multicausality, the PAFs for multiple risk factors cannot be combined by simple addition *(32)*. The combined (joint) PAF that avoids double counting the overlap of multiple risk factors is given by equation 3 *(33)*:

$$PAF = 1 - \prod_{i=1}^{n}(1 - PAF_i) \qquad (3)$$

where PAF_i = PAF for individual risk factor i, and n = total number of risk factors that affect the same disease outcome.

Equation 3 is based on three specific assumptions about the correlation of the exposures to the multiple risks and the interactions of their causal effects *(33)*. Firstly, it assumes that the exposure to the risk factors is uncorrelated within a given country. Secondly, it assumes that the level of exposure to one risk factor does not affect the proportional increase in risk caused by another (i.e. no effect modification). Thirdly, it assumes that the effect of one risk factor does not act through another (i.e. no mediated effects). We accounted for instances where these assumptions are violated based on methods published elsewhere *(9, 33)*. For example, we accounted for the increased risk of ischaemic heart disease caused by physical inactivity that acts through increased blood pressure. In previous analyses, neither high blood glucose nor infectious causes of cancer (see page 40) were considered as independent risk factors. It is likely that some proportion of the burden of high body mass index acts through high blood glucose. In analysis of the Framingham Offspring Study cohort, Wilson et al. found that approximately two thirds of the effect of body mass index is mediated through cholesterol, blood pressure and blood glucose; we therefore reduced the burden of body mass index by two thirds before calculating the joint effect of the risk factors *(34)*. We assumed that infectious causes of cancer act independently of the behavioural and environmental causes of cancer considered in this report, with the exception of the risk factors that increase burden by infection, such as the effect of unsafe injections on liver cancer.

A1.2 Risk factors

This section describes the methods used for each of the 24 risk factors included in this report. A summary of the exposure variable, counterfactual exposure levels, disease outcomes, and sources of exposure and hazard estimates is provided in Table A1, and estimated exposure prevalences in Table A2. Tables A3 and A4 provide a summary of the attributable mortality and DALYs for all 24 risk factors for the world, males, females and populations, grouped by country average income per capita.

Childhood and maternal underweight

The prevalence of child underweight was based on analysis of 388 nationally representative studies for

139 countries from the WHO Global Database on Child Growth and Malnutrition.[1] These were used to estimate prevalence of child underweight (for z-score categories of body mass index <–3, –3 to <–2, –2 to <–1) for each country in the world according to the new WHO Child Growth Standards *(35-38)*. The prevalences of maternal underweight (body mass index < 20 kg/m^2) were derived from country-level estimates of means and standard deviations for body mass index from the WHO *Surveillance of chronic disease risk factors* report *(SuRF report 2) (39)*.

Disease-specific relative risks for mortality associated with childhood underweight were estimated by Black et al. *(9)* using eight data sets from low-income countries (Bangladesh, Ghana, Guinea-Bissau, India, Nepal, the Philippines, Pakistan and Senegal). The estimated risks were then adjusted for confounding due to socioeconomic factors that affect mortality through other pathways, such as non-nutritional determinants of infection or access to better clinical care. The same relative risks as for mortality were used for diarrhoea, pneumonia and malaria morbidity.

The CRA 2000 study *(40)* also estimated the proportion of neonatal mortality and morbidity due to low birth weight that was attributable to maternal underweight. Black et al. *(9)* estimated the attributable fractions for birth asphyxia/trauma and neonatal infections attributable to intrauterine growth restriction (IUGR) in babies born at term (i.e. who have completed 37 weeks of gestation). Data from five community-sampled prospective birth cohorts in developing countries were analysed to estimate relative risks of neonatal death due to birth asphyxia and infections (sepsis, pneumonia and diarrhoea). The results presented here include the attributable mortality and burden for neonatal outcomes associated with IUGR due to maternal underweight, and assuming that IUGR deaths were only 0.4% of total neonatal deaths *(2)*.

Iron deficiency

Anaemia prevalence distributions were updated for 2004 using data collected for the Vitamin and Mineral Nutrition Information System[2] by the WHO Department of Nutrition for Health and Development for preschool-aged children, pregnant women and non-pregnant women. These estimates were based on the most recent national and subnational surveys measuring blood haemoglobin concentration carried out in the years 1993–2005 *(11)*. According to these estimates, 42% of pregnant women and 47% of preschool children worldwide have anaemia. Following previous global burden of disease estimates, the 2004 GBD report assumed that 60% of anaemia was due to iron deficiency in non-malaria areas and 50% in malaria areas *(2)*.

Deaths and DALYs estimated for the global burden of disease cause category "iron-deficiency anaemia" were attributed 100% to iron deficiency. These DALYs include the direct impact of anaemia on functioning at all ages in both sexes, and the impact on cognitive functioning in children *(2)*. In addition, anaemia in pregnancy is considered a risk factor for maternal mortality. The attributable mortality and disease burden for maternal causes was estimated using the methods and assumptions of Stoltzfus et al. *(41)*. Following Black et al., we did not consider the effect of iron deficiency on perinatal mortality *(9)*. Country-specific distributions for anaemia in 2004, and for the theoretical minimum counterfactual distributions, were updated using anaemia prevalence estimates for pregnant women for 2004 *(11)*.

Vitamin A deficiency

Exposure data and hazard estimates were updated using recently published updates for country and regional prevalence of vitamin A deficiency in children and new estimates of the relative risks for cause-specific mortality *(9)*. Exposures were estimated based on the percentage of children under 5 years of age living in areas classified as vitamin A deficient, based on population survey data for low plasma or tissue retinol levels and xerophthalmia, together with information on coverage of vitamin A supplementation programmes.

Blindness from corneal scarring directly due to xerophthalmia is 100% attributed to vitamin A deficiency. The relative risks for mortality due to diarrhoea and measles as a result of vitamin A deficiency

[1] http://www.who.int/nutgrowthdb/
[2] http://www.who.int/vmnis

were derived from a meta-analysis of nine randomized placebo-controlled trials in children aged 6–59 months showing risk reduction with supplementation *(42)*. The findings from three trials of vitamin A supplementation of newborns were used to estimate relative risks for mortality from neonatal infections and from prematurity *(9)*. These trials, which were conducted in Bangladesh, India and Indonesia, showed reductions in mortality during infancy ranging from 15% to 64%. However, three other trials conducted in Guinea-Bissau, Nepal and Zimbabwe have shown no effect of this intervention on infant mortality.

Pooled results from trials did not show a consistent association of vitamin A deficiency with malaria mortality or morbidity, or an increased risk of maternal mortality *(9)*. These disease endpoints were therefore not included in the analysis for vitamin A deficiency.

Zinc deficiency

Exposure data and hazard estimates were updated using recently published estimates of country and regional prevalence of zinc deficiency in children under 5 years of age, and new estimates of the relative risks for mortality and morbidity due to diarrhoeal diseases, lower respiratory tract infections and malaria *(9)*. The child population's risk of zinc deficiency was estimated for the 178 countries for which food availability information was available from the Food and Agriculture Organization of the United Nations. The latest prevalence of stunting for 131 countries was obtained from the WHO Global Database on Child Growth and Malnutrition *(35-38)*. Data from other sources were used to classify 35 additional countries by prevalence of stunting. The total child population of each country was classified as zinc deficient or not zinc deficient based on the combination of the prevalence of stunting and adequacy of zinc in the food supply. Relative risks for diarrhoea, pneumonia and malaria incidence in children due to zinc deficiency were estimated from a meta-analysis of placebo-controlled trials *(9)*.

Suboptimal breastfeeding

We based our analysis on the methods of Black et al., who recently published an analysis of the global burden of suboptimal breastfeeding *(9)*. Black et al. provide data for breastfeeding levels for 30 developing countries and 12 regions, mainly covering the developing world. Data were limited for developed countries; therefore, prevalence estimates from the United States of America (USA) and Australia were used *(43, 44)*. The breastfeeding prevalence for the USA was applied to all high-income countries that were not covered by Black et al. and were not located in the WHO Western Pacific Region. Breastfeeding prevalence from Australia was applied to all Western Pacific countries not covered by Black et al. In this analysis, relative risks for diarrhoeal diseases, lower respiratory tract infections and infectious perinatal conditions were calculated for children aged under 24 months. Relative risks were calculated for these conditions across four exposure categories (exclusive, predominant, partial and non-breastfeeding) in the 0–5 months age group and two (any and non-breastfeeding) in the 6–23 month age group. Relative risks and prevalence data for perinatal infections were estimated only for the 0–1 month age group for all countries. Optimal breastfeeding is defined as exclusive breastfeeding for the first 6 months of life and continued breastfeeding through the second year of life *(9)*.

