

# Chapter 1

## Burden: mortality, morbidity and risk factors

This chapter reviews the current burden and trends of NCDs and the risk factors. It also provides the latest estimates on the number, rates and causes of global deaths from NCDs and the prevalence of the most important related risk factors. A description of the methods used to produce these estimates is provided in Annex 1. Data are presented in two ways: according to the six WHO geographical regions<sup>1</sup> and by the four World Bank income groups.<sup>2</sup> A listing of countries according to the WHO regions and World Bank income groups in 2008 is in Annex 2. Maps showing the global distribution of NCD-related mortality and selected risk factors are presented in Annex 3, along with the individual country estimates for NCD mortality and selected risk factors presented in Annex 4.

### Mortality

A total of 57 million deaths occurred in the world during 2008; 36 million (63%) were due to NCDs, principally cardiovascular diseases, diabetes, cancer and chronic respiratory diseases (1). Nearly 80% of these NCD deaths (29 million) occurred in low- and middle-income countries. NCDs are the most frequent causes of death in most countries in the Americas, the Eastern Mediterranean, Europe, South-East Asia, and the Western Pacific. In the African Region, there are still more deaths from infectious diseases than NCDs. Even there, however, the prevalence of NCDs is rising rapidly and is projected to cause almost three-quarters as many deaths as communicable, maternal, perinatal, and nutritional diseases by 2020, and to exceed them as the most common causes of death by 2030 (2).

WHO projections show that NCDs will be responsible for a significantly increased total number of deaths in the next decade. NCD deaths are projected to increase by 15% globally between 2010 and 2020 (to 44 million deaths). The greatest increases will be in the WHO regions of Africa, South-East Asia and the Eastern Mediterranean, where they will increase by over 20%. In contrast, in the European Region, WHO estimates there will be no increase. In the African Region, NCDs will cause around 3.9 million deaths by 2020. The regions that are projected to have the greatest total number of NCD deaths in 2020 are South-East Asia (10.4 million deaths) and the Western Pacific (12.3 million deaths) (2).

With the exception of the African Region, NCD mortality exceeds that of communicable, maternal, perinatal and nutritional conditions combined. For men in the European Region, deaths from NCDs are estimated to be 13 times higher than these other causes combined, and for men in the Western Pacific Region they are estimated to be eight times higher (Figure 1).

In 2008, the overall NCD age-standardized death rates in low- and middle-income countries were 756 per 100 000 for males and 565 per 100 000 for females – respectively 65% and 85% higher than for men and women in high-income countries. Age-standardized NCD mortality rates for all ages were highest in the African Region for males (844 per 100 000) and for females (724 per 100 000).

The leading causes of NCD deaths in 2008 were: cardiovascular diseases (17 million deaths, or 48% of NCD deaths); cancers (7.6 million, or 21% of NCD deaths); and respiratory diseases, including asthma and chronic obstructive pulmonary disease (COPD), (4.2 million). Diabetes caused an additional 1.3 million deaths.

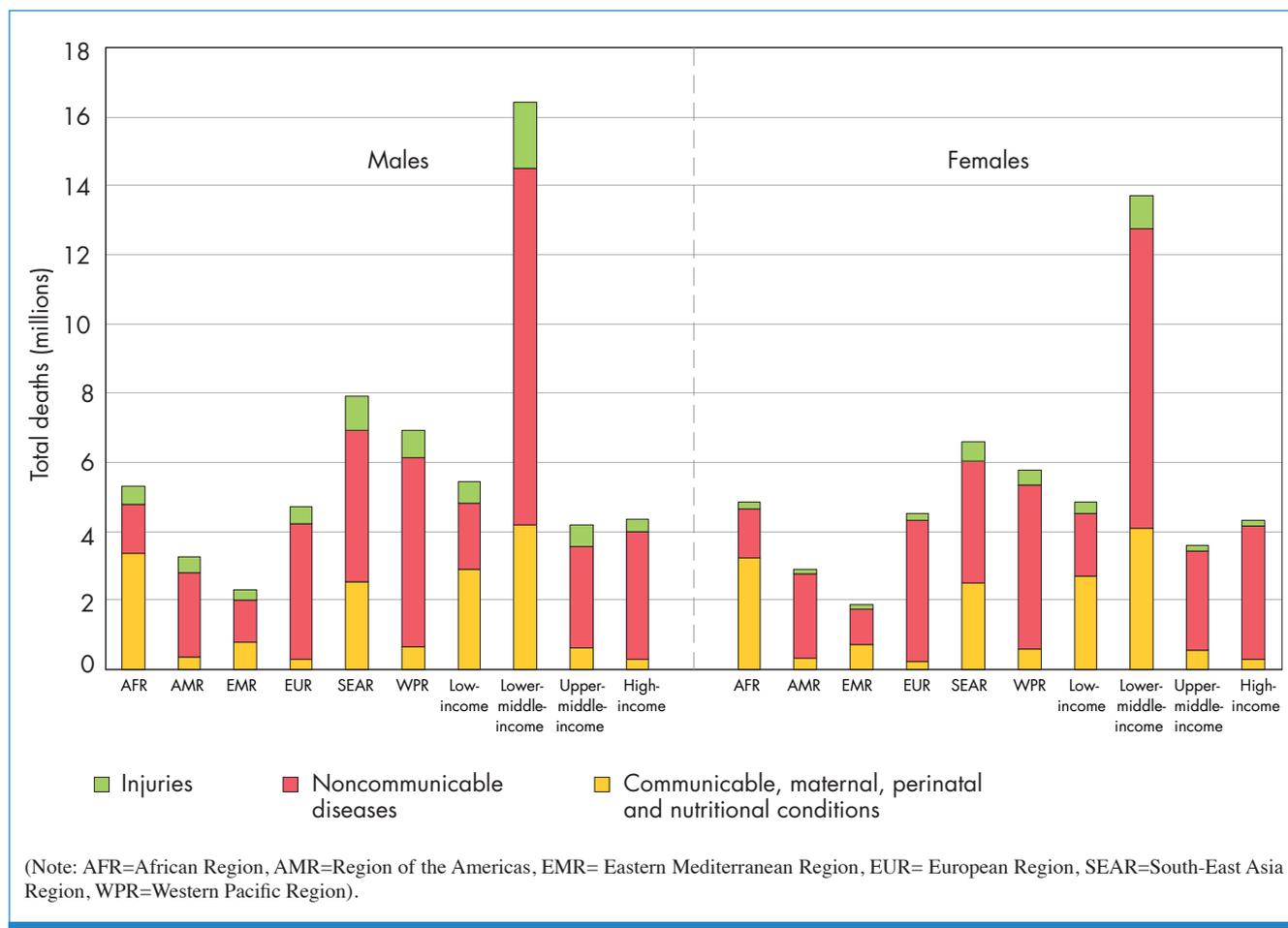
Over 80% of cardiovascular and diabetes deaths, and almost 90% of deaths from COPD, occurred in low- and middle-income countries. Behavioural risk factors, including tobacco use, physical inactivity, and unhealthy diet, are responsible for about 80% of coronary heart disease and

NCD deaths are projected to increase by 15% globally between 2010 and 2020. The greatest increases will be in Africa, the Eastern Mediterranean, and South-East Asia, where they will increase by over 20%

<sup>1</sup> The six WHO regions are the African Region, the Region of the Americas, the South-East Asia Region, the European Region, the Eastern Mediterranean Region and the Western Pacific Region.

<sup>2</sup> The World Bank income groups categorize nations according to average gross national income (GNI) per capita into low-income, lower-middle-income, upper-middle-income and high-income countries. Income groups for the year 2008 were used in this report.

Figure 1. Total deaths by broad cause group, by WHO Region, World Bank income group and by sex, 2008



cerebrovascular disease (3). These important behavioural risk factors of heart disease and stroke are discussed in detail later in this chapter.

More than two thirds of all cancer deaths occur in low- and middle-income countries. Lung, breast, colorectal, stomach and liver cancers cause the majority of cancer deaths. In high-income countries, the leading causes of cancer deaths are lung cancer among men and breast cancer among women. In low- and middle-income countries cancer levels vary according to the prevailing underlying risks. In sub-Saharan Africa, for example, cervical cancer is the leading cause of cancer death among women. Risk factors for cancer include the four shared behavioural factors (tobacco use, unhealthy diet, insufficient physical activity and the harmful use of alcohol), but infections such as hepatitis B, hepatitis C (liver cancer), human papillomavirus (HPV; cervical cancer) and *Helicobacter pylori* (stomach cancer) also cause up to 18% of cancer burden (4). In addition, cancers are also caused by radiation and a variety of environmental and occupational exposures of varying importance, depending on the specific geographical region and cancer site.

Premature death is a major consideration when evaluating the impact of NCDs on a given population, with approximately 44% of all NCD deaths occurring before the age of 70. In low- and middle-income countries, a higher proportion (48%) of all NCD deaths are estimated to occur in people under the age of 70, compared with high-income countries (26%). The difference is even more marked for NCD deaths in younger age ranges: in low- and middle-income countries, 29% of NCD deaths occur among people under the age of 60, compared to 13% in high-income countries.

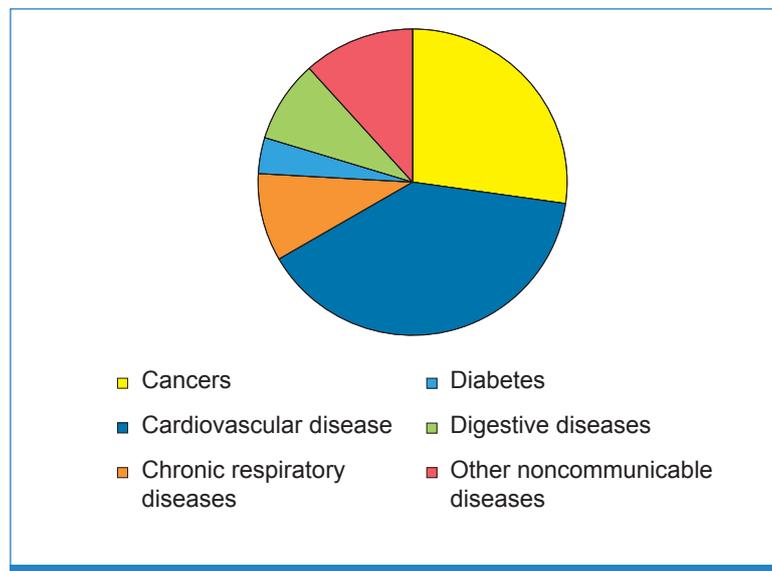
Figure 2 shows the proportion of NCD deaths (in 2008) among people under the age of 70, by cause. Cardiovascular diseases were responsible for the largest proportion of NCD deaths under the age of 70 (39%), followed by cancers (27%). Chronic respiratory diseases, digestive diseases

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and other NCDs were together responsible for approximately 30% of deaths, and diabetes was responsible for 4% (2).

Population growth and improved longevity are leading to increasing numbers and proportions of older people, with population ageing emerging as a significant trend in many parts of the world. As populations age, annual NCD deaths are projected to rise substantially, to 52 million in 2030. Whereas annual infectious disease deaths are projected to decline by around 7 million over the next 20 years, annual cardiovascular disease mortality is projected to increase by 6 million, and annual cancer deaths by 4 million. In low- and middle-income countries, NCDs will be responsible for three times as many disability-adjusted life years (DALYs)<sup>3</sup> and nearly five times as many deaths as communicable diseases, maternal, perinatal and nutritional conditions combined, by 2030 (2).

