In the same series:

The Tobacco Atlas

The Atlas of Heart Disease and Stroke

Dr Judith Mackay and Dr George A. Mensah

with

Dr Shanthi Mendis and Dr Kurt Greenlund

World Health Organization
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A message from

Dr LEE Jong-Wook
Director-General
World Health Organization

Heart disease and stroke are currently the leading cause of death in all developed countries and in most developing countries. There were approximately 17 million deaths due to cardiovascular disease in 2003 – one-third of all deaths in the world.

It is disturbing to note that at least 75% of deaths from heart disease and stroke now occur in the poorer regions of the world, which also face major threats from communicable diseases. These regions thus suffer under the so-called “double burden” of disease. If preventive action is not taken urgently, heart disease and stroke – which are already major public health problems – will rapidly advance across regions and social classes to reach epidemic proportions worldwide.

We know that the major risk factors for heart disease and stroke are high blood pressure, high blood cholesterol, tobacco use, physical inactivity, unhealthy diet and obesity. Many of these risk factors result from unhealthy lifestyles. These unhealthy lifestyle habits, which are linked to urbanization, often start in childhood and youth, encouraged by the influence of mass advertising and social pressures. This underscores the importance of targeting children and young people in all programmes that aim to prevent heart disease and stroke.

Prevention and control of heart disease and stroke in developing countries represent a challenging task. There are a number of major barriers to progress, including lack of reliable epidemiological information, inaccessibility of health care, shortages of trained manpower and resources, and misconceptions about heart disease and stroke among policy-makers and the public.

However, the good news is that knowledge about the causes of heart disease and stroke is growing, and various countries are gaining experience in translating this knowledge into effective action.

I believe that our efforts to control heart disease and stroke can only succeed if they are focused at country level. Current WHO activities in this area are based on the WHO Global Strategy for the Prevention and Control of Noncommunicable Disease, which was adopted by the World Health Assembly in 2000. Our goals are to:

- provide guidance to countries on policy, legislative and financial measures that can help prevent cardiovascular disease;
- assess and track the magnitude of the cardiovascular disease epidemic and its social, economic, behavioural and political determinants in developing countries;
- reduce cardiovascular risk factors and their determinants and promote cardiovascular health for all age groups;
- strengthen the health care of people with cardiovascular disease by developing norms and guidelines for cost-effective interventions.
To achieve these goals, WHO has developed standardized approaches to strengthen national surveillance systems for key risk factors. Further, WHO has initiated programmes at country level to scale up health care for those with established cardiovascular disease and to introduce affordable and innovative approaches for managing cardiovascular risk factors and cardiovascular disease in low-resource settings.

WHO is also in the process of addressing some of the main risk factors for cardiovascular disease through global action, such as the Framework Convention on Tobacco Control and the Global Strategy on Diet, Physical Activity and Health. These strategies will help countries in their efforts to develop and implement policies to reduce the burden of cardiovascular disease.

We recognize that advocacy, resource mobilization, capacity development, and research are necessary to galvanize global action against the causes of cardiovascular disease. WHO is working with other UN agencies, research institutions, nongovernmental organizations, the private sector and civil society to promote these activities. Together we can move the global public health agenda forward to avert unnecessary deaths and suffering due to this eminently preventable disease.
Heart disease and stroke, the main cardiovascular diseases, are truly global epidemics. They deserve the attention of governments, policy-makers, national and international organizations, committed individuals and families everywhere.

Heart disease and stroke are no longer diseases of old men in developed countries. They are also diseases of women, young adults, and even children. They affect the wealthy and the poor. Already they claim more lives in developing than developed countries. The Asian girl on the cover is at risk, as are many children and young adults throughout the world.

The risk factors for heart disease and stroke begin in youth, and most can be prevented or controlled. Yet, worldwide, most people who have risk factors are either not treated or are inadequately treated. Special attention to high blood pressure, high blood cholesterol, tobacco and other major risk factors is crucial.

Cardiovascular diseases are more than just health problems: both the diseases and their underlying causes have major financial implications for governments, businesses and individuals. The “globesity” epidemic is causing international concern. The tobacco epidemic is linked to smuggling, big business and politics. If people are to be encouraged to take regular physical activity, commitment is needed from both individuals and society. The prevention and control of high blood pressure and high blood cholesterol require action from governments and the pharmaceutical industry, not just individual patients.

Research achievements in the field of heart disease and stroke have been phenomenal. We know a lot today, but as Goethe put it, “knowing is not enough, we must apply.” We must apply what we already know, and translate the best science into practice for the benefit of all, worldwide.

The good news, as stated most eloquently in the Victoria Declaration on Heart Health more than a decade ago, is that we know what we need to do to eliminate most heart disease and stroke. What is needed now is the combination of necessary resources and political will on a global scale to take effective action. Now is the time to act – and to change before we have to.

Judith Mackay, Hong Kong SAR, China
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Part 1
   Child health examination, Cuba © WHO/Carlos Gaggero

Part 2
   Woman cooking, Guatemala © WHO/Armando Waak
Types of cardiovascular disease

Risk factors start in childhood and youth

Risk factor: lipids

Risk factor: tobacco

Risk factor: physical inactivity

Risk factor: obesity

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Treatment

The future

Whilst every reasonable effort has been made to contact the copyright holders of images used in the atlas, the authors and publisher will gladly receive information that will enable them to rectify any inadvertent errors in subsequent editions.
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“When man is serene, the pulse of the heart flows and connects, just as pearls are joined together or like a string of red jade, then one can talk about a healthy heart.”