High blood pressure

WHO's *SuRF report 2* presents estimates of mean population blood pressure for 192 Member States, as well as standard deviations *(39)*. Estimates were made using available survey data standardized for age groups and reporting year with regression analysis. Estimates for 2004 were used in this analysis. Relative risks were from the Prospective Studies Collaboration: a meta-analysis of 61 studies *(45)*. Following the CRA 2000 study, we used a counterfactual population systolic blood pressure distribution with a mean of 115 mmHg and a standard deviation of 6 mmHg.

High cholesterol

Mean total serum cholesterol and standard deviation for 2004 were from WHO's *SuRF report 2 (39)*. Relative risks were from the prospective studies collaboration: a meta-analysis of 61 studies *(28)*. We used a counterfactual population serum cholesterol distribution with a mean of 3.8 mmol/l and a standard deviation of 0.5 mmol/l.

High body mass index

Mean body mass index and standard deviation for 2004 were from WHO's *SuRF report 2 (39)*. Relative risks for colon, uterine and post-menopausal breast cancer were from a recent meta-analysis of 221 data sets *(46)*. All other relative risks were from the Asia Pacific Cohort Studies collaboration: a meta-analysis of 33 cohorts *(47, 48)*. We used a counterfactual population body mass index distribution with a mean of 21 kg/m^2 and a standard deviation of 1 kg/m^2.

Low fruit and vegetable intake

We used the estimated regional mean and standard deviation of fruit and vegetable consumption for 2000 from Lock et al. *(49)*. Following Danaei et al. *(50)*, we used relative risks from several recent meta-analyses. Relative risks for ischaemic heart disease were from Dauchet et al. *(51)*, for ischaemic stroke from Dauchet et al. *(52)*, for oesophageal cancer from Boeing et al. *(53)*, and for lung, stomach, colon and rectum cancers from Lock et al. *(49)*. We also used the theoretical minimum risk distribution of fruit and vegetable consumption hypothesized by Lock et al. (fruit and vegetable consumption: mean 600 g/day, standard deviation 50 g/day) as the counterfactual.

Physical inactivity

The CRA 2000 study categorized physical activity into three levels – inactive, insufficiently active and sufficiently active – with the counterfactual exposure distribution being 100% sufficiently active *(54)*. Recent CRA studies have treated physical inactivity as a four-level categorical variable by subdividing the "sufficiently active" exposure group into those "meeting current recommendations" and "highly active" *(50, 55)*. Although physical activity levels equivalent to 2.5 hours per week of moderate-intensity activity or 1 hour per week of vigorous activity – approximately equivalent to 600 MET (metabolic equivalent; that is, energy expenditure measured in units of resting energy expenditure) minutes per week – are considered an important target for population health benefits, the protective effects are expected to continue at higher levels. For this update, four exposure categories were used: dividing the "sufficiently active" exposure group into "moderately active" and "highly active". The threshold for "highly active" was physical activity levels equivalent to at least 1 hour per week of vigorous activity and a total energy expenditure of 1600 MET minutes per week. The theoretical minimum risk exposure distribution was chosen as the whole population being in the "highly active" category to increase consistency of the counterfactual exposure distribution with those for other risk factors and with the definition of theoretical minimum risk *(50, 55)*.

For this update, we used regional prevalence distributions estimated for the CRA 2000 study, with the "sufficiently active" prevalence split into "moderately" and "highly" active using data from the Global Physical Activity Questionnaire (GPAQ), implemented in 28 countries using the WHO Stepwise approach to chronic disease risk factor surveillance (STEPS) approach *(56)*. Age-specific and sex-specific fractions for the "highly active" as a proportion of the "sufficiently active" were estimated for the CRA 2000 subregions based on the subregional average income per capita in 2004, using the GPAQ data for 28 mainly low- and middle-income countries, together with recent data for the USA *(50)* to fit age-specific and sex-specific linear regressions on the log of gross national income per capita. The regression slopes were quite consistent across age and sex groups. The resulting prevalence distributions are summarized in **Table A.2**.

Relative risks consistent with the four-category exposure have been developed by Begg et al. *(55)* and Danaei et al. *(50)*; we used the latter estimates because they were based on the 2000 CRA analysis *(54)*, modified to correspond to the new referent category of "highly active". The revised estimates for mortality and DALYs attributable to physical inactivity for 2004 are higher than the 2000 estimates, with most of the increase being due to mortality among the "inactive" and "insufficiently active" groups assessed against the new referent category. Improved estimates of population distributions of physical activity from the GPAQ and other new survey data sources may result in future revisions to these estimates.

High blood glucose

In addition to deaths and burden of disease directly assigned to diabetes under the rules of the

International Classification of Diseases, mortality from cardiovascular diseases is also higher in people with diabetes, and cardiovascular mortality risk increases continuously with blood glucose concentration, from levels well below the threshold levels used in the definition of diabetes *(8)*. Mortality and disease burden attributable to higher-than-optimal blood glucose are included in this report, using the methods and regional blood glucose concentration estimates developed by Danaei et al. *(8)*. Regional exposure distributions were estimated using measurements of fasting plasma glucose (FPG) concentration from 65 population studies in 52 countries. The theoretical minimum (counterfactual) distribution for FPG was based on the lowest observed distribution in younger adults with mean of 4.9 mmol/l and standard deviation of 0.3 mmol/l. In addition to diabetes mellitus with PAF of 100%, PAFs were estimated for ischaemic heart disease and cerebrovascular disease using relative risks derived from the Asia Pacific Cohort Study meta-analysis of 13 cohorts with 200 000 participants from the WHO regions of South-East Asia and the Western Pacific *(57)*.

Unsafe sex

All sexually transmitted diseases are attributed to unsafe sex. The PAFs for HIV/AIDS and hepatitis B and C due to unsafe sex were derived as described by Slaymaker et al. *(58)*. PAFs were updated for 2004 using country and regional estimates of transmission mode proportions for unsafe sex from UNAIDS monitoring reports and other publications *(59-64)*. All cervical cancer is attributed to sexual transmission of human papillomavirus *(65)*.

Lack of contraception

Non-use and use of ineffective methods of contraception increases the risk of maternal morbidity and mortality associated with unwanted and mistimed births and with unsafe abortion. We used the methods developed by Collumbien et al. for the CRA 2000 study *(66)*. Regional exposure data were updated using most recent country-level data on annual average time trends in the prevalence of use of modern and traditional contraceptive methods, and prevalence of non-use of contraception for the period 1997–2007 *(67)*. Relative risks for unsafe abortion and for maternal conditions – such as maternal haemorrhage, maternal sepsis, hypertensive disorders of pregnancy, obstructed labour and other maternal conditions – were from the CRA 2000 study *(66)*.

Smoking and oral tobacco use

Smoking intensity, average age at initiation and average duration vary considerably from setting to setting and by sex. Using the reported prevalence of smoking in a population would thus bias the calculation of the attributable burden. Therefore, following previous CRA analyses, we used the method of Peto et al., who proposed that current incidence of lung cancer can be used as an indicator of past exposure to tobacco smoke *(68)*. We calculated a "smoking impact ratio" by comparing lung cancer mortality rates in each population with lung cancer mortality rates among non-smokers and smokers observed in the American Cancer Society study: a large long-term follow-up study in the United States *(69)*. Chewing tobacco is an important cause of oral and oesophageal cancers in South Asia. For Bangladesh, India and Pakistan, we estimated oral tobacco use using reported tobacco use in the India World Health Survey *(70)*. Because chewing tobacco is rare in other parts of the world, we did not consider its effects beyond South Asia.

Relative risks of smoking from the American Cancer Society study have recently been updated, and age-specific relative risks were modelled by Danaei et al. *(50)*. We used the relative risks for cancers (lung, upper aerodigestive tract, stomach, cancer, pancreas, cervix uteri, bladder, leukaemia, colon and rectum), selected cardiovascular causes of death, chronic obstructive pulmonary disease and other respiratory causes used by Danaei et al., but originally reported elsewhere *(69, 71, 72)*. Danaie et al. only considered the effect of smoking on hypertensive heart disease in their sensitivity analysis, although the effect is consistently observed *(72)*; because of the importance of hypertensive heart disease worldwide, we included this effect in our primary analysis. Relative risks for tuberculosis and for the effect of chewing tobacco were not available from the American Cancer Society cohort; instead, we used relative risks for tuberculosis from Lin et al. *(73)*, and from Rao et al. for the effect of chewing tobacco on upper aerodigestive tract cancers *(74)*.

We compared current tobacco use with an ideal scenario of no tobacco use.

Alcohol

Estimates for direct deaths and DALYs due to alcohol dependence and harmful use (alcohol use disorders) in 2004 were revised based on a new review of population studies, published data on alcohol production, trade and sales, and health state valuations collected in the WHO Multi-Country Survey Study *(75)*.