**Figure 2. Proportion of global NCD deaths under the age of 70, by cause of death, 2008**



## Morbidity

In addition to information about NCD-related deaths, morbidity data are important for the management of health-care systems and for planning and evaluation of health service delivery. However, reliable data on NCD morbidity are unavailable in many countries. The most comprehensive morbidity data available relate to cancer and are available from population- or hospital-based cancer registries. Such data are important since information on the incidence and types of cancer is required for planning cancer control programmes. Only population-based cancer registries can provide an unbiased description of the cancer profile in a given population. Although disease registries for diabetes, hypertension (raised blood pressure) and renal insufficiency exist in some countries, these are generally only available for well-resourced settings, rather than entire populations. Data on the prevalence of diabetes and raised blood glucose are available from population-based surveys. Raised blood pressure is discussed as a risk factor in the following section.

## Cancer

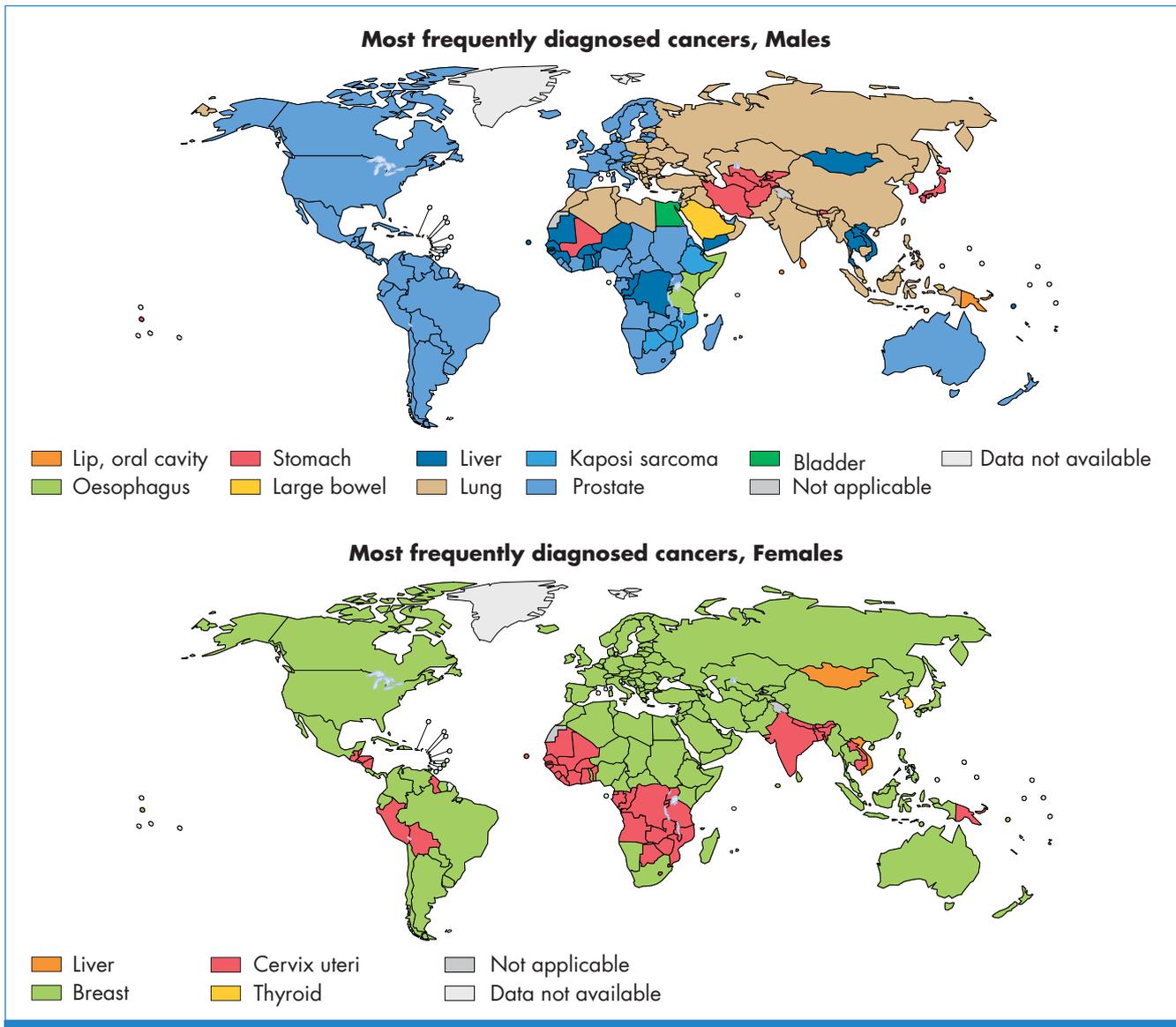
Cancer is predicted to be an increasingly important cause of morbidity and mortality in the next few decades, in all regions of the world. The challenges of tackling cancer are enormous and – when combined with population ageing – increases in cancer prevalence are inevitable, regardless of current or future actions or levels of investment. The forecasted changes in population demographics in the next two decades mean that even if current global cancer rates remain unchanged, the estimated incidence of 12.7 million new cancer cases in 2008 (5) will rise to 21.4 million by 2030, with nearly two thirds of all cancer diagnoses occurring in low- and middle-income countries (6).

Large variations in both cancer frequency and case fatality are observed, even in relation to the major forms of cancer, in different regions of the world. Figure 3 presents the most frequent types of cancer diagnosis (based on age-standardized rates) in each country, for men and women.

The geographical variation in cancer distribution and patterns is mirrored on examination of cancer morbidity and mortality data in relation to the World Bank income groups of countries (Figure 4). Within upper-middle-income and high-income countries, prostate and breast cancers are the

<sup>3</sup> The disability-adjusted life year (DALY) is a measure of overall disease burden, expressed as the number of potential productive years lost due to premature ill-health, disability or early death.

Figure 3. Most frequently diagnosed cancers worldwide, by country and sex, 2008

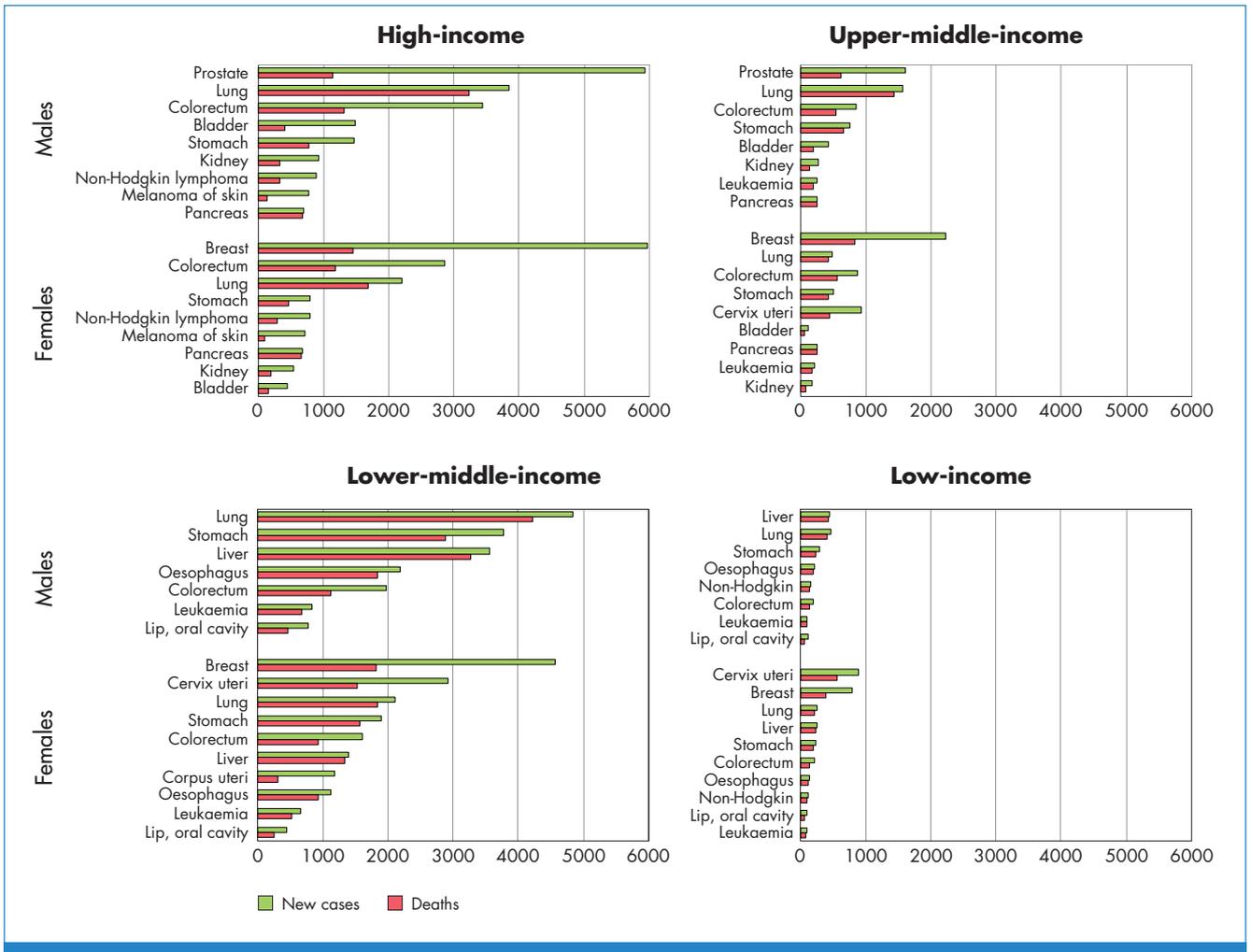


most commonly diagnosed in males and females respectively, with lung and colorectal cancers representing the next most common types in both sexes. These cancers also represent the most frequent types of cancer-related deaths in these countries although lung cancer is the most common cause of cancer death in both sexes. Within low-income countries, the absolute burden of cancer is much lower, and while lung and breast cancers remain among the most common diagnoses and types of cancer-related deaths, cancers of the cervix, stomach and liver are also among the leading types – all of which are cancers with infection-related etiology.