The Yellow Emperor’s Canon of Internal Medicine, 2500 BCE
The human heart is only the size of a fist, but it is the strongest muscle in the human body. The heart starts to beat in the uterus long before birth, usually by 21 to 28 days after conception. The average heart beats about 100,000 times daily or about two and a half billion times over a 70 year lifetime.

With every heartbeat, the heart pumps blood around the body. It beats approximately 70 times a minute, although this rate can double during exercise or at times of extreme emotion.

Blood is pumped out from the left chambers of the heart. It is transported through arteries of ever-decreasing size, finally reaching the capillaries in all the tissues, such as the skin and other body organs. Having delivered its oxygen and nutrients and having collected waste products, blood is brought back to the right chambers of the heart through a system of ever-enlarging veins. During the circulation through the liver, waste products are removed.

This remarkable system is vulnerable to breakdown and assault from a variety of factors, many of which can be prevented and treated. Risk factors will be explored on pages 24–43.
Coronary heart disease
Disease of the blood vessels supplying the heart muscle.
Major risk factors High blood pressure, high blood cholesterol, tobacco use, unhealthy diet, physical inactivity, diabetes, advancing age, inherited (genetic) disposition.
Other risk factors Poverty, low educational status, poor mental health (depression), inflammation and blood clotting disorders.

Rheumatic heart disease
Damage to the heart muscle and heart valves from rheumatic fever, caused by streptococcal bacteria.

Congenital heart disease
Malformations of heart structures existing at birth may be caused by genetic factors or by adverse exposures during gestation. Examples are holes in the heart, abnormal valves, and abnormal heart chambers.
Risk factors Maternal alcohol use, medicines (for example thalidomide, warfarin) used by the expectant mother, maternal infections such as rubella, poor maternal nutrition (low intake of folate), close blood relationship between parents (consanguinity).

Other cardiovascular diseases
Tumours of the heart; vascular tumours of the brain; disorders of heart muscle (cardiomyopathy); heart valve diseases; disorders of the lining of the heart.

Other factors that can damage the heart and blood vessel system
Inflammation, drugs, high blood pressure, unhealthy diet, trauma, toxins and alcohol.

Stroke
Strokes are caused by disruption of the blood supply to the brain. This may result from either blockage (ischaemic stroke) or rupture of a blood vessel (haemorrhagic stroke).
Risk factors High blood pressure, atrial fibrillation (a heart rhythm disorder), high blood cholesterol, tobacco use, unhealthy diet, physical inactivity, diabetes, and advancing age.

Coronary heart disease kills more than 7 million people each year, and strokes kill nearly 5 million. Most of these deaths are in developing countries.

Aortic aneurysm and dissection
Dilatation and rupture of the aorta.
Risk factors Advancing age, long-standing high blood pressure, Marfan syndrome, congenital heart disorders, syphilis, and other infectious and inflammatory disorders.

Peripheral arterial disease
Disease of the arteries supplying the arms and legs.
Risk factors As for coronary heart disease.

Deep venous thrombosis (DVT) and pulmonary embolism
Blood clots in the leg veins, which can dislodge and move to the heart and lungs.
Risk factors Surgery, obesity, cancer, previous episode of DVT, recent childbirth, use of oral contraceptive and hormone replacement therapy, long periods of immobility, for example while travelling, high homocysteine levels in the blood.
Rheumatic fever usually follows an untreated beta-haemolytic streptococcal throat infection in children. It can affect many parts of the body, and may result in rheumatic heart disease, in which the heart valves are permanently damaged, and which may progress to heart failure, atrial fibrillation, and embolic stroke.

Nowadays, rheumatic fever mostly affects children in developing countries, especially where poverty is widespread. Up to 1% of all schoolchildren in Africa, Asia, the Eastern Mediterranean region and Latin America show signs of the disease.

Of 12 million people currently affected by rheumatic fever and rheumatic heart disease, two-thirds are children between 5 and 15 years of age. There are around 300,000 deaths each year, with two million people requiring repeated hospitalization and one million likely to require surgery in the next 5 to 20 years.

Early treatment of streptococcal sore throat can preclude the development of rheumatic fever. Regular long-term penicillin treatment can prevent rheumatic fever becoming rheumatic heart disease, and can halt disease progression in people whose heart valves are already damaged by the disease. In many developing countries, lack of awareness of these measures, coupled with shortages of money and resources, are important barriers to the control of the disease.
Deaths from rheumatic heart disease

Number of deaths
2002

- 10 000 and above
- 5000–9999
- 1000–4999
- 10–99
- 0–9
- no data

Rheumatic heart disease in children
Estimated number of cases in 5 to 14-year-olds
reported 2003

Sub-Saharan Africa
China
South-Central Asia
Latin America
Eastern Mediterranean and North Africa
Eastern Europe
Pacific
Developed countries

<table>
<thead>
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Total

1,008,207
“He that eats but one dish seldom needs the doctor.”
Old Scottish proverb
Over 300 risk factors have been associated with coronary heart disease and stroke. The major established risk factors meet three criteria: a high prevalence in many populations; a significant independent impact on the risk of coronary heart disease or stroke; and their treatment and control result in reduced risk.