For other health effects, two different dimensions of alcohol consumption have been shown to affect health: average volume of alcohol consumption and patterns of drinking, especially heavy drinking occasions (binge drinking). As in the previous CRA 2000 study *(76)*, patterns of drinking were used in addition to average volume in the modelling of impact on injury and ischaemic heart disease. Exposure distributions for alcohol consumption categories and drinking patterns were estimated for 2004 using large representative surveys in the 2000s and national estimates of average recorded and unrecorded adult per capita alcohol consumption for 2003, using methods described by Rehm et al. *(77)*.

The identified alcohol-attributable disease and injury conditions and relative risk estimates were the same as in the CRA 2000 *(76)* with one addition: colon and rectum cancer was added, based on the 2007 evaluation of the International Agency for Research on Cancer on the carcinogenicity of alcohol beverages *(77, 78)*.

Illicit drugs

The global burden of disease cause category "drug use disorders" includes heroin and cocaine dependence and problem use, and is therefore 100% attributed to illicit drugs. The PAFs for HIV/AIDS and hepatitis B and C due to illicit drugs were derived as described by Degenhardt et al. *(79)*. For HIV/AIDS, PAFs were updated for 2004 using country and regional estimates of transmission-mode proportions for injecting drug use; these estimates were from UNAIDS monitoring reports and other publications *(59-64)*. For the GBD 2004, estimates of deaths due to drug use disorders for 2002 were updated using regional trends in the use of illicit opiate drugs reported by the United Nations Office on Drugs and Crime *(18)*.

Unsafe water, sanitation and hygiene

Unsafe water, sanitation and hygiene is divided into six exposure categories, ranging from the ideal scenario of improved drinking water and sanitation with high population coverage, to the worst scenario of having neither. "Improved water" refers to the coverage by an improved drinking-water source, and "improved sanitation" refers to coverage by an improved sanitation facility. Improved drinking-water sources include: piped water into dwelling, plot or yard; public tap or standpipe; tubewell or borehole; protected dug well; protected spring; and rainwater collection. Improved sanitation facilities include: flush or pour-flush to piped sewer system, septic tank or pit latrine; ventilated improved pit latrine; pit latrine with slab; and composting toilet. Exposure estimates came from the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation; coverage data were for the year 2004 *(19)*. Relatives risks for diarrhoea were from the CRA 2000 study *(80)*.

Urban outdoor air pollution

Many air pollutants are harmful to human health; following the CRA 2000 study, we only considered the effects of particulate matter on health *(81)*. Exposure to particulate matter increases the risk of cardiopulmonary conditions, respiratory infections and lung cancer. The mean concentration of particulate matter with an aerodynamic diameter of 10 μm or less (PM_{10}) was estimated for all cities with a population over 100 000 using both modelled and measured data for the years 2002–2004, including country data reported to WHO *(81, 82)*. The proportion of PM_{10} that has an aerodynamic diameter of 2.5 μm or fewer ($PM_{2.5}$) was estimated for three regions: low-mortality European countries (0.73), developed countries (0.65) and developing countries (0.5) *(20)*. The relative risks for respiratory infections and lung cancer were from the CRA 2000 study *(81)*. The relative risks for cardiopulmonary mortality from the CRA 2000 study were used, but a revised exposure–response function (as recommended by Ostro et al. *(20)*) was used.

Indoor smoke from solid fuels

Indoor smoke exposure is measured by estimating the proportion of the population using solid fuels or coal. A ventilation factor is also calculated for countries to take into account exposure to smoke. These estimates were updated by WHO in 2007 using data from health surveys, including the World Health Survey *(83)*. The relative risks for lower respiratory infections, chronic obstructive pulmonary disease and lung cancer come from the CRA 2000 study *(84)*.

Lead exposure

New WHO estimates of blood lead levels, based on a systematic review, were used for this analysis. These estimates reflect the decline in mean blood lead levels since 2000, due to the continuing phase-out of leaded fuels. In addition to considering the effect of lead exposure during development on mild mental retardation, we considered the effect of adult exposure to lead on blood pressure, as was done in the CRA 2000 methods *(85)*, updated with the relative risks for increased blood pressure used in this analysis *(45)*. Following the CRA 2000 study, the effect of acute lead poisoning was not considered in this study. The ideal exposure level for lead is less than 1 μg/dl, however, effects are only estimated to 5 μg/dl to be consistent with available epidemiological evidence.

Climate change

The CRA 2000 study compared observed and projected climate conditions (based on several climate change scenarios) with a counterfactual situation, represented by average climate conditions during 1961–1990, when the effect of carbon emissions on climate was thought to be minimal *(86)*. We estimated the climate conditions for 2004 using projections from the original analysis. The projected climate conditions were linked to health outcomes, including malaria incidence, diarrhoea incidence, malnutrition (via the effects on yields of agricultural crops) and flooding, as described in the CRA 2000 study. Although McMichael et al. *(86)* quantified the effect of increased average temperatures on the balance of cardiovascular mortality in cold and hot temperatures, it is not known whether these deaths were brought forward or delayed by years or only a few weeks. To be consistent with analyses for other risk factors, these deaths were not included in the total deaths presented in summary tables and figures.

Occupational exposures and hazards

The CRA 2000 study included estimates of the disease and injury burden produced by selected occupational risk factors: occupational carcinogens, airborne particulates, noise, ergonomic stressors and risk factors for injuries *(87)*. The disease burden for mesothelioma attributable to asbestos exposure, and for asbestosis, silicosis and pneumoconiosis attributable to occupational exposures, were discussed by Concha-Barientos et al. *(87)*, but not included in the overall attributable mortality and disease burden estimates for occupational exposures and hazards.

PAFs from the CRA 2000 study *(87)* were assumed to apply for 2004 for the five selected occupational risks. In addition, asbestos-caused mesothelioma was also included in the 2004 estimates for occupational carcinogens: PAFs were from Driscoll et al. *(88)*. Asbestosis, silicosis and pneumoconiosis due to occupational exposures were included in the 2004 estimates for airborne particulates: PAFs were from Driscoll et al. *(89)*.

Unsafe health-care injections

Hauri et al. *(90, 91)* estimated the burden of contaminated injections in health-care settings for the year 2000. Globally, they estimated that 5% of HIV infections, 32% of hepatitis B infections and 40% of hepatitis C infections were due to inadequately sterilized injection equipment used in health-care settings. Their analysis for HIV transmission assumed an average transmission probability per contaminated injection of 1.2%, and an average of 0.3% for all needlestick injury plus 2.1% for deep needlestick injury. A more recent meta-analysis by Baggaley et al. *(92)* estimated a range of 0.24–0.65% with a point estimate of 0.45%, which we used here. This is consistent with another recent review *(93)* and an analysis of observed HIV transmission in a rural population in Uganda *(94)*.

Attributable fractions for HIV due to unsafe health-care injections were further adjusted to take

account of the recent downwards revisions for HIV incidence, prevalence and mortality in many regions *(63)*. Data for India from the National AIDS Control Organisation AIDS case reporting system for 2007 gave a transmission distribution of sexual (87.4%), mother to child (4.7%), unsafe blood products (1.7%), infected needles and syringes (1.8%), and unspecified and other (4.1%) *(95)*. Making a conservative assumption that 25% of the unspecified and other transmission is from unsafe medical injections, we have assumed that the fraction of HIV incidence due to unsafe medical injections in India is 3.0%, with an uncertainty range of 1.8% to 5%.

Hauri et al. applied the same age-specific PAFs for HIV incidence and mortality *(90, 91)*. However, recent evidence suggests that incident HIV cases due to unsafe injections in the age range 0–4 years will survive at least 5 years *(96, 97)*, so PAFs for HIV/AIDS mortality have been set to zero. Mortality PAFs for ages 5–14 years were also recalculated using the incidence PAF for 0–4 years, together with estimates of the proportion of infected people who die before age 15 years.

With these revisions, the global proportion of HIV deaths attributable to unsafe medical injections was reduced to 1.3% in 2004. Use of the upper and lower bounds for the HIV PAF for India give a range of 0.9% to 1.8% for this proportion. The revised PAF for African countries with high HIV prevalence was 1.5%, which is reasonably consistent with recent estimates for Kenya and Uganda *(98, 99)*.

Child sexual abuse

The original WHO CRA study *(25)* produced estimates of the burden of disease attributable to child sexual abuse. We used those estimates for relative risks and the prevalence of child sexual abuse (based on epidemiological studies) and assumed no trend in prevalence of child sexual abuse between 2000 and 2004.