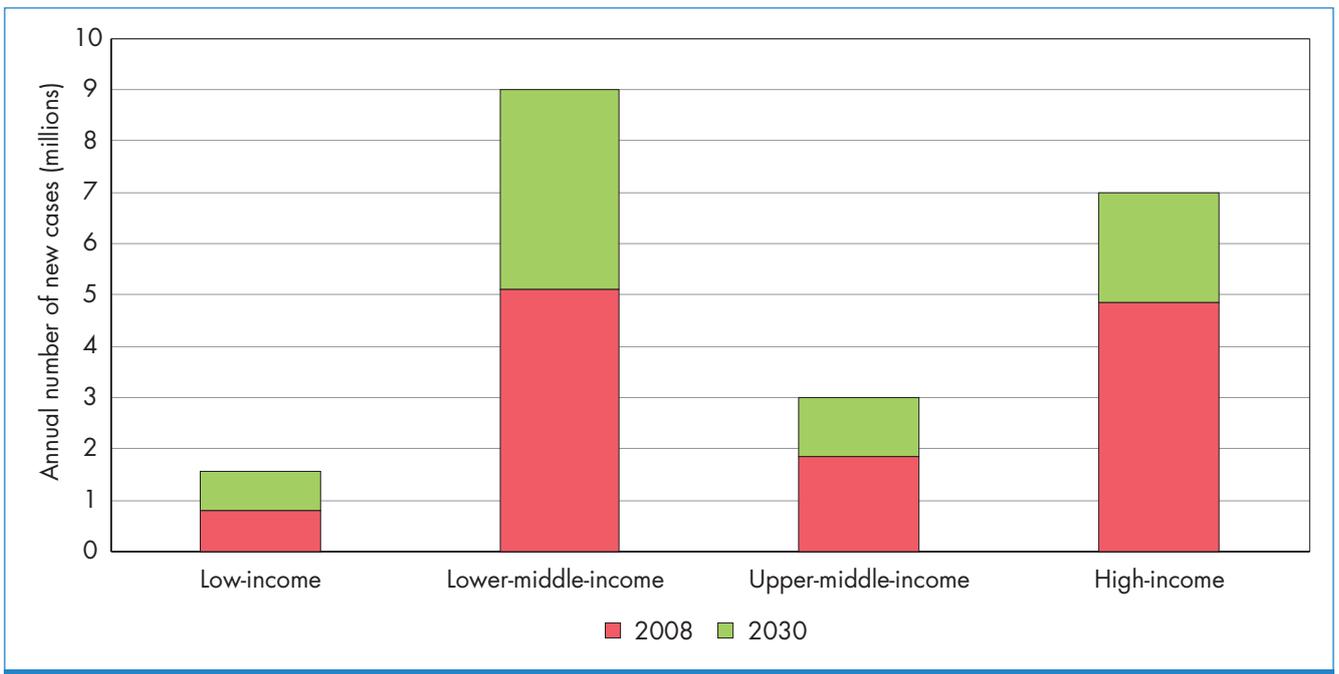
Middle-income countries are intermediate with respect to their patterns of cancer burden. Within the lower-middle-income countries, the three most common types of cancer are lung, stomach and liver cancers in males, and breast, cervix and lung cancer in females, i.e. a similar pattern to the low-income countries (although liver, colorectal and oesophageal cancers are also of importance). The lower-middle-income group contains some of the most populous countries in the world, including China and India, hence the absolute numbers of cancers and cancer-related deaths are notably high in this group.

Future planning of service provision is an integral part of cancer control programmes. Considering the projected growth in cancer morbidity, important differences can be observed in relation to World Bank income groups. The estimated percentage increase in cancer incidence by 2030 (compared with 2008) will be greater in low- (82%) and lower-middle-income countries (70%) compared with the upper-middle- (58%) and high-income countries (40%). Without any changes in underlying risk

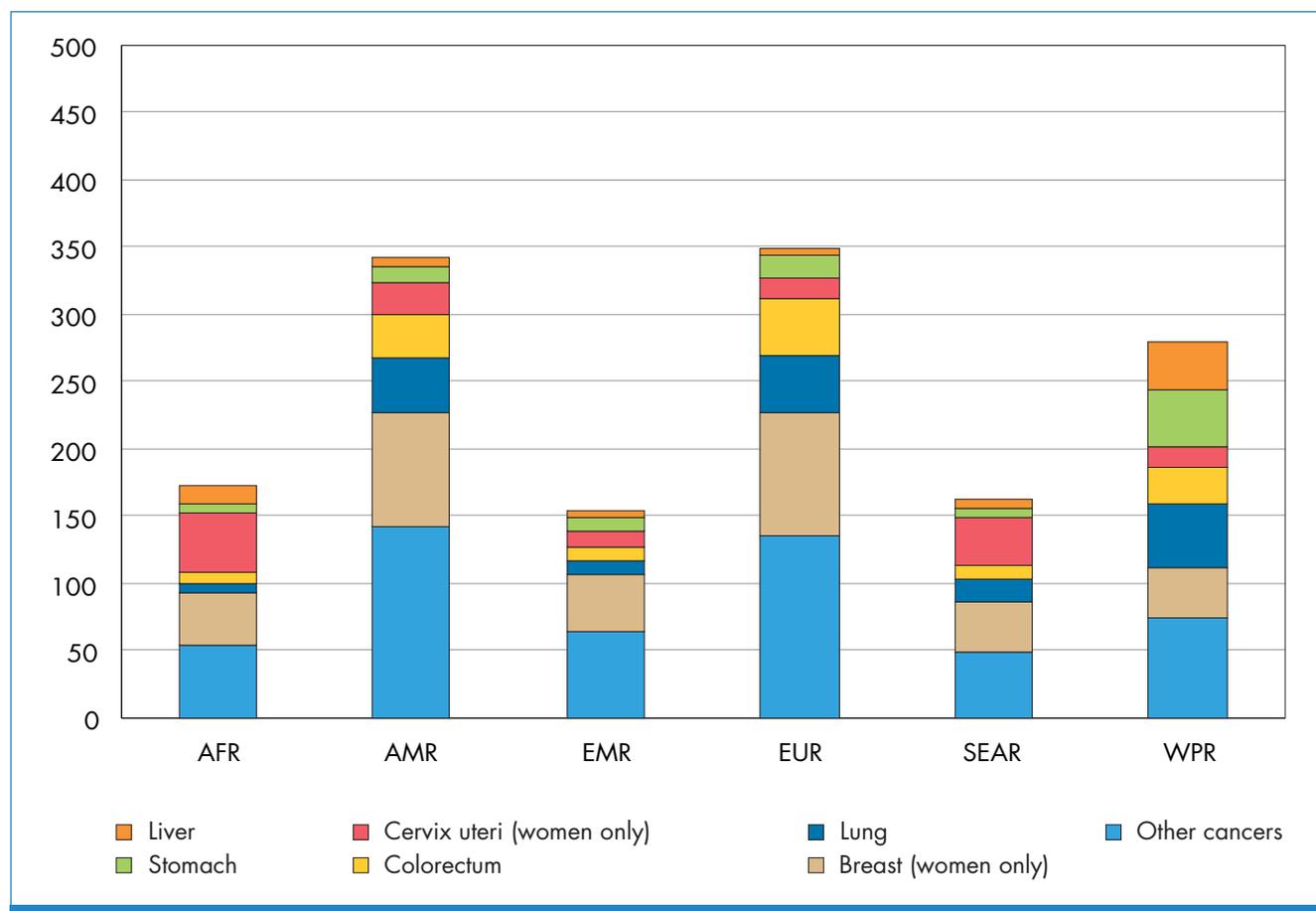
**Figure 4. Estimated annual number of new cases and deaths for the 10 most common cancers, by World Bank income groups and by sex, 2008**



**Figure 5. Estimated annual number of new cancer cases 2008 and predicted 2030, by World Bank income groups**



**Figure 6. Age-standardized incidence of all cancers (excluding non-melanoma skin cancer), by type, per 100 000 population for both sexes, by WHO Region, 2008**



factors (i.e. based only on anticipated demographic changes), between 10 and 11 million cancers will be diagnosed annually in 2030 in the low- and lower-middle-income countries (Figure 5).

The WHO Regions of Europe and the Americas had the highest incidence of all types of cancer combined for both sexes (Figure 6). Countries in the Eastern Mediterranean Region had the lowest incidence rates. Except in the African and South-East Asia Regions, men have higher overall rates for all types of cancer than women.

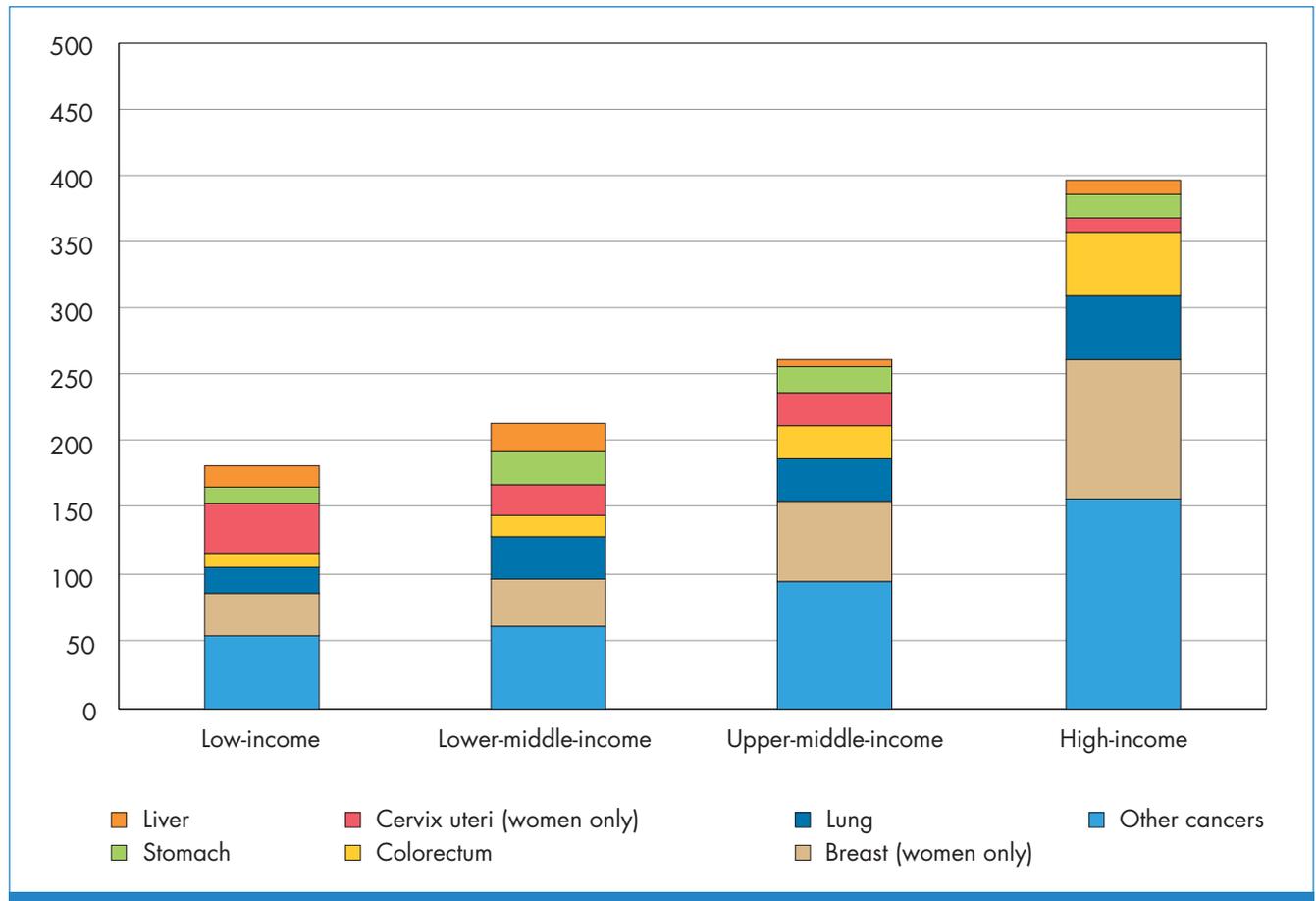
Lung cancer rates among both sexes (combined) were highest in the Western Pacific Region, followed by Europe and the Americas. They were lowest in the African Region.

Women in the African Region had the highest incidence of cancer of the cervix uteri, followed by those in the South-East Asia Region. Women in the Eastern Mediterranean Region had the lowest cervical cancer incidence. For breast cancer, women in the European Region had the highest rates followed by the Region of the Americas. These latter rates were more than double those of the other WHO regions.

Men in the Region of the Americas had the highest rates of prostate cancer, followed by the European Region. The lowest rate of prostate cancer was in the South-East Asia Region.