Risk factors for cardiovascular disease are now significant in all populations. In the developed countries, at least one-third of all CVD is attributable to five risk factors: tobacco use, alcohol use, high blood pressure, high cholesterol and obesity.

In developing countries with low mortality, such as China, cardiovascular risk factors also figure high on the top 10 list. These populations face a double burden of risks, grappling with the problems of undernutrition and communicable diseases, while also contending with the same risks as developed nations.

Even in developing countries with high mortality, such as those in sub-Saharan Africa, high blood pressure, high cholesterol, tobacco and alcohol use, as well as low vegetable and fruit intake, already figure among the top risk factors.

Some major risks are modifiable in that they can be prevented, treated, and controlled. There are considerable health benefits at all ages, for both men and women, in stopping smoking, reducing cholesterol and blood pressure, eating a healthy diet and increasing physical activity.
### Major modifiable risk factors

- **High blood pressure**  
  Major risk for heart attack and the most important risk factor for stroke.
- **Abnormal blood lipids**  
  High total cholesterol, LDL-cholesterol and triglyc eride levels, and low levels of HDL-cholesterol increase risk of coronary heart disease and ischaemic stroke.
- **Tobacco use**  
  Increases risks of cardiovascular disease, especially in people who started young, and heavy smokers. Passive smoking an additional risk.
- **Physical inactivity**  
  Increases risk of heart disease and stroke by 50%.
- **Obesity**  
  Major risk for coronary heart disease and diabetes.
- **Unhealthy diets**  
  Low fruit and vegetable intake is estimated to cause about 31% of coronary heart disease and 11% of stroke worldwide; high saturated fat intake increases the risk of heart disease and stroke through its effect on blood lipids and thrombosis.
- **Diabetes mellitus**  
  Major risk for coronary heart disease and stroke.

### Other modifiable risk factors

- **Low socioeconomic status (SES)**  
  Consistent inverse relationship with risk of heart disease and stroke.
- **Mental ill-health**  
  Depression is associated with an increased risk of coronary heart disease.
- **Psychosocial stress**  
  Chronic life stress, social isolation and anxiety increase the risk of heart disease and stroke.
- **Alcohol use**  
  One to two drinks per day may lead to a 30% reduction in heart disease, but heavy drinking damages the heart muscle.
- **Use of certain medication**  
  Some oral contraceptives and hormone replacement therapy increase risk of heart disease.
- **Lipoprotein(a)**  
  Increases risk of heart attacks especially in presence of high LDL-cholesterol.
- **Left ventricular hypertrophy (LVH)**  
  A powerful marker of cardiovascular death.

### Non-modifiable risk factors

- **Advancing age**  
  Most powerful independent risk factor for cardiovascular disease; risk of stroke doubles every decade after age 55.
- **Heredity or family history**  
  Increased risk if a first-degree blood relative has had coronary heart disease or stroke before the age of 55 years (for a male relative) or 65 years (for a female relative).
- **Gender**  
  Higher rates of coronary heart disease among men compared with women (premenopausal age); risk of stroke is similar for men and women.
- **Ethnicity or race**  
  Increased stroke noted for Blacks, some Hispanic Americans, Chinese, and Japanese populations. Increased cardiovascular disease deaths noted for South Asians and American Blacks in comparison with Whites.

### "Novel" risk factors

- **Excess homocysteine in blood**  
  High levels may be associated with an increase in cardiovascular risk.
- **Inflammation**  
  Several inflammatory markers are associated with increased cardiovascular risk, e.g. elevated C-reactive protein (CRP).
- **Abnormal blood coagulation**  
  Elevated blood levels of fibrinogen and other markers of blood clotting increase the risk of cardiovascular complications.
Although cardiovascular diseases typically occur in middle age or later, risk factors are determined to a great extent by behaviours learned in childhood and continued into adulthood, such as dietary habits and smoking.

Throughout the world, these risks are starting to appear earlier. Physical activity decreases markedly in adolescence, particularly in girls. Obesity has increased substantially, not only in Europe and North America, but also in traditionally slender populations such as the Chinese and Japanese. Type 2 diabetes was previously rare in children, but is increasing in adolescents in, for example, North America, Japan and Thailand.

Markers of CVD can be seen in young children. Post-mortems of children who died in accidents have found fatty streaks and fibrous plaques in the coronary arteries. These early lesions of atherosclerosis were most frequently found in children whose risk factors included smoking, elevated plasma lipids, high blood pressure and obesity.

Programmes to address childhood and youth risk factors are mostly confined to developed countries, but urgent action is required worldwide. Families, schools, communities, health professionals, public health officials and policy-makers all need to promote healthy lifestyles in children and young people. Unless the spread of risk factors is stemmed, the world faces an epidemic of CVD.
Boys

In the USA, physical activity decreases precipitously, especially in girls, beginning around age 10 years.

Girls

Early starters

Percentage of students, primarily aged 13 to 15 years, using tobacco 1999-2003

- 45% and above
- 30%-44.9%
- 15%-29.9%
- below 15%
- no data

Subnational data (region or city)
High blood pressure (hypertension) is one of the most important preventable causes of premature death worldwide. Even a blood pressure at the top end of the normal range increases risk. High blood pressure is defined as a systolic blood pressure (SBP) above 140 mmHg and/or a diastolic blood pressure (DBP) above 90 mmHg.