Infections and cancers

In our analysis of the primary risks for cancer, we also calculated the proportion of cancers caused by chronic infections based on prior publications *(100, 101)*. Parkin *(100)* estimated the proportion of bladder cancer caused by blood flukes; cervical cancer caused by human papillomavirus; mouth and oropharynx cancers and lymphoma caused by herpesvirus; and stomach cancer caused by *H. pylori* infection. Perz et al. *(101)* calculated the fraction of liver cancer attributed to hepatitis B and C. We applied the attributable fractions calculated by Parkin and Perz et al. to the GBD 2004 estimates of cancer incidence and mortality to estimate the contribution of infections to the cancer burden worldwide.

Table A1: Definitions, theoretical minima, disease outcomes and data sources for the selected global risk factors

Risk factor	Exposure variable	Theoretical minimum	Outcomes[a]	Exposure estimates	Hazard estimates
Childhood and maternal undernutrition					
Underweight	Children < –1 SD weight-for-age compared with the new WHO standards in 1 SD increments *(37, 38)*; maternal body mass index <20 kg/m^2	Same proportion of children below –1 SD weight-for-age as the international reference group; all women of childbearing age with body mass index ≥20 kg/m^2	Mortality and acute morbidity from diarrhoeal diseases, malaria, measles, pneumonia and selected other infectious diseases and protein-energy malnutrition for children <5; perinatal conditions from maternal underweight	Updated estimates of childhood underweight prevalence in 2005 according to new WHO standards *(35-38)*. Updated estimates of maternal underweight for WHO Member States *(39)*	Revised relative risks for child underweight and IUGR outcomes *(9)*
Iron deficiency	Haemoglobin concentrations estimated from prevalence of anaemia	Haemoglobin distributions that halve anaemia prevalence in malarial regions and reduce it by 60% in non-malarial regions, estimated to occur if all iron deficiency were eliminated[b]	Anaemia and its sequelae (including cognitive impairment), maternal mortality	Updated estimates for WHO Member States *(11)*	Systematic review and meta-analysis of cohort studies *(41)*
Vitamin A deficiency	Prevalence of vitamin A deficiency, estimated as low serum retinol concentrations (<0.70 µmol/l) among children aged 0–4 years	No vitamin A deficiency	Mortality due to diarrhoeal diseases, measles, prematurity and low birth weight, and neonatal infections (children <5), morbidity due to vitamin A deficiency and its sequelae (all age groups)	Updated estimates of the prevalence of vitamin A deficiency in children <5 for 2004 *(9)*	From Rice et al. *(42)* for 6–59 months, new relative risk estimates for 0–5 months *(9)*
Zinc deficiency	Less than the USA recommended dietary allowances for zinc	No zinc deficiency	Diarrhoeal diseases, pneumonia, malaria	Updated estimates of the prevalence of zinc deficiency in children <5 for 2004 *(9)*	New relative risk estimates from intervention trials *(9)*
Suboptimal breastfeeding	Prevalence of suboptimal breastfeeding (exclusive, predominant, partial, non-breastfeeding)	100% exclusive breastfeeding from 0–5 months and any breastfeeding from 6–23 months	Diarrhoeal diseases, lower respiratory infections, other causes arising in perinatal period (infectious disease component only)	New estimates of prevalence of suboptimal breastfeeding from recent national survey data *(9, 43, 44)*	New relative risk estimates from a random effects meta-analysis of 7 studies, including a multicentre study in Ghana, India and Peru *(9)*
Other nutrition-related risk factors and physical activity					
High blood pressure	Usual level of systolic blood pressure	Mean of 115 mmHg and SD of 6 mmHg	IHD, stroke, hypertensive disease and other cardiovascular diseases	Updated WHO estimates for Member States *(39)*	Meta-analysis of 61 cohort studies with 1 million North American and European participants *(45)*

(Table A1 continued)

Risk factor	Exposure variable	Theoretical minimum	Outcomes[a]	Exposure estimates	Hazard estimates
High cholesterol	Usual level of total blood cholesterol	Mean of 3.8 mmol/l and standard deviation of 0.6 mmol/l	IHD, ischaemic stroke	Updated WHO estimates for Member States *(39)*	Meta-analysis of 61 cohorts with 900 000 participants from Europe and North America *(28)*
Overweight and obesity (high BMI)	BMI (height (m) divided by weight (kg) squared)	Mean of 21 kg/m^2 and standard deviation of 1 kg/m^2	IHD, ischaemic stroke, hypertensive disease, diabetes, osteoarthritis, colon and uterine cancers, post-menopausal breast cancer	Updated WHO estimates for Member States *(39)*	APCS meta-analysis for cardiovascular and metabolic outcomes *(47)* and new meta-analysis of 221 data sets for cancers *(46)*
High blood glucose	Fasting plasma glucose (FPG) concentration	Mean of 4.9 mmol/l and standard deviation of 0.3 mmol/l	Diabetes mellitus, IHD, cerebrovascular disease	Regional estimates of FPG distribution for people aged 30 years and over *(8)*	APCS meta-analysis of 13 cohorts with 200 000 participants from the Asia-Pacific region *(57)*
Low fruit and vegetable consumption	Fruit and vegetable intake per day	600g (SD 50 g) intake per day for adults	IHD, stroke, colon and rectum cancers, gastric cancer, lung cancer, oesophageal cancer	Systematic review of food consumption surveys and food availability data *(49)*	Systematic review and meta-analyses of published cohort studies *(49, 51-53)*
Physical inactivity	Four categories of inactive, low, medium, and high activity levels *(50, 55)*. Activity in discretionary-time, work and transport considered	High activity level: minimum 3 days per week of vigorous intensity activity (minimum 1500 MET-minutes/week), or 7 days per week of any intensity activity (minimum 3000 MET-minutes/week)	IHD, breast cancer, colon cancer, diabetes mellitus	Prevalence estimates for three categories of physical inactivity from Bull et al. *(54)*. Sufficiently active category split into moderate and highly active using data for 28 countries *(50, 56)*.	Systematic review of published cohort studies *(50, 54)*
Sexual and reproductive health					
Unsafe sex	Sex with an infected partner without any measures to prevent infection	No unsafe sex	HIV/AIDS, sexually transmitted infections and cervical cancer	PAF = 1 (STDs excluding HIV/AIDS, cervical cancer); HIV/AIDS proportions from UNAIDS Reference Group estimates *(58)*, updated using information from UNAIDS Monitoring Reports and other sources *(59-64)*	
Lack of contraception	Prevalence of traditional methods or non-use of contraception	Use of modern contraceptives for all women who want to space or limit future pregnancies	Maternal mortality and morbidity	Data from *World contraceptive use 2007 (67)*	From CRA 2000 study *(66)*

(Table A1 continued)

Risk factor	Exposure variable	Theoretical minimum	Outcomes[a]	Exposure estimates	Hazard estimates
Addictive substances					
Tobacco	Current levels of smoking impact ratio (indirect indicator of accumulated smoking risk based on excess lung cancer mortality); oral tobacco use prevalence	No tobacco use	Lung, upper aerodigestive, stomach, liver, pancreas, cervix, bladder, colon, rectum and kidney cancers, myeloid leukaemia, COPD, other respiratory diseases, tuberculosis, all vascular diseases, diabetes	Updated smoking impact ratios calculated from GBD 2004 lung cancer mortality estimates *(2)*; oral tobacco prevalence for South Asia from WHS-India *(70)*	Relative risks for most causes from the ACS cohort *(69, 71, 72)*, as used by Danaie et al. *(50)*; from meta-analyses for tuberculosis *(73)* and for mouth and oropharynx cancers from chewing tobacco *(74)*
Alcohol	Current alcohol consumption volumes and patterns	No alcohol use	IHD, stroke, hypertensive disease, diabetes, liver cancer, mouth and oropharynx cancer, breast cancer, oesophagus cancer, colon and rectum cancers, other cancers, liver cirrhosis, epilepsy, alcohol use disorders, depression, intentional and unintentional injuries	Updated estimates of alcohol consumption for WHO Member States *(75, 77)*.	Relative risks for colon and rectum cancer added *(78)*; other relative risks from Rehm et al. *(76)*
Illicit drugs	Use of amphetamine, cocaine, heroin or other opioids and intravenous drug use	No illicit drug use	HIV/AIDS, overdose, drug use disorder, suicide, and trauma	Revised based on trends in illicit drug use reported by UNODC *(18)*	PAFs from Degenhardt et al. *(79)*; HIV/AIDS PAFs updated using information from UNAIDS Monitoring Reports and other sources *(59-64)*
Environmental risks					
Indoor smoke from solid fuels	Use of solid fuel or coal household use taking into account a ventilation factor	No solid fuel or coal use	Lower respiratory infections, lung cancer, COPD	Updated estimates for WHO Member States *(83)*	Relative risks come from the CRA 2000 study *(84)*
Unsafe water, sanitation and hygiene	Six categories of exposure: • Ideal situation, corresponding to the absence of transmission of diarrhoeal disease through water, sanitation and hygiene • Regulated water supply and partial sewage treatment • Improved water and basic sanitation • Basic sanitation only • Improved water only • No improved supply or basic sanitation	Absence of transmission of diarrhoeal disease through water and sanitation	Diarrhoeal diseases	Updated estimates for WHO Member States *(19)*	Relative risks come from the CRA 2000 study *(80)*