Among the WHO regions, the countries in the Western Pacific Region had by far the highest incidence of stomach cancer and liver cancer. The lowest incidence of stomach cancer was in the African Region. Men in the Western Pacific Region had five times the rate of liver cancer of men in all other regions, except for the African Region (where it remained more than double the rate). Women in the Western Pacific Region also had a considerably higher liver cancer incidence rate than women in other regions.

**Figure 7. Age-standardized incidence rates of all cancer (excluding non-melanoma skin cancer), by type of cancer, per 100 000 population for both sexes, by World Bank income groups, 2008**



The European Region had the highest incidence of colorectal cancer followed by the Region of the Americas, while the African Region had the lowest reported incidence.

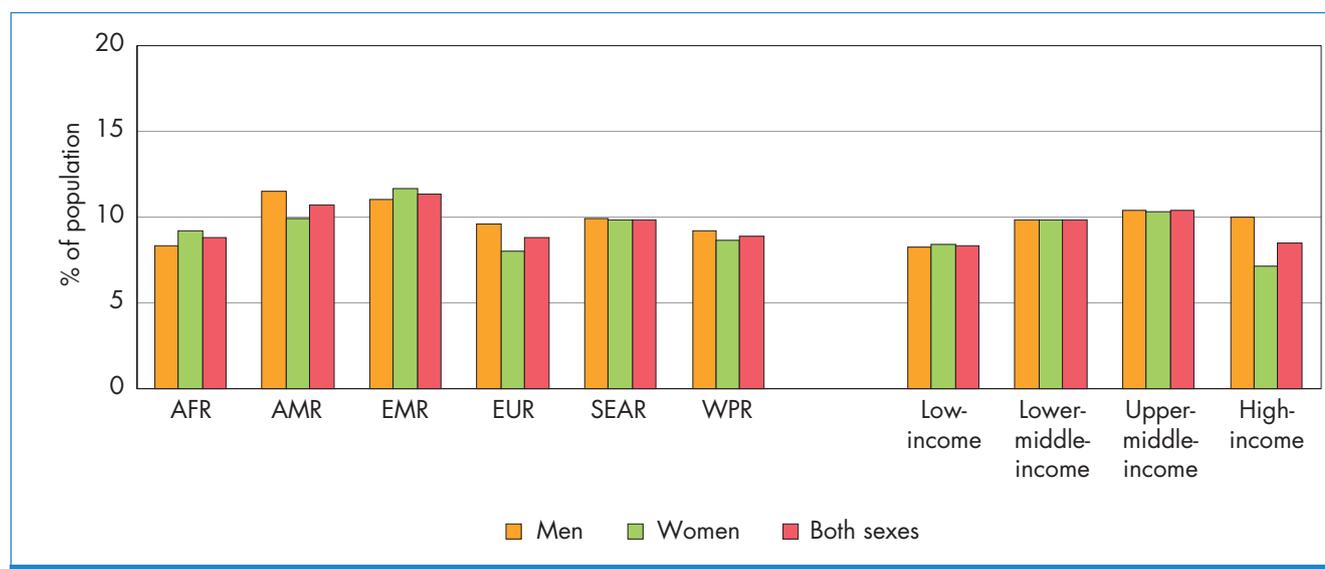
According to the World Bank income groups, the cancer rates for all cancers combined (excluding non-melanoma skin cancers) rose with increasing levels of country income (Figure 7). High-income countries had more than double the rate of all cancers combined of low-income countries. In all countries, other than those in the low-income category, men have considerably higher combined rates of all types of cancer than women. The exception of low-income countries is most likely explained by the high rates of cervical cancer among women in the African Region.

High-income countries had more than double the lung cancer incidence of low-income countries. High-income countries had approximately 10 times the rate of prostate cancer than lower-middle-income countries. For breast cancer, incidence rates rose rapidly in accordance with level of country income, with high-income countries demonstrating more than three times the rate of low-income countries. Similarly, colorectal cancer incidence also rose in parallel with the level of country income. Conversely, high-income countries had considerably lower cervical cancer incidence rates than low- and middle-income countries. Finally, low- and lower-middle income countries also had the highest rates of liver cancer.

## Diabetes

Impaired glucose tolerance and impaired fasting glycaemia are risk categories for future development of diabetes and cardiovascular disease (7). In some age groups, people with diabetes have a two-fold increase in the risk of stroke (8). Diabetes is the leading cause of renal failure in many populations in both developed and developing countries. Lower limb amputations are at least 10 times more common in people with diabetes than in non-diabetic individuals in developed countries; more than

**Figure 8. Age-standardized prevalence of diabetes in adults aged 25+ years, by WHO Region and World Bank income group, comparable estimates, 2008**



half of all non-traumatic lower limb amputations are due to diabetes (9). Diabetes is one of the leading causes of visual impairment and blindness in developed countries (10). People with diabetes require at least two to three times the health-care resources compared to people who do not have diabetes, and diabetes care may account for up to 15% of national health care budgets (11). In addition, the risk of tuberculosis is three times higher among people with diabetes (12).

The apparent prevalence of hyperglycaemia depends on the diagnostic criteria used in epidemiological surveys.<sup>4</sup> The global prevalence of diabetes in 2008 was estimated to be 10% in adults aged 25+ years. The prevalence of diabetes was highest in the Eastern Mediterranean Region and the Region of the Americas (11% for both sexes) and lowest in the WHO European and Western Pacific Regions (9% for both sexes) (Figure 8). The magnitude of diabetes and other abnormalities of glucose tolerance are considerably higher than the above estimates if the categories of ‘impaired fasting’ and ‘impaired glucose tolerance’ are also included.

The estimated prevalence of diabetes was relatively consistent across the income groupings of countries. Low-income countries showed the lowest prevalence (8% for both sexes), and the upper-middle-income countries showed the highest (10% for both sexes).

## Risk factors

As mentioned previously, common, preventable risk factors underlie most NCDs. Most NCDs are strongly associated and causally linked with four particular behaviours: tobacco use, physical inactivity, unhealthy diet and the harmful use of alcohol. These behaviours lead to four key metabolic/physiological changes: raised blood pressure, overweight/obesity, hyperglycaemia and hyperlipidemia. In terms of attributable deaths, the leading NCD risk factor globally is raised blood pressure (to which 13% of global deaths are attributed), followed by tobacco use (9%), raised blood glucose (6%), physical inactivity (6%), and overweight and obesity (5%) (13).

This chapter discusses these two groupings of behavioural risk factors and consequent metabolic/physiological risk factors, in the order of their relative contribution to total global deaths. At the end of this section, additional modifiable risk factors with potentially substantial impact on the cancer burden are described.

<sup>4</sup> Diabetes is defined as having a fasting plasma glucose value  $\geq 7.0$  mmol/L (126 mg/dl) or being on medication for raised blood glucose.

Most NCDs are strongly associated and causally linked with four behaviours: tobacco use, physical inactivity, unhealthy diet and the harmful use of alcohol

## Modifiable behavioural risk factors

### Tobacco

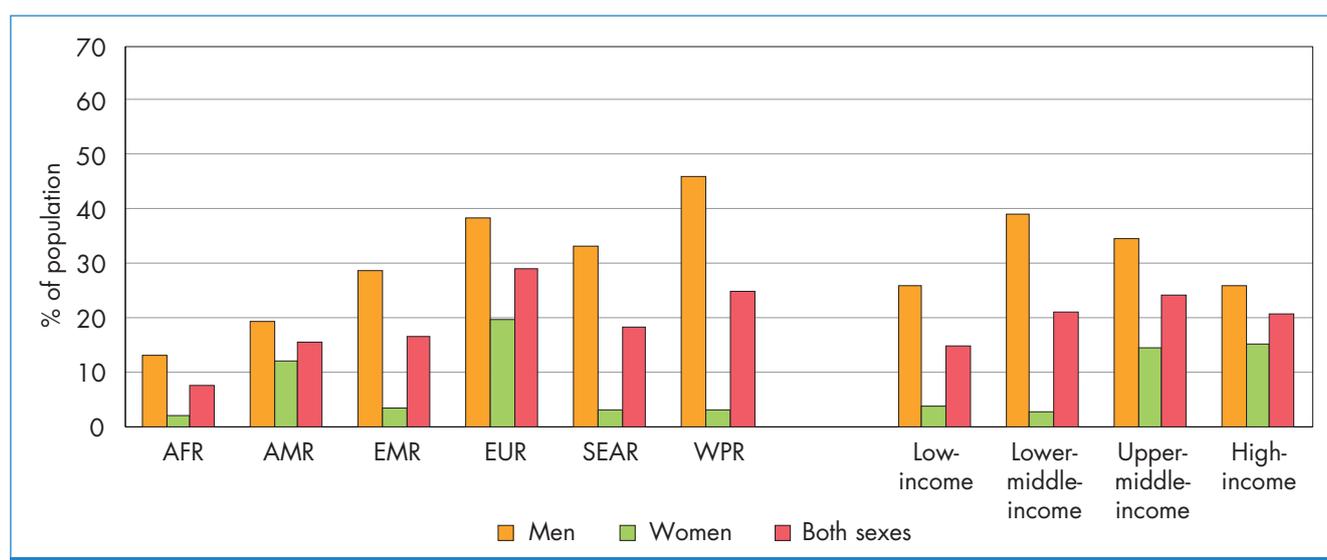
Tobacco use and exposure comes in both smokeless and smoking forms. Smokeless tobacco is consumed in un-burnt forms through chewing or sniffing and contains several carcinogenic, or cancer-causing, compounds. Smokeless tobacco has been associated with oral cancer, hypertension, heart disease and other conditions. Smoking tobacco, by far the most commonly used form globally, contains over 4000 chemicals, of which 50 are known to be carcinogenic.

There are currently about 1 billion smokers in the world. Manufactured cigarettes represent the major form of smoked tobacco. Current smokers are estimated to consume about 6 trillion cigarettes annually (14). In addition to cigarettes, other forms of tobacco are also consumed, particularly in Asia, Africa and the Middle East and to a lesser extent in Europe and the Americas. Data on these additional forms of smoked tobacco are not readily available, but are nonetheless substantial. In India alone, about 700 billion ‘bidis’ (a type of filter-less hand-rolled cigarette) are consumed annually.

Risks to health from tobacco use result not only from direct consumption of tobacco but also from exposure to second-hand smoke (15). Almost 6 million people die from tobacco use and exposure each year, accounting for 6% of all female and 12% of all male deaths in the world (13). Of these deaths, just over 600 000 are attributable to second-hand smoke exposure among non-smokers (16) and more than 5 million to direct tobacco use (both smoking and smokeless) (13, 16). By 2020, annual tobacco-related deaths are projected to increase to 7.5 million (17), accounting for 10% of all deaths in that year. Smoking is estimated to cause about 71% of all lung cancer deaths, 42% of chronic respiratory disease and nearly 10% of cardiovascular disease. Smoking is also an important risk factor for communicable diseases such as tuberculosis and lower respiratory infections (18).

If no serious action is taken, annual tobacco-related deaths are projected to increase to 8 million by 2030, accounting for 10% of all deaths

**Figure 9. Age-standardized prevalence of daily tobacco smoking in adults aged 15+ years, by WHO Region and World Bank income group, comparable estimates, 2008**



The prevalence of daily tobacco smoking varied widely among the six WHO regions in 2008 (Figure 9). The highest overall prevalence for smoking is estimated at nearly 29% in the European Region, while the lowest is the African Region (8%). The highest prevalence of smoking among men was in the Western Pacific Region (46%) and among women in the European Region (20%). In all regions, men smoked more than women, with the largest disparities for daily cigarette smoking being in the Western Pacific Region, where men smoked 15 times more than women, followed by the South-East Asia Region where men smoked 10 times more than women. The smallest disparity between men and women was in the Region of the Americas, where men smoke about 1.5 times more than women.