In most countries, up to 30% of adults suffer from high blood pressure and a further 50% to 60% would be in better health if they reduced their blood pressure, by increasing physical activity, maintaining an ideal body weight and eating more fruits and vegetables.

In people aged up to 50 years, both DBP and SBP are associated with cardiovascular risk; above this age, SBP is a far more important predictor. Blood pressure usually rises with age, except where salt intake is low, physical activity high, and obesity largely absent.

Most natural foods contain salt, but processed food may be high in salt; in addition, individuals may add salt for taste. Dietary salt increases blood pressure in most people with hypertension, and in about a quarter of those with normal blood pressure, especially with increasing age. A high intake of salt independently increases the risk of CVD in overweight persons.

In addition to lifestyle changes, effective medication is available for control of high blood pressure.
Average systolic blood pressure of people aged 30 years and above estimated to 2005 mmHg
- data from urban populations only

<table>
<thead>
<tr>
<th>Category</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>140 and above</td>
<td>Red</td>
</tr>
<tr>
<td>130–139</td>
<td>Purple</td>
</tr>
<tr>
<td>120–129</td>
<td>Blue</td>
</tr>
<tr>
<td>below 120</td>
<td>Light blue</td>
</tr>
<tr>
<td>no data</td>
<td>Gray</td>
</tr>
</tbody>
</table>

High blood pressure contributes to around half of all cardiovascular disease. The lower your blood pressure the better, as long as you do not feel faint or light-headed.

The risk of cardiovascular disease doubles for every 10 point increase in diastolic blood pressure or every 20 point increase in systolic blood pressure.
High levels of LDL-cholesterol, and other abnormal lipids (fats), are risk factors for cardiovascular disease. Cholesterol is a soft, waxy substance found among the lipids in the bloodstream and in all the body’s cells. It is needed to form cell membranes and hormones, and for other bodily functions.

The body can make cholesterol, or it can obtain it from food, especially animal products such as meats, poultry, fish, eggs, and dairy products. Certain saturated vegetable fats and oils, including coconut fat and palm oil, are cholesterol-free but cause an increase in blood cholesterol. Some foods that do not contain animal products may contain trans-fats, which also cause the body to make more cholesterol. Fruit, vegetables and cereals do not contain cholesterol.

Cholesterol is transported around the body in two kinds of lipoproteins: low-density lipoprotein, or LDL, and high-density lipoprotein, or HDL. A high level of LDL can lead to clogging of the arteries, increasing the risk of heart attack and ischaemic stroke, while HDL reduces the risk of coronary heart disease and stroke.

The female sex hormone estrogen tends to raise HDL-cholesterol levels, which may help explain why premenopausal women are relatively protected from developing coronary heart disease.

### Current recommended lipid levels

<table>
<thead>
<tr>
<th>Lipid Type</th>
<th>European guideline</th>
<th>US guideline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cholesterol</td>
<td>less than 5.0 mmol/l</td>
<td>less than 240 mg/dl (6.2 mmol/l)</td>
</tr>
<tr>
<td>LDL-cholesterol</td>
<td>less than 3.0 mmol/l</td>
<td>less than 160 mg/dl (3.8 mmol/l)</td>
</tr>
<tr>
<td>HDL-cholesterol</td>
<td>1.0 mmol/l or more in males 1.2 mmol/l or more in females</td>
<td>40 mg/dl (1 mmol/l) or more</td>
</tr>
<tr>
<td>Triglycerides (fasting)</td>
<td>less than 1.7 mmol/l</td>
<td>less than 200 mg/dl (2.3 mmol/l)</td>
</tr>
</tbody>
</table>
Average cholesterol levels in women aged 30 and above mmol/litre estimated to 2005
* data from urban populations only

- 6.0 and above
- 5.5–5.99
- 5.0–5.49
- 3.0–4.99
- no data

Fatty deposits along the inside of artery walls lead to atherosclerosis and narrowing of the arteries.

Trends in cholesterol levels in Beijing, China

Average total cholesterol in people aged 25 to 64 years 1984–1999 mmol/l

<table>
<thead>
<tr>
<th>Year</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984</td>
<td>4.15</td>
<td>4.17</td>
</tr>
<tr>
<td>1988</td>
<td>4.43</td>
<td>4.43</td>
</tr>
<tr>
<td>1993</td>
<td>4.44</td>
<td>4.34</td>
</tr>
<tr>
<td>1996</td>
<td>4.61</td>
<td>4.55</td>
</tr>
<tr>
<td>1999</td>
<td>5.25</td>
<td>5.1</td>
</tr>
</tbody>
</table>

Average cholesterol levels in men more than 0.4 mmol/litre higher than in women
Average cholesterol levels in women more than 0.4 mmol/litre higher than in men
The public may believe that the major risk from cigarettes is lung cancer, but far more smokers develop cardiovascular disease — mainly heart attacks and stroke. In 1940, a link was identified between cigarette use and coronary heart disease, and there is now a huge body of scientific literature linking tobacco with CVD. The risks are much higher in people who started smoking before the age of 16. Tobacco use, other than smoking, and passive smoking are also implicated as CVD risks.