(Table A1 continued)

Risk factor	Exposure variable	Theoretical minimum	Outcomes[a]	Exposure estimates	Hazard estimates
Urban outdoor air pollution	Annual mean fine particulate matter with an aerodynamic diameter greater than 2.5 µm ($PM_{2.5}$) and 10 µm (PM_{10})	Mean concentration of 7.5 µg/m^3 for $PM_{2.5}$ and 15 µg/m^3 for PM_{10}	Respiratory infections, lung cancers, selected cardiopulmonary diseases	Updated estimates for WHO Member States *(81, 82)*	Relative risks come from the CRA 2000 study *(81)*
Lead exposure	Mean and standard deviation of blood lead level	Blood lead below 1 µg/dl[c]	Mild mental retardation, raised blood pressure (which increases the risk of IHD), stroke, hypertensive disease and other cardiovascular diseases	Updated WHO estimates for Member States	Relative risks for mild mental retardation and raised blood pressure from the CRA 2000 study *(85)*; relative risks for the effect of blood pressure on cardiovascular outcomes from the prospective cohorts study *(45)*
Global climate change	Climate scenarios based on actual and counterfactual carbon emissions and concentrations	Average of 1961–1990 climate conditions	Diarrhoea, flood injury, malaria, undernutrition and associated disease outcomes	Climate change that resulted from unmitigated carbon emissions, as projected to 2004 in the 2000 CRA study *(86)*	Relative risks derived from observed relationships between climate and health, from CRA 2000 study *(86)*
Occupational risks					
Occupational risk factors for injuries	Current proportions of workers exposed to injury risk factors	Exposure corresponding to lowest rate of work-related fatalities observed: 1 per million per year for 16- to 17-year-olds employed as service workers in the USA	Unintentional injuries	PAFs estimated for CRA 2000 assumed to hold for 2004 *(87)*	
Occupational carcinogens	Proportions of workers exposed to background, low, and high levels of workplace carcinogens	No work-related exposure above background to chemical or physical agents that cause cancer	Leukaemia, lung cancer, mesothelioma	PAFs estimated for CRA 2000 assumed to hold for 2004 *(87)*; PAFs for mesothelioma are from Driscoll et al. *(88)*	
Occupational airborne particulates	Proportions of workers with background, low and high levels of exposure	No work-related exposure above background	COPD and asthma, pneumoconiosis, silicosis and asbestosis	PAFs estimated for CRA 2000 assumed to hold for 2004 *(87)*; PAFs for asbestosis, silicosis and pneumoconioses are from Driscoll et al. *(89)*	
Occupational ergonomic stressors	High, moderate, and low exposure based on occupational categories	Physical workload at the level of managers and professionals (low)	Lower back pain	PAFs estimated for CRA 2000 assumed to hold for 2004 *(87)*	

(Table A1 continued)

Risk factor	Exposure variable	Theoretical minimum	Outcomes[a]	Exposure estimates	Hazard estimates
Occupational noise	High and moderate exposure categories (>90 dBA and 85–90 dBA)	Less than 85 dBA on average over 8 working hours	Hearing loss	PAFs estimated for CRA 2000 assumed to hold for 2004 *(87)*	
Other selected risks					
Unsafe health-care injections	Exposure to at least one contaminated injection	No contaminated injections	Acute infection with HBV, HCV and HIV, cirrhosis and liver cancer	Previous PAFs for HIV *(90)* adjusted to take into account a recent meta-analysis of the transmission probability for HIV through reuse of a contaminated needle *(92)*, revised estimates for HIV incidence and prevalence *(63)* and recent data on transmission modes for HIV infection in India *(95)*. Previous PAFs for hepatitis B and C, cirrhosis and liver cancer assumed to apply for 2004.	
Childhood sexual abuse	Prevalence of non-contact abuse, contact abuse and intercourse	No abuse	Depression, panic disorder, alcohol abuse/ dependence, drug abuse/dependence, post-traumatic stress disorder and suicide in adulthood	Prevalences estimated by Andrews et al. for year 2000 assumed to apply for 2004 *(25)*	Systematic review and meta-analysis of published studies *(25)*

ACS, American Cancer Society; AIDS, acquired immunodeficiency syndrome; BMI, body mass index; COPD, chronic obstructive pulmonary disease; CRA, comparative risk assessment; dBA, A-weighted decibels (the noise power calculated in dB); GBD, global burden of disease; HIV, human immunodeficiency virus; HBV, hepatitis B virus; HCV, hepatitis C virus; IHD, ischaemic heart disease; IUGR, intrauterine growth restriction; MET, metabolic equivalent; PAF, population attributable fraction; PM, particulate matter; SD, standard deviation; STD, sexually transmitted disease; UNAIDS, Joint United Nations Programme on HIV/AIDS; UNODC, United Nations Office on Drugs and Crime; USA, United States of America; WHO, World Health Organization; WHS, World Health Survey.

[a] Outcomes likely to be causal but not quantified due to lack of sufficient evidence on prevalence and/or hazard size are not listed here.
[b] The theoretical minimum haemoglobin levels vary across regions and age-sex groups (from 11.66 g/dl in children under 5 years in South-East Asian Region (SEAR)-D to > 14.5 g/dl in adult males in developed countries) because the other risks for anaemia (e.g. malaria) vary.
[c] Theoretical minimum for lead is the blood lead level expected at background exposure levels. Health effects were quantified for blood lead levels above 5 µg/dl where epidemiological studies have quantified hazards.

Table A2: Summary prevalence of selected risk factors by income group in WHO regions,[a] 2004

Risk factor	Prevalence measure[b]	World			Africa	South-East Asia	The Americas		
		Both sexes	Males	Females	Low and middle income	Low and middle income	Total	High income	Low and middle income
Population (millions)		6 437	3 244	3 193	738	1 672	874	329	545
		(000)	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*
Childhood and maternal undernutrition									
Underweight	Child stunting (%)[c]	29	29	29	43	42	12	2	16
	Child wasting (%)[d]	9	9	9	11	15	2	1	2
Iron deficiency	Prevalence of iron-deficiency anaemia (%)[e]								
	Children aged 0–14 years	26	26	26	34	41	12	2	16
	Adults aged ≥15 years	15	12	18	21	21	6	3	8
	Pregnant women	–	–	41	56	48	24	5	31
Vitamin A deficiency	Children at risk of vitamin A deficiency (%)[f]	64	64	64	93	92	20	0	28
Zinc deficiency	Children living in zinc-deficient areas (%)[g]	89	89	88	100	100	66	1	91
Suboptimal breastfeeding	Not exclusively breastfed to 6 months (%)	69	69	69	78	62	68	61	71
Other nutrition-related risk factors and physical activity									
High blood pressure	Mean systolic pressure (mmHg)[h]	126.5	126.9	126.0	128.2	125.3	125.6	126.3	125.0
	Systolic ≥140 mmHg (%)[h]	23	22	23	27	19	21	21	21
High cholesterol	Mean serum cholesterol (mmol/l)[i]	5.1	5.0	5.1	4.3	5.1	5.3	5.4	5.3
	Cholesterol level ≥6 mmol/l[i]	22	20	23	8	21	28	28	28
High blood glucose	Mean fasting plasma glucose (mmol/l)[j]	5.4	5.4	5.4	5.1	5.6	5.4	5.4	5.3
	Diabetic (fpg >7 mmol/l) (%)[j]	11	11	11	4	17	10	13	9
Overweight and obesity	Mean BMI (kg/m^2)[k]	24.5	24.3	24.6	23.0	22.1	27.9	29.0	27.0
	Overweight and obese (BMI ≥ 25) (%)	42	40	43	30	22	70	76	65
	Obese (BMI ≥ 30) (%)	12	9	15	6	2	33	43	26
Low fruit and vegetable intake	Mean fruit and vegetable intake (g/day) [l]	303	314	293	279	239	244	297	207
	Less than five servings per day[m]	67	64	71	71	80	69	65	71
Physical inactivity	Inactive (%)	17	16	19	11	16	22	21	22
	Insufficiently active (%)	41	42	39	49	38	38	41	36
	Moderately active (%)	17	15	20	14	17	19	20	18
	Highly active (%)	25	28	22	25	28	21	18	24
Addictive substances									
Tobacco use	Current smokers (%)[l]	26	43	10	9	21	24	23	26
	Smoking impact ratio (%)[l]	18	25	10	5	12	25	40	13
Alcohol use	Proportion consuming alcohol (%)[l]	44	55	34	36	12	65	58	69
	≥40 grams alcohol/day (%)[l]	13	22	3	18	5	16	19	14
	Average per capita consumption (grams alcohol per day)[l]	14	21	6	16	4	19	21	18
Sexual and reproductive health									
Unmet contraceptive need	Unmet need (%)[n]	43	0	43	70	39	23	2	34
Environmental risks									
Unsafe water, sanitation, hygiene	Improved water supply (%)[o]	83	83	83	57	84	94	100	91
	Improved sanitation (%)[p]	59	59	60	40	41	86	100	77
Urban outdoor air pollution	Concentration of particles less 10 µm (µg/m^3)	62	62	61	65	92	36	24	47
Indoor smoke from solid fuels	Proportion using biofuel (%)	46	46	45	77	81	11	0	18