Among men, the highest prevalence of smoking was in lower-middle-income countries. Smoking then declines as country income rises. Among women, relatively high rates (around 15%) are reported in upper-middle and high-income countries, and about five times lower (between 2% and 4%) in low- and lower-middle-income countries.

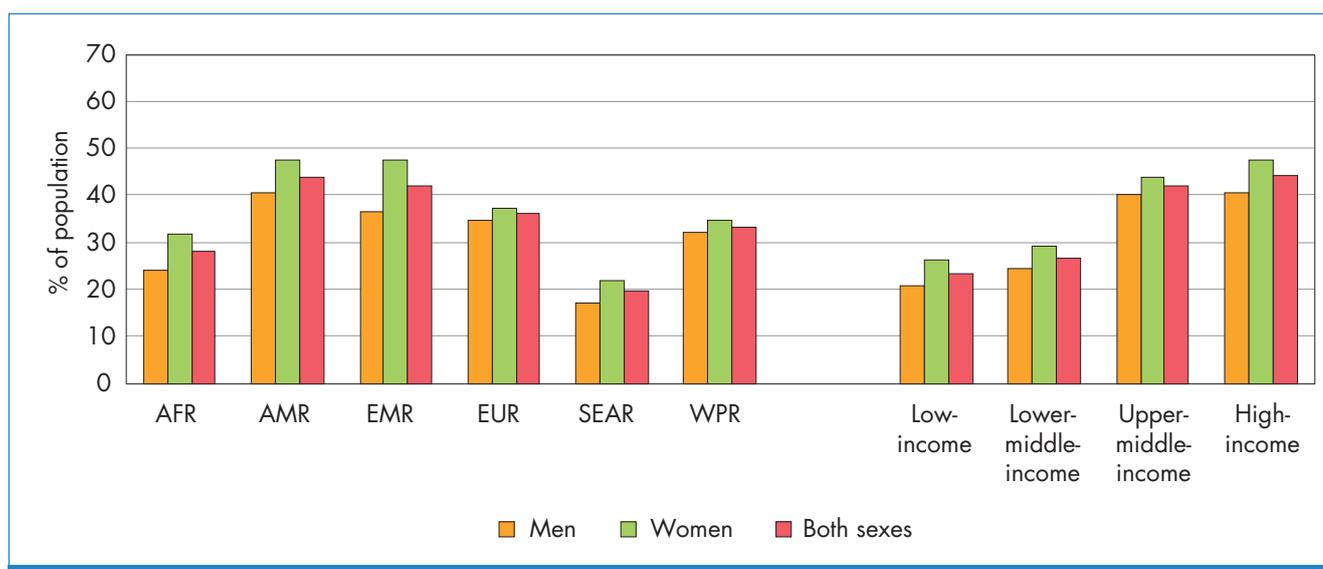
### Insufficient physical activity

Insufficient physical activity is the fourth leading risk factor for mortality (13). Approximately 3.2 million deaths and 32.1 million DALYs (representing about 2.1% of global DALYs) each year are attributable to insufficient physical activity (13).<sup>5</sup> People who are insufficiently physically active have a 20–30% increased risk of all-cause mortality compared to those who engage in at least 30 minutes of moderate intensity physical activity on most days of the week (19).

Participation in 150 minutes of moderate physical activity each week (or equivalent) is estimated to reduce the risk of ischaemic heart disease by approximately 30%, the risk of diabetes by 27%, and the risk of breast and colon cancer by 21–25% (13, 19). Additionally, physical activity lowers the risk of stroke, hypertension and depression. It is a key determinant of energy expenditure and thus fundamental to energy balance and weight control (19).

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**Figure 10. Age-standardized prevalence of insufficient physical activity in adults aged 15+ years, by WHO Region and World Bank income group, comparable estimates, 2008**



Globally, 31% of adults aged 15 years or older were insufficiently active (men 28% and women 34%) in 2008. Prevalence of insufficient physical activity was highest in the WHO Region of the Americas and the Eastern Mediterranean Region. In both of these regions, almost 50% of women were insufficiently active, while the prevalence for men was 40% in the Americas and 36% in Eastern Mediterranean. The South-East Asia Region showed the lowest percentages (15% for men and 19% for women).

In all WHO regions, men were more active than women, with the biggest difference in prevalence between the two sexes in the Eastern Mediterranean Region. This was also the case in nearly every individual country (Figure 10).

The prevalence of insufficient physical activity rose according to the level of country income. High-income countries had more than double the prevalence compared to low-income countries

<sup>5</sup> Insufficient physical activity is defined as less than five times 30 minutes of moderate activity per week, or less than three times 20 minutes of vigorous activity per week, or equivalent.

for both men and women, with 41% of men and 48% of women being insufficiently physically active in high-income countries as compared to 18% of men and 21% of women in low-income countries. Nearly every second woman in high-income countries was insufficiently physically active (Figure 10). These data may be explained by increased work and transport-related physical activity for both men and women in the low- and lower-middle-income countries. The increased automation of work and other aspects of life in higher-income countries is a likely determinant of insufficient physical activity.

## Harmful use of alcohol

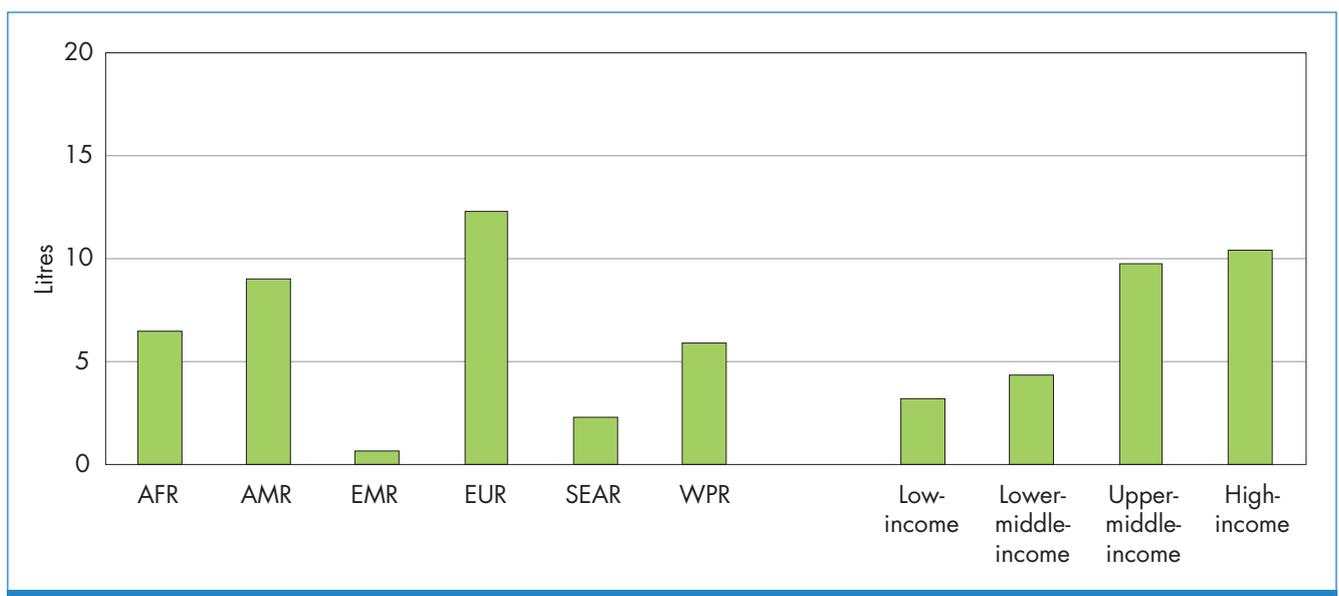
The harmful use of alcohol is a major risk factor for premature deaths and disabilities in the world (13). Hazardous and harmful drinking was responsible for 2.3 million deaths worldwide in 2004 (2). That amounts to 3.8% of all deaths in the world. More than half of these deaths occurred as a result of NCDs, including cancers, cardiovascular disease and liver cirrhosis. An estimated 4.5% of the global burden of disease – as measured in DALYs – is caused by harmful use of alcohol. Cancers, cardiovascular disease and liver cirrhosis are responsible for a quarter of this burden.

There is a direct relationship between higher levels of alcohol consumption and rising risk of some cancers, liver diseases and cardiovascular diseases. The relationship between alcohol consumption and ischaemic heart and cerebrovascular diseases is complex. It depends on both the amount and the pattern of alcohol consumption.

Some epidemiological data, generated mainly in high-income countries, suggest that low-risk patterns of alcohol consumption may have a beneficial effect on selected disease outcomes and in some segments of populations (20–23), but these effects tend to disappear if the patterns of drinking are characterized by heavy episodic drinking (24, 25).

Although alcohol consumption is deeply embedded in the cultures of many societies, an estimated 45% of the global adult population has never consumed alcoholic beverages in their lives. An estimated 55% of women never consumed alcohol (26).

**Figure 11. Total adult (15+ years of age) per capita consumption of pure alcohol (litres) for both sexes, by WHO Region and World Bank income group, projected estimates, 2008**



There is a high level of variation in alcohol consumption around the world (Figure 11). On average, global adult per capita consumption was estimated at 6.0 litres of pure alcohol in 2008. Adult per capita consumption was highest in the European Region (12.2 litres) and lowest in the Eastern Mediterranean Region (0.6 litres).

In general, abstention rates are lower and per capita consumption is higher in the countries with higher income. The adult per capita consumption in upper-middle- and high-income countries (around 10 litres) was more than double the level of low- and lower-middle-income countries (around 3 to 4 litres).

## Unhealthy diet

Aligning varying sources and types of data to generate overall estimations of unhealthy diet prevalence is not possible. For that reason, estimates of specific elements of unhealthy diets are presented separately in this section. The World Cancer Research Fund has estimated that 27–39% of the main cancers can be prevented by improving diet, physical activity and body composition (27).

Approximately 16 million (1.0%) DALYs and 1.7 million (2.8%) of deaths worldwide are attributable to low fruit and vegetable consumption (13, 28). Adequate consumption of fruit and vegetables reduces the risk for cardiovascular diseases, stomach cancer and colorectal cancer (29, 30). There is convincing evidence that the consumption of high levels of high-energy foods, such as processed foods that are high in fats and sugars, promotes obesity compared to low-energy foods such as fruits and vegetables (28).

The amount of dietary salt consumed is an important determinant of blood pressure levels and overall cardiovascular risk (31).