Smoking promotes CVD through several mechanisms. It damages the endothelium lining of the blood vessels, increases cholesterol plaques (fatty deposits in the arteries), increases clotting, raises LDL-cholesterol levels and lowers HDL, and promotes coronary artery spasm. Nicotine accelerates the heart rate and raises blood pressure.

A gene has been discovered that increases smokers’ risk of developing coronary heart disease by up to four times. Around a quarter of the population carries one or more copies of this gene.

Women smokers are at particular risk, with a higher risk of heart attack than male smokers. Women who smoke only three to five cigarettes a day double their risk of heart attack, while men who smoke six to nine cigarettes a day double their risk.
Men

Smoking prevalence

Percentage of people aged 18 years and above who smoke 2003 or latest available data
- data from urban populations only

- 60% and above
- 45%-59.9%
- 30%-44.9%
- 15%-29.9%
- below 15%
- no data

 Quitting smoking effectively reduces cardiovascular risk to close to that of a person who has never smoked.

Women

Only 4% of both smokers and nonsmokers in China know that smoking causes heart disease.

Tobacco causes a fifth of cardiovascular disease worldwide.
Industrialization, urbanization and mechanized transport have reduced physical activity, even in developing countries, so that currently more than 60% of the global population are not sufficiently active.

Physical exercise is linked to longevity, independently of genetic factors. Physical activity, even at an older age, can significantly reduce the risk of coronary heart disease, diabetes, high blood pressure, and obesity, help reduce stress, anxiety and depression, and improve lipid profile. It also reduces the risks of colon cancer, breast cancer and ischaemic stroke.

Doing more than 150 minutes of moderate physical activity or 60 minutes of vigorous physical activity a week — whether at work, in the home, or elsewhere — can reduce the risk of coronary heart disease by approximately 30%.

Despite documented evidence of the benefit of physical activity in preventing and treating cardiovascular and other chronic diseases, more than a quarter of a million individuals die each year in the United States because of a “lack of regular physical exercise”.

Only 8% of the world’s population currently owns a car. Between 1980 and 1998, the global fleet of cars, trucks and buses grew by 80%, with a third of the increase taking place in developing countries.
Physical activity levels

Energy expenditure per week in work, leisure and transport MET-mins
2002-2003
1 MET is the amount of energy expended while sitting quietly at rest
- 6000 and above
- below 1300
- 3500-5999
- no data
- 1300-3499

Being physically inactive increases your risk of coronary heart disease and ischaemic stroke by around 1.5 times.

Worldwide, physical inactivity causes about 1.9 million deaths, 20% of cardiovascular disease and 22% of coronary heart disease.

In 1997, in China there were 250 bicycles to every car, while the USA had less than one bicycle to every car.

25% of the world's cars are in the USA, a country with just 5% of the world's population.

Singapore keeps moving
Percentage participation in any form of sport for at least 20 minutes, on 3 or more days a week, by age 1998

Transport
Number of motor vehicles per 1000 people
1996 selected countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>519</td>
</tr>
<tr>
<td>Japan</td>
<td>97</td>
</tr>
<tr>
<td>Brazil</td>
<td>81</td>
</tr>
<tr>
<td>Hong Kong SAR</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>7</td>
</tr>
<tr>
<td>India</td>
<td></td>
</tr>
</tbody>
</table>

The global fleet
Number of vehicles
1950-1994, 2025 projected

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Million</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>630</td>
</tr>
<tr>
<td>1994</td>
<td></td>
</tr>
<tr>
<td>2025</td>
<td></td>
</tr>
</tbody>
</table>
Belt size, abdominal girth and waist-to-hip ratio are useful indicators of obesity. The Body Mass Index (BMI), a measure of weight in relation to height, is commonly used for classifying overweight and obesity. The risks of cardiovascular disease and type 2 diabetes tend to increase on a continuum with increasing BMI, but for practical purposes a person with a BMI of over 25 is considered overweight, while someone with a BMI of over 30 is obese. But one size does not fit all. In women, a BMI as low as 21 may be associated with the greatest protection from coronary heart disease death. The BMI for observed risk in different Asian populations varies from 22 to 25 kg/m².

Availability of food, changes in the kind of food eaten, and decreased exercise are presenting humanity with one of its greatest challenges. Low fruit and vegetable intake accounts for about 20% of CVD worldwide. Obese smokers live 14 fewer years than nonsmokers of normal weight. More than 60% of adults in the USA are overweight or obese. Triple-width coffins, capable of holding a 300 kg (700 lb) body, are in increasing demand. Worldwide, airlines are having to recalculate their passenger “payload” weight. There are 70 million overweight people in China. South Pacific populations used to be physically active and slim, but the region now has some of the world’s highest rates of obesity.

### Apple shape at higher risk of CVD than pear shape

<table>
<thead>
<tr>
<th>Increased CVD risk if:</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waist to hip ratio</td>
<td>more than 0.90</td>
<td>more than 0.85</td>
</tr>
<tr>
<td>Waist measurement</td>
<td>more than 101 cm (40 inches)</td>
<td>more than 89 cm (35 inches)</td>
</tr>
</tbody>
</table>
Men

Body Mass Index (BMI)

Average BMI of people aged 15 years and above estimated to 2005 kg/m²
- data from urban populations only

- 27 and above
- 25–26.9
- 23–24.9
- 18–22.9
- no data

Women
Diabetes is a risk factor for coronary heart disease and stroke, and is the most common cause of amputation that is not the result of an accident.