Risk factor	Prevalence measure[b]	Eastern Mediterranean			Europe			Western Pacific		
		Total	High income	Low and middle income	Total	High income	Low and middle income	Total	High income	Low and middle income
Population (millions)		520	31	489	883	407	476	1 738	204	1 534
		(000)	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*
Childhood and maternal undernutrition										
Underweight	Child stunting (%) [c]	29	16	30	8	2	13	18	4	19
	Child wasting (%) [d]	10	3	11	2	1	3	5	1	6
Iron deficiency	Prevalence of iron-deficiency anaemia (%) [e]									
	Children aged 0–14 years	24	15	24	12	5	17	16	7	17
	Adults aged ≥15 years	13	10	13	8	6	10	15	9	16
	Pregnant women	44	31	44	25	14	32	30	17	32
Vitamin A deficiency	Children at risk of vitamin A deficiency (%) [f]	78	33	81	16	1	27	33	8	35
Zinc deficiency	Children living in zinc-deficient areas (%) [g]	100	99	100	28	3	46	94	28	100
Suboptimal breastfeeding	Not exclusively breastfed to 6 months (%)	72	87	71	66	62	68	71	68	71
Other nutrition-related risk factors and physical activity										
High blood pressure	Mean systolic pressure (mmHg) [h]	126.8	123.8	127.1	133.7	134.0	133.4	123.1	129.2	122.0
	Systolic ≥140 mmHg (%) [h]	23	17	23	36	36	35	19	28	17
High cholesterol	Mean serum cholesterol (mmol/l) [i]	4.8	4.8	4.8	5.5	5.7	5.4	4.9	5.4	4.9
	Cholesterol level ≥6 mmol/l [i]	15	15	15	34	39	29	17	26	16
High blood glucose	Mean fasting plasma glucose (mmol/l) [j]	5.6	5.5	5.6	5.4	5.5	5.3	5.3	5.5	5.3
	Diabetic (fpg >7 mmol/l) (%) [j]	17	15	17	12	14	9	7	14	6
Overweight and obesity	Mean BMI (kg/m^2) [k]	25.2	28.5	25.0	26.9	26.8	27.0	23.4	24.1	23.3
	Overweight and obese (BMI ≥ 25) (%)	48	74	46	65	65	65	31	39	30
	Obese (BMI ≥ 30) (%)	18	37	16	24	23	25	3	7	2
Low fruit and vegetable intake	Mean fruit and vegetable intake (g/day) [l]	350	343	350	376	462	298	343	399	335
	Less than five servings per day [m]	58	59	57	56	42	69	64	52	66
Physical inactivity	Inactive (%)	17	18	17	20	18	22	16	17	16
	Insufficiently active (%)	37	38	37	43	51	35	41	49	40
	Moderately active (%)	18	18	18	18	17	19	17	17	17
	Highly active (%)	27	26	28	20	15	24	26	17	27
Addictive substances										
Tobacco use	Current smokers (%) [l]	18	18	18	33	29	37	32	29	32
	Smoking impact ratio (%) [l]	12	1	13	36	32	40	12	17	11
Alcohol use	Proportion consuming alcohol (%) [l]	6	10	6	74	83	66	58	73	56
	≥40 grams alcohol/day (%) [l]	1	1	1	27	25	28	11	14	11
	Average per capita consumption (grams alcohol per day)[l]	2	2	1	26	27	25	15	19	15
Sexual and reproductive health										
Unmet contraceptive need	Unmet need (%) [n]	52	50	52	20	0	35	53	7	58
Environmental risks										
Unsafe water, sanitation, hygiene	Improved water supply (%) [o]	85	92	85	96	100	92	80	94	78
	Improved sanitation (%) [p]	67	90	65	92	100	86	52	87	47
Urban outdoor air pollution	Concentration of particles less 10 µm (µg/m^3)	116	98	118	35	30	39	67	34	76
Indoor smoke from solid fuels	Proportion using biofuel (%)	41	0	43	6	0	11	37	0	42

(Table A2 continued)

Risk factor	Prevalence measure[b]	World			Africa	South-East Asia	The Americas		
		Both sexes	Males	Females	Low and middle income	Low and middle income	Total	High income	Low and middle income
Population (millions)		6 437	3 244	3 193	738	1 672	874	329	545
		(000)	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*
Other selected risks									
Unsafe health-care injections	Proportion receiving injections contaminated with hepatitis B per year (%)	6	6	6	4	9	0	0	0
Child sexual abuse	Proportion of adults with history of abuse (%) [q]	16	10	22	15	26	8	11	6

[a] See Table A5 for a list of Member States by WHO region and income category.
[b] Estimates are for the population most relevant to the risk factor – alcohol, childhood sexual abuse, physical inactivity are for ages ≥15 years; blood pressure, cholesterol, overweight, and fruit and vegetables are for ages ≥30 years; iron, vitamin A, zinc and underweight are for children under 5 years; and lack of contraception is for females 15–44 years. Many risk factors were characterized at multiple levels for the analyses in this report – this table does not include full details of exposure distributions but rather selected informative indicators (eg. % exposed, % exceeding a commonly used threshold, mean level).
[c] Prevalence of stunting here defined as height-for-age more than 2 standard deviations below the WHO reference standard for children aged 0–4 years. Health outcomes were assessed for levels of stunting more than 1 standard deviation below the WHO reference standard.
[d] Prevalence of wasting here defined as weight-for-age more than 2 standard deviations below the WHO reference standard for children aged 0–4 years.
[e] Prevalence of anaemia attributed to iron-deficiency only. Anaemia is defined as blood haemoglobin level <110 g/l in pregnant women, <120 g/l in children and adult women and <130 g/l in adult men. Attributable deaths and DALYs are calculated using the estimated distribution of blood haemoglobin among those who have anaemia.
[f] Prevalences were estimated based on the per cent of children under five years of age living in areas classified as vitamin A deficient based on population survey data for low plasma or tissue retinol levels and xerophthalmia, together with information on coverage of vitamin A supplementation programs *(9)*.
[g] Child populations of countries were classified as at risk of zinc deficiency based on the prevalence of stunting and the adequacy of absorbable zinc in the food supply at the country level *(9)*.
[h] Persons aged ≥30 years.
[i] For persons aged ≥ 30 years. 1 mmol/l = 38.7 mg/dl; 6 mmol/l = 232 mg/dl.
[j] For persons aged ≥30 years. 5.55 mmol/l = 100 mg/dl; 7 mmol/l = 125 mg/dl.
[k] For persons aged ≥30 years. Body mass index (BMI) is defined as weight (kg) divided by height (m) squared.
[l] Persons aged ≥15 years.
[m] Persons aged ≥15 years. Average serving assumed to correspond to 80 g.
[n] Proportion of women who want to prevent or space conception and are not using modern contraceptive methods.
[o] Proportion of the population with improved or regulated water supply.
[p] Proportion of the population with improved sanitation coverage or full sewage treatment.
[q] Proportion of adults aged ≥ 15 years reporting a history of child sexual abuse by an older person involving contact (genital touching or fondling), intercourse or attempted intercourse.