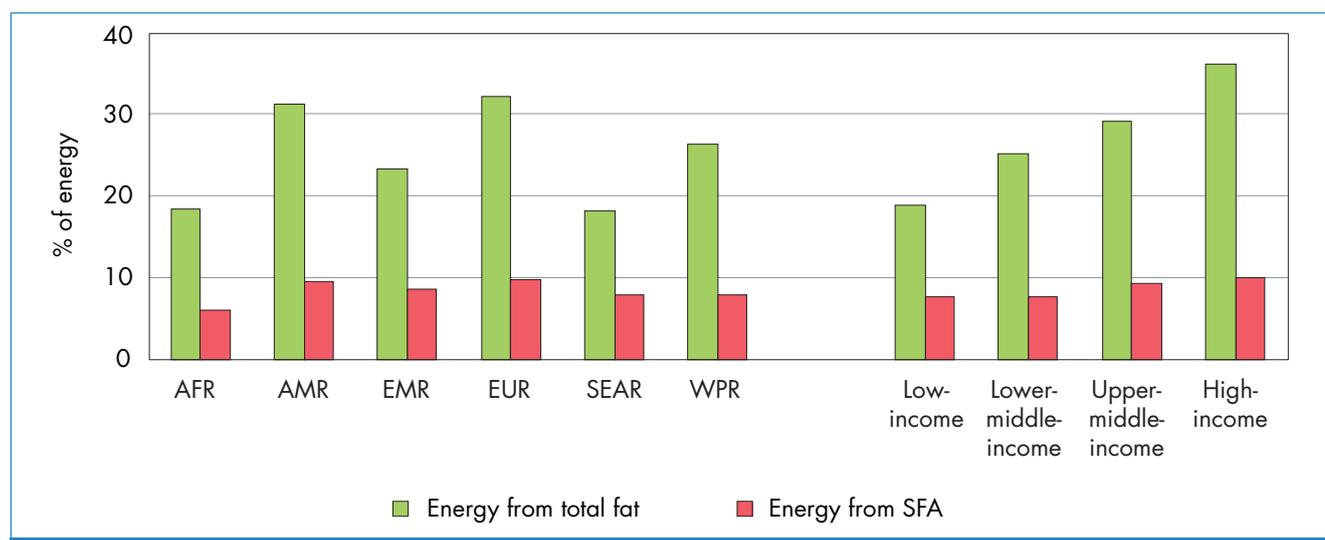
A population salt intake of less than 5 grams per person per day is recommended by WHO for the prevention of cardiovascular disease (32). However, data from various countries indicate that most populations are consuming much more salt than this (33).

It is estimated that decreasing dietary salt intake from the current global levels of 9–12 grams per day – to the recommended level of 5 grams per day – would have a major impact on reducing blood pressure and cardiovascular disease (34).

There is convincing evidence that saturated fat and trans-fat increase the risk of coronary heart disease and that replacement with monosaturated and polyunsaturated fat reduces the risk (35). There is also evidence that the risk of type 2 diabetes is directly associated with consumption of saturated fat and trans-fat and inversely associated with polyunsaturated fat from vegetable sources (36, 37).

In the absence of comparable data on individual dietary intakes around the world, the availability of food for human consumption derived from national *Food balance sheets* (38) has been used. However, these may not accurately reflect actual consumption and should be treated as indicative only.

**Figure 12. Availability of total fat and saturated fatty acids (SFA) (as % dietary energy supply) for 2005–7, by WHO Region and World Bank income group<sup>6</sup>**



<sup>6</sup> Source: Food and Agriculture Organization (FAO) *Food Balance Sheets*.

There were large variations across regions of the world in the amount of total fats available for human consumption (Figure 12). The lowest quantities available were recorded in the South-East Asia Region, and the highest availability in the European Region. For saturated fatty acids (SFA), the lowest rates were in the African Region, and the highest was in the European Region and the Region of the Americas, with very high values observed in some of the Pacific Islands. Energy from SFA usually accounts for a third of the energy from total fat, with the notable exception of the South-East Asia Region, where SFAs account for over 40% of total fat intake.

The availability of total fat increases with country income level, while the availability of saturated fats clusters around the value of 8% in low- and lower-middle-income countries and 10% in upper-middle-income and in high-income countries.

**Figure 13. Percent of available energy from fat (1961–2007), by World Bank income group, 2008<sup>7</sup>**

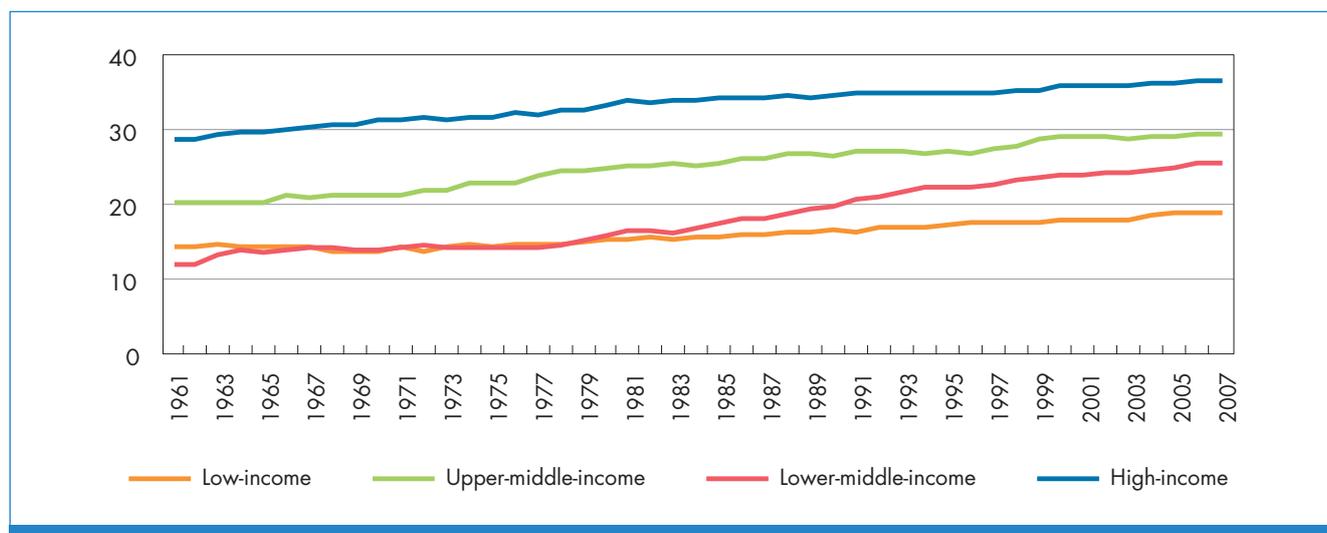


Figure 13 shows the trend in the availability of fat in the last four decades by World Bank income groups. Increase has been steady and particularly rapid since the 1980s in lower-middle-income countries.

In relation to cancer, dietary contaminants – as well as dietary constituents – are a significant problem in some regions. One example is widespread naturally-occurring aflatoxins, which contaminate cereals and nuts and cause liver cancer when eaten (39). Aflatoxin was estimated to have a causative role in 5–28% of all hepatocellular cancers (40). The association of nasopharyngeal cancer with consumption of Chinese-style salted-fish is another example (41).

## Metabolic/physiological risk factors

### Raised blood pressure

Worldwide, raised blood pressure<sup>8</sup> is estimated to cause 7.5 million deaths, about 12.8% of the total of all annual deaths (13). This accounts for 57 million DALYs or 3.7% of total DALYs. Raised blood pressure is a major risk factor for coronary heart disease and ischaemic as well as haemorrhagic stroke (27). Blood pressure levels have been shown to be positively and progressively related to the risk for stroke and coronary heart disease (42). In some age groups, the risk of cardiovascular disease doubles for each incremental increase of 20/10 mmHg of blood pressure, starting as low as

<sup>7</sup> Source: Food and Agriculture Organization of the United Nations (FAO) *Food balance sheets*.

<sup>8</sup> Raised blood pressure is defined as systolic blood pressure of  $\geq 140$  mmHg and/or diastolic blood pressure of  $\geq 90$  mmHg, or using medication to lower blood pressure.

115/75 mmHg (43). In addition to coronary heart diseases and stroke, complications of raised blood pressure include heart failure, peripheral vascular disease, renal impairment, retinal haemorrhage and visual impairment (44). Treating systolic blood pressure and diastolic blood pressure so they are below 140/90 mmHg is associated with a reduction in cardiovascular complications (33).

**Figure 14. Age-standardized prevalence of raised blood pressure in adults aged 25+ years, by WHO Region and World Bank income group, comparable estimates, 2008**



Globally, the overall prevalence of raised blood pressure in adults aged 25 and over was around 40% in 2008 (Figure 14). The proportion of the world's population with high blood pressure, or uncontrolled hypertension, fell modestly between 1980 and 2008. However, because of population growth and ageing, the number of people with hypertension rose from 600 million in 1980 to nearly 1 billion in 2008 (45).

The prevalence of raised blood pressure was highest in the African Region, where it was 46% for both sexes combined. The lowest prevalence of raised blood pressure was in the WHO Region of the Americas, with 35% for both sexes. Men in this region had a slightly higher prevalence than women (39% and 32% respectively). In all WHO regions, men have slightly higher prevalence of raised blood pressure than women, but this difference was only statistically significant in the Region of the Americas and the European Region.

Across the income groups of countries, the prevalence of raised blood pressure was consistently high, with low-, lower-middle- and upper-middle-income countries all having rates of around 40% for both sexes. The prevalence in high-income countries was lower, at 35% for both sexes.

## Overweight and obesity

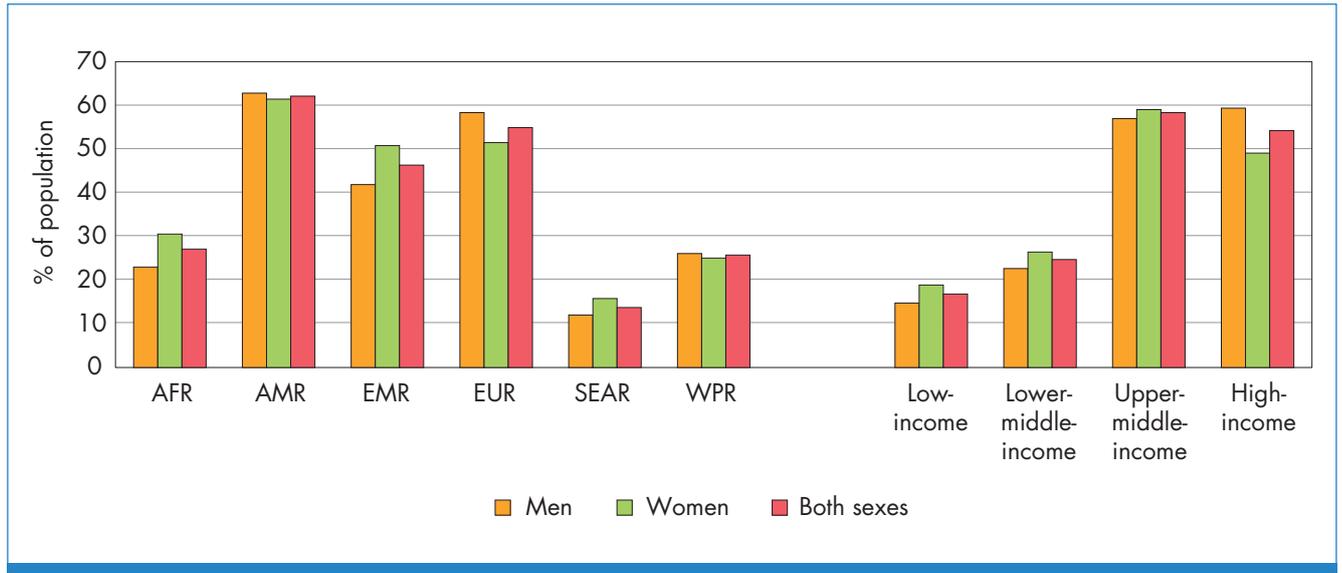
Worldwide, 2.8 million people die each year as a result of being overweight<sup>9</sup> (including obesity<sup>10</sup>) and an estimated 35.8 million (2.3%) of global DALYs are caused by overweight or obesity (13). Overweight and obesity lead to adverse metabolic effects on blood pressure, cholesterol, triglycerides and insulin resistance. Risks of coronary heart disease, ischaemic stroke and type 2 diabetes mellitus increase steadily with increasing body mass index (BMI), a measure of weight relative to height

<sup>9</sup> Overweight is defined as BMI  $\geq 25$  kg/m<sup>2</sup>.