Insulin is a hormone produced by the pancreas and used by the body to regulate glucose (sugar). Diabetes occurs when the body does not produce enough insulin, or cannot use it properly, leading to too much sugar in the blood. Symptoms include thirst, excessive urination, tiredness, and unexplained weight loss.

There are two main types of diabetes. Type 1 diabetes, in which the pancreas stops making insulin, accounts for 10% to 15% of cases. The majority of people with diabetes have type 2 disease, in which insulin is produced in smaller amounts than needed, or is not properly effective. This form is preventable, because it is related to physical inactivity, excess calorie intake and obesity. People with type 1 diabetes need insulin injections to lower blood sugar, but many people with type 2 do not.

At least half of all people with diabetes are unaware of their condition. Diabetes is more prevalent in developed countries, but modernization and lifestyle changes are likely to result in a future epidemic of diabetes in developing countries.

Over 170 million people in the world have diabetes, and the numbers are increasing.

Lifestyle changes can be more effective than drugs in preventing type 2 diabetes.
Prevalence of diabetes

Percentage of people aged 20 and above with diabetes 2000

- 15% and above
- 10%-14.9%
- 5%-9.9%
- below 5%
- no data

Top 5 largest numbers of people aged 20 and above with diabetes 2000

Diabetes prevalence and trends

Percentage of people aged 20 and above with diabetes

2000 and 2030 projected

- 4.6%
- 6.4%
- 6.3%
- 8.4%
- 4.1%
- 6.0%

2000
2030
world
developed countries
developing countries
"Wealth is both an enemy and a friend." Nepalese proverb

In developing countries, coronary heart disease has historically been more common in the more educated and higher socioeconomic groups, but this is beginning to change. In industrial countries, such as Canada, the United Kingdom, and the United States, there is a widening social class difference in the opposite direction.

Studies in developed countries suggest that low income is associated with a higher incidence of coronary heart disease, and with higher mortality after a heart attack. The prevalence of risk factors for heart disease, such as high blood pressure, smoking and diabetes, is also higher. The use of medications is lower, especially of lipid-lowering agents and ACE inhibitors, as well as other treatments, such as cardiac catheterization.

The pathways by which socioeconomic status might affect cardiovascular disease include: lifestyle and behaviour patterns; ease of access to health care; and chronic stress.
Educational level and obesity in Italy

Percentage increased risk of obesity in people aged 35 to 74 years, in comparison with university graduates 1998

- women
- men
- upper secondary education diploma
- no qualification

In China, years of education are more important than occupation, income or marital status in relation to cardiovascular risk factors, especially cigarette smoking.

Income and obesity in Saudi Arabia

Percentage of people aged 20 years and above with Body Mass Index of more than 30 kg/m² 1990–1993

Prevalence of diabetes by income in India

Percentage of people aged 20 years and above with diabetes, by income level 2000
Women: a special case?

Widespread misconceptions persist about heart disease, often thought to be primarily a disease of middle-aged men. In reality, cardiovascular disease affects as many women as men, albeit at an older age. Many women still believe that they are more at risk from cancer than from heart disease.

Risk factors for CVD are similar for men and women, but tobacco use is more dangerous in women. In addition, high blood triglycerides are an important cause of atherosclerosis in young women, but not in young men. The menopause has no direct effect, but hormone replacement therapy increases the risk of CVD.

Heart disease is under-detected in women, particularly younger women. In developed countries, women are less likely to be referred to a heart specialist, to be hospitalized, to be prescribed medicine or invasive treatment, or to be referred for exercise testing or echocardiography. Women are more likely to enter the medical system with the diagnosis of a second heart attack.

After a first stroke, women are kept in hospital longer, and remain more disabled than men receiving similar care. More research is needed to improve our understanding of the differences in responses to treatment in men and women.

In the interim, however, adherence to the published guidelines for the prevention and control of heart disease and stroke seems prudent.

### Risk factors

#### Modifiable risks – risk or prevalence is higher in women than men

- Tobacco use (higher risk)
- High triglyceride levels (higher risk)
- Diabetes (more prevalent)
- Obesity (more prevalent)
- Depression (more prevalent)

#### Modifiable risks – risk is similar in men and women

- High blood pressure
- High total cholesterol
- Low HDL-cholesterol
- Combined hyperlipidaemia
- Unhealthy diet
- Physical inactivity
- Stress

#### Risks for women only

- Oral contraceptive use
- Hormone replacement therapy
- Polycystic ovary syndrome
- Risk of heart attack highest early in each menstrual cycle

#### Non-modifiable risks for men and women

- Advancing age
- Gender
- Heredity
- Ethnicity/race
Smoking
Percentage increase in risk of heart attack in people who smoke in Denmark 1976-1993

Women who smoke are at higher risk of heart attack than men who smoke.

No time to walk
Percentage of women in the United Kingdom aged 15 years and above who do not exercise more because of lack of time or motivation 2003

Walking reduces coronary heart disease
Percentage reduction in risk of coronary heart disease by non-vigorous walking in women aged 45 and above in the USA 1992-1999

Hormone replacement therapy
Percentage increase in risk of CVD in healthy women using HRT in the USA 1991-2000
“You don’t get to choose how you’re going to die, or when. You can only decide how you’re going to live now.”