Risk factor	Prevalence measure[b]	Eastern Mediterranean			Europe			Western Pacific		
		Total	High income	Low and middle income	Total	High income	Low and middle income	Total	High income	Low and middle income
Population (millions)		520	31	489	883	407	476	1 738	204	1 534
		(000)	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*
Other selected risks										
Unsafe health-care injections	Proportion receiving injections contaminated with hepatitis B per year (%)	9	0	9	0	0	1	7	0	8
Child sexual abuse	Proportion of adults with history of abuse (%) [q]	12	11	12	10	8	12	16	13	16

Table A3: Attributable mortality by risk factor and income group in WHO regions,[a] estimates for 2004

Risk factor[b]	Sex						Africa	South-East Asia	The Americas		
	Both sexes		Males		Females		Low and middle income	Low and middle income	Total	High income	Low and middle income
Population (millions)	6 437		3 244		3 193		738	1 672	874	329	545
	(000)	*% total*	*(000)*	*% total*	*(000)*	*% total*	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*
Total deaths (all causes)	**58 772**	**100**	**31 082**	**100**	**27 690**	**100**	**11 248**	**15 279**	**6 158**	**2 695**	**3 464**
Childhood and maternal undernutrition											
Underweight	2 225	3.8	1 163	3.7	1 062	3.8	982	829	27	0	27
Iron deficiency	273	0.5	55	0.2	217	0.8	87	122	18	3	15
Vitamin A deficiency	651	1.1	339	1.1	312	1.1	273	252	10	0	10
Zinc deficiency	433	0.7	226	0.7	208	0.7	249	111	8	0	8
Suboptimal breastfeeding	1 247	2.1	649	2.1	599	2.2	479	366	67	5	62
Other nutrition-related risk factors and physical activity											
High blood pressure	7 512	12.8	3 544	11.4	3 968	14.3	515	1 438	828	412	416
High cholesterol	2 625	4.5	1 371	4.4	1 255	4.5	83	756	338	174	164
High blood glucose	3 387	5.8	1 675	5.4	1 712	6.2	241	1 044	501	212	289
Overweight and obesity	2 825	4.8	1 319	4.2	1 506	5.4	166	343	587	288	299
Low fruit and vegetable intake	1 674	2.8	898	2.9	777	2.8	89	450	183	82	102
Physical inactivity	3 219	5.5	1 567	5.0	1 651	6.0	202	782	451	229	222
Addictive substances											
Tobacco use	5 110	8.7	3 578	11.5	1 532	5.5	145	1 037	863	600	263
Alcohol use	2 252	3.8	1 942	6.2	310	1.1	269	354	347	56	291
Illicit drug use	245	0.4	192	0.6	53	0.2	9	73	31	16	14
Sexual and reproductive health											
Unsafe sex	2 355	4.0	1 033	3.3	1 321	4.8	1 746	332	107	20	87
Unmet contraceptive need[c]	163	0.3	0	0.0	163	0.6	60	73	6	0	6
Environmental risks											
Unsafe water, sanitation, hygiene	1 908	3.2	994	3.2	914	3.3	896	599	59	3	56
Urban outdoor air pollution	1 152	2.0	609	2.0	543	2.0	61	207	143	72	71
Indoor smoke from solid fuels	1 965	3.3	886	2.9	1 079	3.9	551	630	30	0	29
Lead exposure	143	0.2	94	0.3	49	0.2	9	70	7	0	6
Global climate change	141	0.2	73	0.2	68	0.2	57	58	2	0	2
Occupational risks											
Risk factors for injuries	352	0.6	331	1.1	21	0.1	42	121	24	3	20
Carcinogens	177	0.3	137	0.4	41	0.1	6	32	19	10	9
Airborne particulates	457	0.8	352	1.1	105	0.4	29	118	29	15	14
Ergonomic stressors	1	0.0	1	0.0	0	0.0	0	0	0	0	0
Noise	0	0.0	0	0.0	0	0.0	0	0	0	0	0
Other selected risks											
Unsafe health care injections	417	0.7	279	0.9	138	0.5	30	121	2	0	2
Child sexual abuse	82	0.1	41	0.1	41	0.1	4	38	4	2	2

[a] See Table A5 for a list of Member States by WHO region and income category.

[b] The table shows estimated deaths attributable to each risk factor considered individually, relative to its own counterfactual risk exposure distribution. These risks may act in part through, or jointly with, other risks. Total deaths attributable to groups of risk factors will thus usually be less than the sum of the deaths attributable to individual risks.

[c] Unmet contraceptive need refers to "non-use and use of ineffective methods of contraception" among those wanting to control their fertility to avoid conception or space the birth of children.

Risk factor[b]	Eastern Mediterranean			Europe			Western Pacific		
	Total	High income	Low and middle income	Total	High income	Low and middle income	Total	High income	Low and middle income
Population (millions)	520	31	489	883	407	476	1 738	204	1 534
	(000)	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*
Total deaths (all causes)	**4 306**	**113**	**4 194**	**9 493**	**3 809**	**5 683**	**12 191**	**1 478**	**10 714**
Childhood and maternal undernutrition									
Underweight	301	1	300	28	0	27	59	0	58
Iron deficiency	25	0	25	8	4	4	12	1	11
Vitamin A deficiency	86	1	86	10	0	10	20	0	19
Zinc deficiency	46	0	46	5	0	5	15	0	15
Suboptimal breastfeeding	208	2	205	36	2	33	92	1	92
Other nutrition-related risk factors and physical activity									
High blood pressure	475	19	456	2 491	740	1 752	1 764	200	1 564
High cholesterol	178	6	172	926	242	684	345	52	293
High blood glucose	283	13	270	748	258	490	570	86	484
Overweight and obesity	233	18	215	1 081	318	763	414	56	358
Low fruit and vegetable intake	78	3	75	423	77	346	451	40	412
Physical inactivity	219	8	211	992	301	691	573	87	486
Addictive substances									
Tobacco use	187	3	184	1 472	595	877	1 405	261	1 144
Alcohol use	22	1	21	618	25	593	641	52	590
Illicit drug use	47	1	46	45	11	33	41	3	38
Sexual and reproductive health									
Unsafe sex	52	0	52	54	16	38	65	6	58
Unmet contraceptive need[c]	21	0	21	1	0	1	3	0	3
Environmental risks									
Unsafe water, sanitation, hygiene	226	2	224	33	3	30	95	1	94
Urban outdoor air pollution	95	4	91	225	76	149	421	47	373
Indoor smoke from solid fuels	142	0	142	20	0	19	591	0	591
Lead exposure	26	1	25	8	0	8	23	0	22
Global climate change	20	0	20	1	0	1	4	0	4
Occupational risks									
Risk factors for injuries	43	2	42	27	4	24	95	4	91
Carcinogens	6	0	6	42	14	27	72	9	62
Airborne particulates	15	0	15	46	19	27	220	9	211
Ergonomic stressors	0	0	0	0	0	0	0	0	0
Noise	0	0	0	0	0	0	0	0	0
Other selected risks									
Unsafe health-care injections	55	0	55	14	0	14	195	9	185
Child sexual abuse	4	0	4	7	2	6	24	3	21

Table A4: Attributable DALYs by risk factor and income group in WHO regions,[a] estimates for 2004