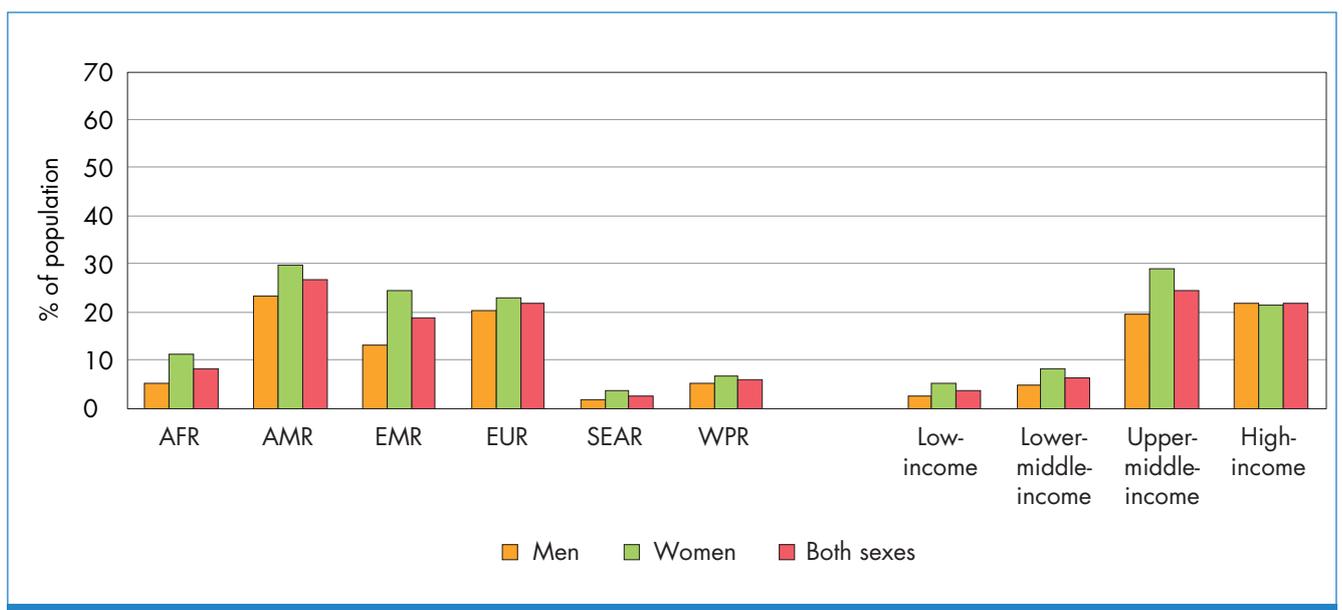
<sup>10</sup> Obesity is defined as body mass index BMI  $\geq 30$  kg/m<sup>2</sup>.

(46). Raised BMI also increases the risk of cancer of the breast, colon/rectum, endometrium, kidney, oesophagus (adenocarcinoma) and pancreas (27, 46). Mortality rates increase with increasing degrees of overweight, as measured by BMI. To achieve optimal health, the median BMI for adult populations should be in the range of 21 to 23 kg/m<sup>2</sup>, while the goal for individuals should be to maintain a BMI in the range 18.5 to 24.9 kg/m<sup>2</sup>. There is increased risk of co-morbidities for BMIs in the range of 25.0 to 29.9 kg/m<sup>2</sup>, and moderate to severe risk of co-morbidities for a BMI greater than 30 kg/m<sup>2</sup> (47).

**Figure 15. Age-standardized prevalence of overweight in adults aged 20+ years, by WHO Region and World Bank income group, comparable estimates, 2008**



**Figure 16. Age-standardized prevalence of obesity in adults aged 20+ years, by WHO Region and World Bank income group, comparable estimates, 2008**



In 2008, 35% of adults aged 20 years and older were overweight (BMI  $\geq$  25 kg/m<sup>2</sup>) (34% men and 35% of women). The worldwide prevalence of obesity has nearly doubled between 1980 and 2008. In 2008, 10% of men and 14% of women in the world were obese (BMI  $\geq$  30 kg/m<sup>2</sup>), compared with

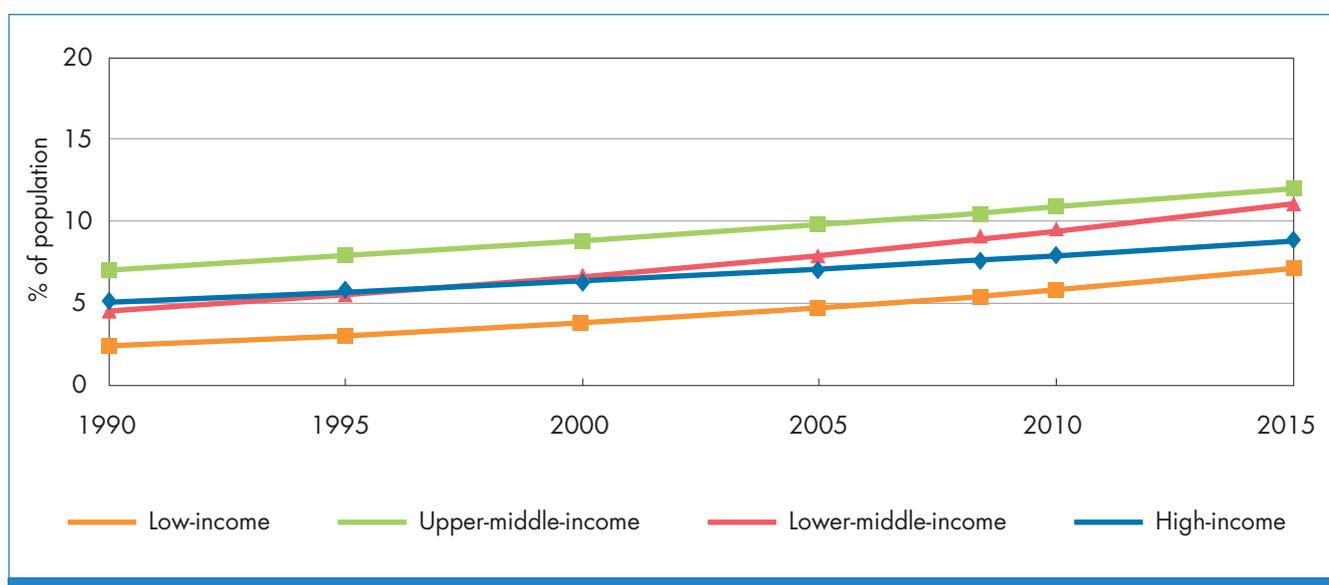
5% for men and 8% for women in 1980. An estimated 205 million men and 297 million women over the age of 20 were obese in 2008 – a total of more than half a billion adults worldwide (48).

The prevalence of overweight and obesity were highest in the WHO Region of the Americas (62% for overweight in both sexes, and 26% for obesity) and lowest in the WHO Region for South-East Asia (14% overweight in both sexes and 3% for obesity) (Figures 15 and 16). In the WHO European Region, the Eastern Mediterranean and the Region for the Americas, over 50% of women were overweight. For all three regions, roughly half of overweight women are obese (23% of women in Europe, 24% in the Eastern Mediterranean, 29% in the Americas). In all WHO regions, women were more likely to be obese than men. In the African, South-East Asian and Eastern Mediterranean Regions, women had roughly double the obesity prevalence of men.

The prevalence of raised BMI increases with income level of countries, up to upper-middle-income levels. The prevalence of overweight in high-income and upper-middle-income countries was more than double that of low- and lower-middle-income countries. For obesity, the difference more than triples from 7% obesity in both sexes in lower-middle-income countries to 24% in upper-middle-income countries. Women's obesity was significantly higher than men's, with the exception of high-income countries where it was of similar prevalence. In low- and lower-middle-income countries, obesity among women was approximately double that among men.

The prevalence of obesity varies across socioeconomic groups within individual countries. In high-income countries, an inverse relationship has been identified between socioeconomic status and obesity in women for several decades (49). More recent research conducted in the European Union (50), and specifically in the Netherlands (51), Spain (52), Sweden (53) and the United Kingdom (54), have shown an inverse relationship between education and either BMI or obesity among both men and women. In medium- and low-income countries a positive relationship between socioeconomic status and obesity in men, women and children has instead been observed.

**Figure 17. Infant and young child overweight trends from 1990 to 2015, by World Bank income group**



Estimates for overweight among infants and young children globally for 2008 indicate that there were 40 million (or 6%) preschool children with a weight-for-height above more than two standard deviations of the WHO child growth standards median.

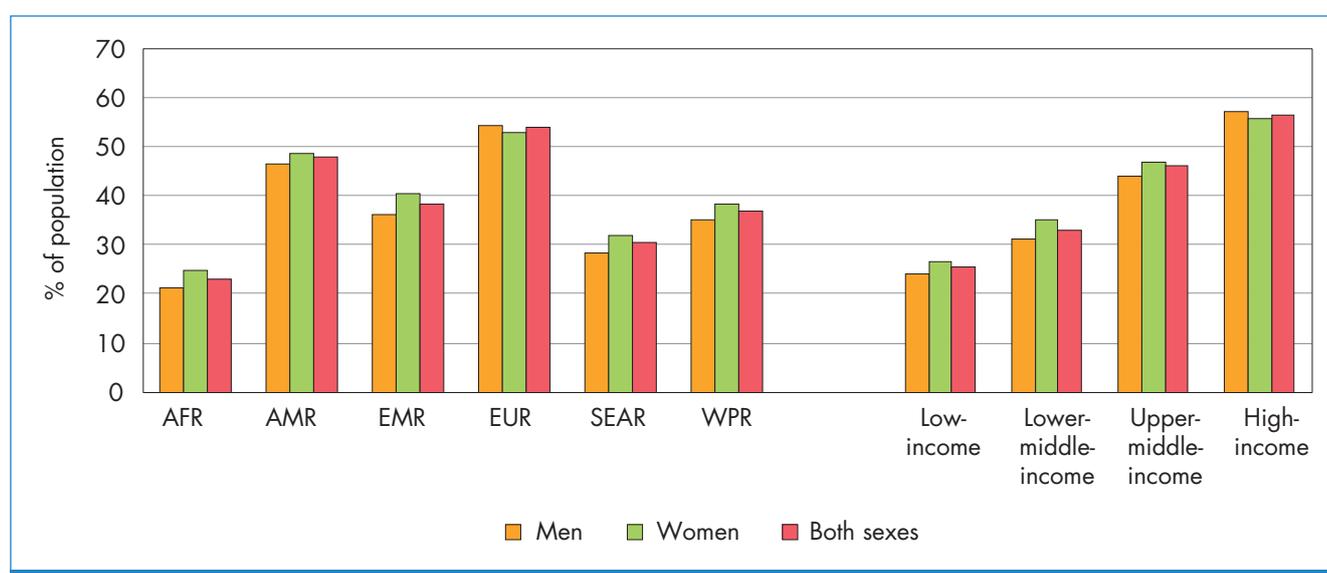
The highest prevalence of overweight among infants and young children was found in the upper-middle-income group, while the fastest rise in overweight was in the lower-middle-income group (Figure 17). Low-income countries had the lowest rate but overweight rose over time among all country income groups. Rising income is associated with rising rates of overweight among infants and young children. In high-income countries, such as the United Kingdom and the United States, lower socioeconomic status is associated with a higher prevalence of obesity (55, 56).