Joan Baez, folk singer and activist, USA (1941–)
Disability-adjusted life years (DALYs) lost can be thought of as "healthy years of life lost". They indicate the total burden of a disease, as opposed to simply the resulting deaths.

Cardiovascular disease is responsible for 10% of DALYs lost in low- and middle-income countries, and 18% in high-income countries.

A heart attack occurs when the blood vessels supplying the heart muscle become blocked, starving it of oxygen, leading to the heart muscle’s failure or death. Heart attack has the same risk factors as CVD in general. Cold weather, exercise, or strong emotion can precipitate a heart attack.

Coronary heart disease is decreasing in many developed countries, but is increasing in developing and transitional countries, partly as a result of increasing longevity, urbanization, and lifestyle changes.

Risk of heart attack can change when people migrate. Japan has a low rate of coronary heart disease, but after moving to the USA, Japanese people have been found to have a gradually increasing risk. This eventually approaches that of people born in the USA.
Healthy years of life lost to coronary heart disease

DALYs lost per 1000 population, age-standardized estimates for 2002
Disability-adjusted life years combine years of potential life lost due to premature death with years of productive life lost due to disability

- 30 and above
- 20-29
- 0-9
- 10-19
- no data

Disease burden in women
Percentage of DALYs lost due to top ten diseases in women aged 15 years and above 2002
Civilization kills. Since 1990, more people have died from coronary heart disease than from any other cause. Unlike stroke, coronary heart disease is a comparative newcomer on the world stage. Variations in death rates are marked: they are lower in populations with short life expectancy.

Heart disease mortality rates are also affected by differences between countries in the major risk factors, especially blood pressure, blood cholesterol, smoking, physical activity, and diet. While genetic factors play a part, 80% to 90% of people dying from coronary heart disease have one or more major risk factors that are influenced by lifestyle.

Death rates from coronary heart disease have decreased in North America and many western European countries. This decline has been due to improved prevention, diagnosis, and treatment, in particular reduced cigarette smoking among adults, and lower average levels of blood pressure and blood cholesterol. It is expected that 82% of the future increase in coronary heart disease mortality will occur in developing countries.

Of all coronary heart disease patients who die within 28 days after the onset of symptoms, about two-thirds die before reaching hospital. This highlights not only the need for early recognition of the warning signs of a heart attack, but also the need for prevention.
Deaths from coronary heart disease

Number of deaths from coronary heart disease
2002

- 500 000 and above
- 100 000-499 999
- 10 000-99 999
- less than 1000
- no data

Top 3 highest number of deaths from coronary heart disease

<table>
<thead>
<tr>
<th>Country</th>
<th>Increase/Decrease</th>
<th>Percentage Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Croatia</td>
<td>+61%</td>
<td>+62%</td>
</tr>
<tr>
<td>Kazakhstan</td>
<td>+36%</td>
<td>+56%</td>
</tr>
<tr>
<td>Belarus</td>
<td>+30%</td>
<td>+53%</td>
</tr>
<tr>
<td>Ukraine</td>
<td>+38%</td>
<td>+49%</td>
</tr>
<tr>
<td>Romania</td>
<td>+26%</td>
<td>+20%</td>
</tr>
</tbody>
</table>

3.8 million men and 3.4 million women worldwide die each year from coronary heart disease.

Change of heart
Percentage change in coronary heart disease death rates, in people aged 35 to 74 years 1988-1998 selected countries

- Croatia: +61%
- Kazakhstan: +36%
- Belarus: +30%
- Ukraine: +38%
- Romania: +26%

Women: increase
Men: decrease
"I waked and sat up...when I felt a confusion and indistinctness in my head which lasted, I suppose about half a minute. Soon after I perceived that I had suffered a paralytick stroke, and that my Speech was taken from me."

Samuel Johnson, England, 1783

Stroke is the brain equivalent of a heart attack. Blood must flow to and through the brain for it to function. If its flow is obstructed, by a blood clot moving to the brain, or by narrowing or bursting of blood vessels, the brain loses its energy supply, causing damage to tissues leading to stroke.

Annually, 15 million people worldwide suffer a stroke. Of these, 5 million die and another 5 million are left permanently disabled, placing a burden on family and community. Stroke is uncommon in people under 40 years; when it does occur, the main cause is high blood pressure. Stroke also occurs in about 8% of children with sickle cell disease.

The major risk factors for stroke are similar to those for coronary heart disease, with high blood pressure and tobacco use the most significant modifiable risks. Atrial fibrillation, heart failure and heart attack are other important risk factors.

The incidence of stroke is declining in many developed countries, largely as a result of better control of high blood pressure, and reduced levels of smoking. However, the absolute number of strokes continues to increase because of the ageing population.
Healthy years of life lost to stroke

DALYs lost per 1000 population, age-standardized 2002
Disability-adjusted life years combine years of potential life lost due to premature death with years of productive life lost due to disability

- 20 and above
- 15-19
- below 5
- 10-14
- no data

Stroke in young people
Number of new cases of stroke per 100,000 people per year selected populations 1986-1997

10
age 17-49 years
Israel

9
15-44
Italy

3
0-39
Kuwait

15-40
Libyan Arab
Jamahiriya

40-49
South Africa
Blacks

20-54
USA
Northern Manhattan
Blacks

11-50
Spain
Cantabria

20-44
USA
Northern Manhattan
Hispanics

20-44
USA
Northern Manhattan
Whites

26

14

15-44
Italy

14
North

47
47

25

33

10

NEW
ZEALAND
Deaths from stroke

Stroke carries a high risk of death. Survivors can experience loss of vision and/or speech, paralysis, and confusion. Historically called “apoplexy”, “stroke” is so called because of the way it strikes people down.