Risk factor[b]	Sex						Africa	South-East Asia	The Americas		
	Both sexes		Males		Females		Low and middle income	Low and middle income	Total	High income	Low and middle income
Population (millions)	6 437		3 244		3 193		738	1 672	874	329	545
	(000)	*% total*	*(000)*	*% total*	*(000)*	*% total*	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*
Total DALYs (all causes)	**1 523 259**	**100**	**796 133**	**100**	**727 126**	**100**	**376 525**	**442 979**	**143 233**	**45 116**	**98 116**
Childhood and maternal undernutrition											
Underweight	90 683	6.0	47 171	5.9	43 511	6.0	38 575	34 342	1 378	25	1 352
Iron deficiency	19 734	1.3	6 918	0.9	12 815	1.8	4 710	7 946	1 069	123	946
Vitamin A deficiency	22 099	1.5	11 499	1.4	10 600	1.5	9 323	8 548	343	0	343
Zinc deficiency	15 580	1.0	8 120	1.0	7 460	1.0	8 964	3 928	319	1	317
Suboptimal breastfeeding	43 842	2.9	22 721	2.9	21 121	2.9	16 692	12 809	2 472	187	2 285
Other nutrition-related risk factors and physical activity											
High blood pressure	57 227	3.8	30 823	3.9	26 404	3.6	5 010	13 447	5 476	2 229	3 247
High cholesterol	29 723	2.0	17 576	2.2	12 147	1.7	1 071	9 856	3 595	1 593	2 002
High blood glucose	41 305	2.7	21 468	2.7	19 837	2.7	2 906	13 326	6 166	2 374	3 792
Overweight and obesity	35 796	2.3	17 747	2.2	18 049	2.5	2 259	5 133	7 880	3 631	4 249
Low fruit and vegetable intake	15 974	1.0	9 171	1.2	6 803	0.9	1 031	4 865	1 705	674	1 031
Physical inactivity	32 099	2.1	16 795	2.1	15 304	2.1	2 289	9 010	4 349	1 913	2 435
Addictive substances											
Tobacco use	56 897	3.7	43 291	5.4	13 606	1.9	1 930	12 764	8 837	5 681	3 157
Alcohol use	69 424	4.6	59 283	7.4	10 141	1.4	7 759	12 066	13 102	3 402	9 700
Illicit drug use	13 223	0.9	10 178	1.3	3 045	0.4	1 131	2 585	3 110	1 433	1 677
Sexual and reproductive health											
Unsafe sex	70 017	4.6	30 064	3.8	39 954	5.5	50 771	10 559	3 146	536	2 610
Unmet contraceptive need[c]	11 501	0.8	0	0.0	11 501	1.6	3 645	4 934	773	6	766
Environmental risks											
Unsafe water, sanitation, hygiene	64 240	4.2	33 459	4.2	30 781	4.2	28 700	20 176	2 219	69	2 150
Urban outdoor air pollution	8 747	0.6	4 981	0.6	3 766	0.5	881	1 911	884	393	492
Indoor smoke from solid fuels	41 009	2.7	20 614	2.6	20 395	2.8	18 057	12 492	735	5	730
Lead exposure	8 977	0.6	4 891	0.6	4 087	0.6	1 050	4 044	580	20	560
Global climate change	5 404	0.4	2 800	0.4	2 604	0.4	2 029	2 320	81	2	80
Occupational risks											
Risk factors for injuries	11 612	0.8	10 810	1.4	802	0.1	1 385	4 029	772	95	677
Carcinogens	1 897	0.1	1 419	0.2	479	0.1	87	391	181	81	100
Airborne particulates	6 751	0.4	5 272	0.7	1 479	0.2	553	1 820	590	251	339
Ergonomic stressors	898	0.1	530	0.1	368	0.1	102	261	87	28	59
Noise	4 509	0.3	3 069	0.4	1 441	0.2	381	1 574	314	123	191
Other selected risks											
Unsafe health-care injections	6 960	0.5	4 506	0.6	2 453	0.3	827	2 308	40	0	39
Child sexual abuse	9 018	0.6	3 433	0.4	5 585	0.8	603	4 048	753	401	352

DALY, disability-adjusted life year.

[a] See Table A5 for a list of Member States by WHO region and income category.

[b] The table shows estimated DALYs attributable to each risk factor considered individually, relative to its own counterfactual risk exposure distribution. These risks may act in part through, or jointly, with other risks. Total DALYs attributable to groups of risk factors will thus usually be less than the sum of the DALYs attributable to individual risks.

[c] Unmet contraceptive need refers to "non-use and use of ineffective methods of contraception" among those wanting to control their fertility to avoid conception or space the birth of children.

Risk factor[b]	Eastern Mediterranean			Europe			Western Pacific		
	Total	High income	Low and middle income	Total	High income	Low and middle income	Total	High income	Low and middle income
Population (millions)	520	31	489	883	407	476	1 738	204	1 534
	(000)	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*	*(000)*
Total DALYs (all causes)	**141 993**	**4 379**	**137 614**	**151 461**	**49 331**	**102 130**	**264 772**	**22 305**	**242 466**
Childhood and maternal undernutrition									
Underweight	11 882	65	11 816	1 148	19	1 129	3 358	32	3 326
Iron deficiency	1 689	49	1 640	948	251	696	3 373	210	3 162
Vitamin A deficiency	2 915	17	2 898	318	1	317	653	4	649
Zinc deficiency	1 638	12	1 626	174	1	174	557	2	555
Suboptimal breastfeeding	7 299	89	7 210	1 263	98	1 164	3 307	36	3 270
Other nutrition-related risk factors and physical activity									
High blood pressure	4 317	188	4 129	17 121	3 807	13 314	11 856	1 273	10 583
High cholesterol	2 297	105	2 192	8 975	1 859	7 116	3 930	570	3 360
High blood glucose	3 880	258	3 623	7 304	2 308	4 996	7 722	1 077	6 645
Overweight and obesity	3 231	321	2 910	11 758	3 132	8 625	5 536	839	4 698
Low fruit and vegetable intake	908	38	870	3 624	547	3 077	3 841	299	3 542
Physical inactivity	2 612	144	2 468	8 264	2 189	6 075	5 575	806	4 768
Addictive substances									
Tobacco use	2 793	31	2 762	17 725	5 526	12 199	12 848	1 871	10 976
Alcohol use	763	53	710	17 342	3 165	14 177	18 393	1 541	16 851
Illicit drug use	2 117	22	2 095	2 395	937	1 458	1 886	155	1 731
Sexual and reproductive health									
Unsafe sex	2 166	36	2 131	1 543	384	1 159	1 832	125	1 707
Unmet contraceptive need[c]	1 671	33	1 638	131	4	127	348	4	344
Environmental risks									
Unsafe water, sanitation, hygiene	7 364	85	7 280	1 182	69	1 113	4 599	86	4 513
Urban outdoor air pollution	971	37	933	1 456	369	1 087	2 644	231	2 414
Indoor smoke from solid fuels	4 239	0	4 239	485	4	482	5 001	2	4 999
Lead exposure	1 638	91	1 547	134	7	126	1 531	11	1 521
Global climate change	756	11	745	26	1	25	192	3	190
Occupational risks									
Risk factors for injuries	1 686	63	1 623	823	114	709	2 918	115	2 803
Carcinogens	84	4	80	408	116	291	747	75	671
Airborne particulates	357	12	345	676	284	392	2 755	163	2 592
Ergonomic stressors	61	3	58	99	32	67	289	23	266
Noise	346	22	324	538	161	376	1 356	86	1 270
Other selected risks									
Unsafe health-care injections	938	0	938	261	0	261	2 586	126	2 460
Child sexual abuse	512	22	490	798	213	585	2 303	197	2 106

Table A5: Countries grouped by WHO region and income per capita[a] in 2004

WHO region	Income category	WHO Member States
African Region	Low and middle	Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, South Africa, Swaziland, Togo, Uganda, United Republic of Tanzania, Zambia, Zimbabwe
Region of the Americas	High	Bahamas, Canada, United States of America
	Low and middle	Antigua and Barbuda, Argentina, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, Uruguay, Venezuela (Bolivarian Republic of)
Eastern Mediterranean Region	High	Bahrain, Kuwait, Qatar, Saudi Arabia, United Arab Emirates
	Low and middle	Afghanistan, Djibouti, Egypt, Iran (Islamic Republic of), Iraq, Jordan, Lebanon, Libyan Arab Jamahiriya, Morocco, Oman, Pakistan, Somalia, Sudan, Syrian Arab Republic, Tunisia, Yemen
European Region	High	Andorra, Austria, Belgium, Cyprus, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Luxembourg, Malta, Monaco, Netherlands, Norway, Portugal, San Marino, Slovenia, Spain, Sweden, Switzerland, United Kingdom
	Low and middle	Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Poland, Moldova, Romania, Russian Federation, Serbia and Montenegro, Slovakia, Tajikistan, The former Yugoslav Republic of Macedonia, Turkey, Turkmenistan, Uzbekistan, Ukraine
South-East Asia Region	Low and middle	Bangladesh, Bhutan, Democratic People's Republic of Korea, India, Indonesia, Maldives, Myanmar, Nepal, Sri Lanka, Thailand, Timor-Leste
Western Pacific Region	High	Australia, Brunei Darussalam, Japan, New Zealand, Republic of Korea, Singapore
	Low and middle	Cambodia, China, Cook Islands, Fiji, Kiribati, Lao People's Democratic Republic, Malaysia, Marshall Islands, Micronesia (Federated States of), Mongolia, Nauru, Niue, Palau, Papua New Guinea, Philippines, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu, Viet Nam
Non-Member States or territories		American Samoa, Anguilla, Aruba, Bermuda, British Virgin Islands, Cayman Islands, Channel Islands, Faeroe Islands, Falkland Islands (Malvinas), French Guiana, French Polynesia, Gibraltar, Greenland, Guadeloupe, Guam, Holy See, Isle of Man, Liechtenstein, Martinique, Montserrat, Netherlands Antilles, New Caledonia, Northern Mariana Islands, West Bank and Gaza Strip, Pitcairn, Puerto Rico, Réunion, Saint Helena, Saint Pierre et Miquelon, Tokelau, Turks and Caicos Islands, United States Virgin Islands, Wallis and Futuna Islands, Western Sahara

[a] WHO Member States are classified as low and middle income if their 2004 gross national income per capita is less than US$ 10 066, and as high income if their 2004 gross national income per capita is US$ 10 066 or more, as estimated by the World Bank *(102)*.