The fastest rise in overweight among infants and young children is in lower-middle-income countries

## Raised cholesterol

Raised cholesterol levels<sup>11</sup> increase the risks of heart disease and stroke (57). Globally, a third of ischaemic heart disease is attributable to high cholesterol. Overall, raised cholesterol is estimated to cause 2.6 million deaths (4.5% of total) and 29.7 million DALYs, or 2.0% of total DALYs (13). Raised total cholesterol is a major cause of disease burden in both the developed and developing world as a risk factor for ischaemic heart disease and stroke (36). For example, a 10% reduction in serum cholesterol in men aged 40 has been reported to result in a 50% reduction in heart disease within five years; the same serum cholesterol reduction for men aged 70 years can result in an average 20% reduction in heart disease occurrence in the next five years (58).

**Figure 18. Age-standardized prevalence of raised total cholesterol in adults aged 25+ years, by WHO Region and World Bank income group, comparable estimates, 2008**



In 2008, the global prevalence of raised total cholesterol among adults was 39% (37% for males and 40% for females). Globally, mean total cholesterol changed little between 1980 and 2008, falling by less than 0.1 mmol/L per decade in men and women (59). The prevalence of elevated total cholesterol was highest in the WHO European Region (54% for both sexes), followed by the WHO Region of the Americas (48% for both sexes). The WHO African Region and the WHO South-East Asia Region showed the lowest percentages (23% and 30% respectively).

The prevalence of raised total cholesterol increased noticeably according to the income level of the country (Figure 18). In low-income countries, around a quarter of adults had raised total cholesterol, in lower-middle-income countries this rose to around a third of the population for both sexes. In high-income countries, over 50% of adults had raised total cholesterol; more than double the level of the low-income countries.

## Additional modifiable risk factors for cancer

The shared NCD risk factors mentioned above are highly relevant to the prevention of cancer of the lung and a number of other cancer sites (tobacco smoking), and both breast and colorectal cancer (unhealthy diet, overweight and physical inactivity).

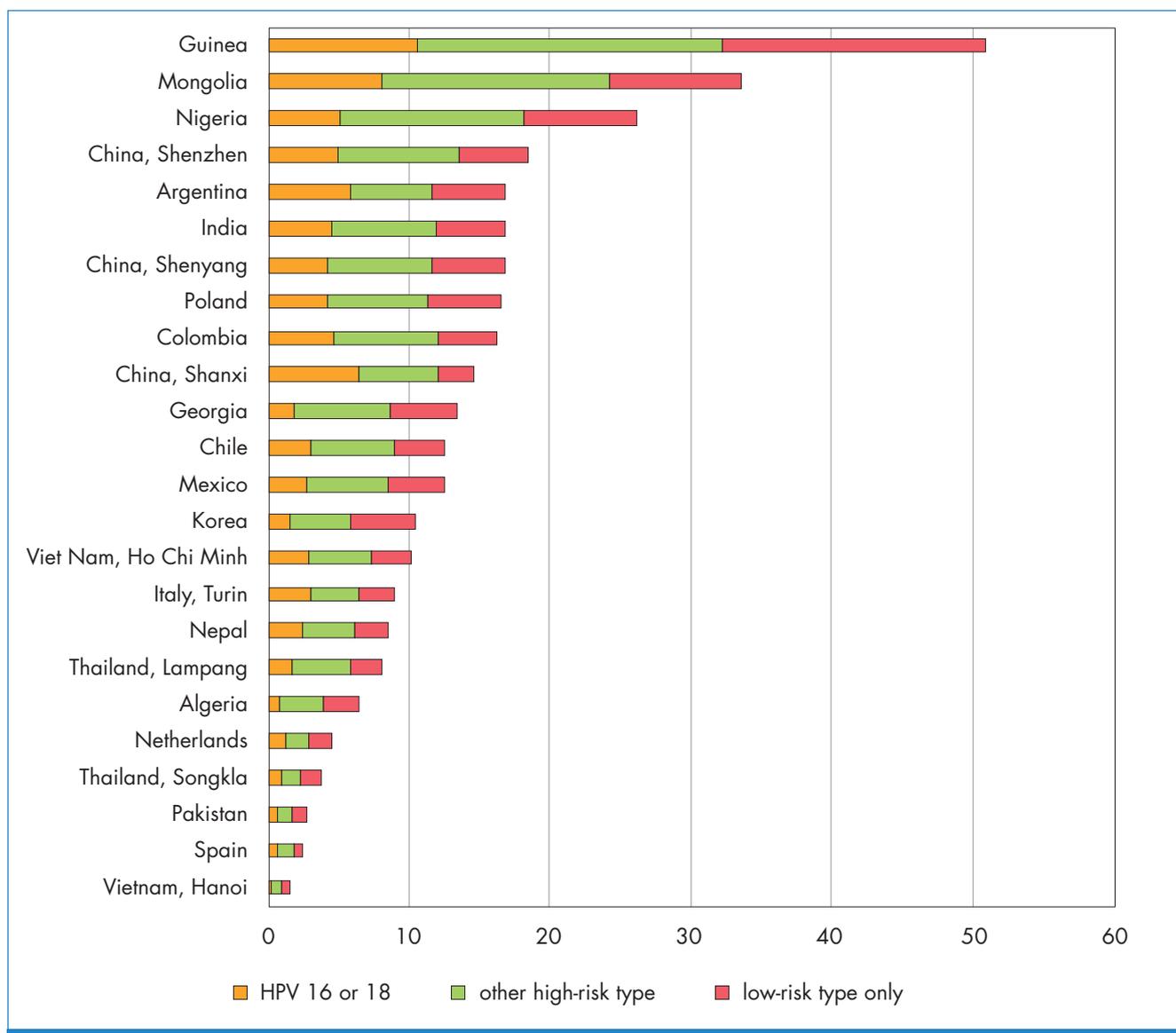
Among the four cancer sites that show more elevated incidence and mortality in low- and lower-middle rather than high-income countries (cervix, liver, stomach and oesophagus), all except cancer of the oesophagus are predominantly caused by chronic infections (60). Conservative estimates have

<sup>11</sup> Raised cholesterol was defined, in these estimates, as 5.0 mmol/L or 190 mg/dl or higher.

shown that about 2 million cancer cases per year (18% of the global cancer burden) are attributable to a few specific chronic infections (4). This fraction is substantially larger in low-income countries (26%) than in high-income countries (8%), making the prevention or eradication of these infections a priority to overcome inequalities in cancer incidence between poor and rich populations. The principal infectious agents, each responsible for approximately 5% of cancers worldwide, are HPV (100% of cancer of the cervix, the majority of cancers of anogenital tract in each sex, and between 20% and 60% of cancer of the oro-pharynx depending upon the population); Hepatitis B virus (HBV) and Hepatitis C virus (HCV) (responsible for 50% and 85% of primary liver cancers in high- and low-income countries, respectively); and *Helicobacter pylori* (that causes at least 80% of noncardia carcinomas of the stomach) (4, 61-63).

The prevalence of cervical infection with high-risk HPV types, for instance, varies substantially in different populations in a way that closely resembles the geographical distribution of corresponding cancer incidence. The prevalence of cervical HPV infection in women, for instance, varies by over tenfold according to International Agency for Research on Cancer (IARC) population-based HPV surveys: from less than 3% to more than 25% in some settings (64) (Figure 19). An even more extreme variation is seen for HCV infection. The transmission of HCV has been largely stopped in high-income countries, where major epidemics had taken place in the last decades (e.g. Italy and Japan) but not in many low-resource countries (e.g., Egypt, Mongolia and Pakistan), where it is still mainly sustained by unsafe transfusions and use or sharing of contaminated needles.

**Figure 19. Prevalence of cervical HPV in sexually active women, 15-59 years, (1995-2009)**



A wide range of environmental causes of cancer, encompassing environmental contaminants or pollutants, occupationally-related exposures and radiation, together make a significant contribution to cancer burden (65) and are often modifiable at low cost.

Notable examples of environmental causes of cancer are asbestos, benzene, indoor and outdoor air pollution and contaminants such as arsenic. Ionizing radiation increases the risk for several cancer types (66, 67). Diagnostic X-rays were estimated to contribute between 0.5–3% to the overall cancer burden in high-income countries (68). Risk related to radon is high in miners, and residential radon has been estimated to cause 2% of cancer deaths in Europe (69). Protection against solar radiation and UV tanning devices are effective cancer prevention strategies in populations of people with light-coloured skin.

Approximately 50 occupational agents and work-related exposure circumstances are carcinogenic to humans (65). In the United Kingdom, for example, an overall 5% of cancers were estimated to be attributable to occupation (70), but this is likely to be higher in countries with less stringent standards of worker protection, less attention to industrial hygiene or with child labour.

## Conclusion

NCDs are the leading causes of death globally. They are strongly influenced by four main behavioural risk factors: tobacco use, insufficient physical activity, harmful use of alcohol, and unhealthy diet, which lead to: elevated blood pressure, raised blood glucose and cholesterol levels, and excess body weight.

Age-specific death rates due to NCDs are generally higher in countries with low-income levels. Almost half of deaths caused by NCDs in low- and middle-income countries occur under the age of 70, and almost 30% below the age of 60, with potentially serious consequences for productivity and socioeconomic development.

Cancer is a particularly complex disease with a distribution of cancer sites that varies geographically in relation to the prevalence and level of different risk factors. A number of additional etiological agents are important and more common in low-income countries, particularly certain chronic infections, together with environmental and occupational exposures.

The prevalence of risk factors varies between the country income groups, with the patterns of variation differing between the various risk factors and among men and women. High-, middle- and low-income countries face differing risk profiles.

Raised blood pressure has a notably higher prevalence in low-income countries.

Some key risk factors are high or becoming more prevalent in middle-income countries. These include tobacco use among men, where the highest prevalence is among the lower-middle-income countries of the Western Pacific Region and European Region. The prevalence of both overweight and obesity among adults is highest in upper-middle-income countries. While physical inactivity is highest in high-income countries, in middle-income countries the rates of inactivity are rising among women and have already reached high-income country levels among men.

Several risk factors have the highest prevalence in high-income countries. These include: adult per capita alcohol consumption; physical inactivity among women; total fat consumption and raised total cholesterol.

The number of deaths from NCDs is projected to increase substantially in the coming decades. There are, however, a number of reasons for some cautious optimism. Countries of Western Europe, North America and some parts of Latin America are making significant progress in reducing cardiovascular disease deaths. In general, smoking prevalence and blood pressure in these countries are declining. Further progress in reducing tobacco use, salt and fat intake, and harmful use of alcohol, as well as increasing physical activity, can greatly reduce or attenuate the occurrence of NCDs.

## Key Messages

- Noncommunicable diseases are the biggest global killers today.
- Sixty-three percent of all deaths in 2008 – 36 million people – were caused by NCDs.
- Nearly 80% of these deaths occurred in low- and middle-income countries, where the highest proportion of deaths under the age of 70 from NCDs occur.
- The prevalence of NCDs, and the resulting number of related deaths, are expected to increase substantially in the future, particularly in low- and middle-income countries, due to population growth and ageing, in conjunction with economic transition and resulting changes in behavioural, occupational and environmental risk factors.
- NCDs already disproportionately affect low- and middle-income countries. Current projections indicate that by 2020 the largest increases in NCD mortality will occur in Africa and other low- and middle-income countries.

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