Previous stroke significantly increases risk of further episodes. Certain racial, ethnic and socioeconomic groups are also at greater risk of stroke. The most important modifiable cause of stroke is high blood pressure; for every ten people who die of stroke, four could have been saved if their blood pressure had been regulated. Among those aged under 65, two-fifths of deaths from stroke are linked to smoking. Other modifiable risk factors include unhealthy diet, high salt intake, underlying heart disease, diabetes and high blood lipids.

The risk of death depends on the type of stroke. Transient ischaemic attack or TIA — where symptoms resolve in less than 24 hours — has the best outcome, followed by stroke caused by carotid stenosis (narrowing of the artery in the neck that supplies blood to the brain). Blockage of an artery is more dangerous, with rupture of a cerebral blood vessel the most dangerous of all.

Even where advanced technology and facilities are available, 60% of those who suffer a stroke die or become dependent. Given these dismal statistics and the high cost of treatment of stroke, high priority should be accorded to preventive strategies.
Number of deaths from stroke 2002

- 200,000 and above
- 100,000-199,999
- Below 1000
- 10,000-99,999
- No data

**Top 3 highest number of deaths from stroke**
- 5,5 million
- 7,2 million
- 5,5 million

**Stroke compared with other causes of death**

Percentages and numbers of deaths worldwide from stroke and other leading causes 2002

- Malaria: 2% (1.2 million)
- Tuberculosis: 3% (1.6 million)
- Diarrhoeal diseases: 3% (1.8 million)
- Perinatal causes: 4% (2.5 million)
- Chronic obstructive pulmonary disease: 5% (2.7 million)
- HIV/AIDS: 5% (3.7 million)
- Respiratory infections: 7% (3.7 million)
- Injuries: 9% (5.2 million)
- Cancer: 12% (7.1 million)
- Heart disease: 13% (7.2 million)
- Other causes: 27% (15.6 million)
- Total deaths: 57 million

**Other causes**

- Malaria: 1.2 million
- Tuberculosis: 1.6 million
- Diarrhoeal diseases: 1.8 million
- Perinatal causes: 2.5 million
- Chronic obstructive pulmonary disease: 2.7 million
- HIV/AIDS: 3.7 million
- Respiratory infections: 3.7 million
- Injuries: 5.2 million
- Cancer: 7.1 million
- Heart disease: 7.2 million
- Other causes: 15.6 million
- Total deaths: 57 million
The costs of cardiovascular disease are diverse: the cost to the individual and to the family of health care and time off work; the cost to government of health care; and the cost to the country of lost productivity.

We attempt here to quantify some of these costs. However, the value of a human life is beyond our analysis.

**Economic costs**

"The art of economics consists in looking not merely at the immediate but at the longer effects of any act or policy; it consists in tracing the consequences of that policy not merely for one group but for all groups."

Henry Hazlitt, USA (1894–1993)

The Global costs of smoking include health care costs associated with smoking-related illnesses result in a global net loss of US$200 billion per year, with one third of those losses occurring in developing countries. Estimated 1994.

USA, Australia and Europe

2002 reports indicate that up to 10% of health budgets are spent on diabetes-related illnesses.

USA

"If just 10% of adults began walking regularly, Americans could save US$5.6 billion in costs related to heart disease." – President George W. Bush, 2002.

Health problems related to obesity, such as heart disease and type 2 diabetes, cost the USA an estimated US$177 billion a year.

Cholesterol reducers were the top-selling medications in 2003, generating US$13.9 billion in sales.

The American Heart Association estimates that stroke will cost a total of US$53.6 billion in 2004. Direct costs for medical care and therapy will average US$33 billion and indirect costs from lost productivity will be US$20.6 billion.

In 2001, the National Stroke Association estimated that the average cost per patient for the first 90 days after a stroke was US$15,000, although 10% of cases cost more than US$35,000.

**Latin America and the Caribbean**

Permanent disabilities resulting from diabetes cost US$50 billion in 2000, while costs associated with insulin, hospitalization, consultations and care totalled US$10.6 billion.

**Global costs of diabetes**

Between 4% and 5% of health budgets are spent on diabetes-related illnesses. WHO, 2003

**Price of weekly dose of medication**

Expressed in kg of cheapest crop available (yam, rice or potato)

2003

<table>
<thead>
<tr>
<th>selected countries</th>
<th>Chile</th>
<th>China</th>
<th>Egypt</th>
<th>Georgia</th>
<th>Ghana</th>
<th>Indonesia</th>
<th>Pakistan</th>
<th>Sri Lanka</th>
<th>Turkey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simvastatin</td>
<td>30.0</td>
<td>3.0</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>1.2</td>
<td>2.0</td>
<td>3.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Aspirin</td>
<td>1.6</td>
<td>1.5</td>
<td>0.9</td>
<td>0.9</td>
<td>0.9</td>
<td>0.9</td>
<td>0.9</td>
<td>0.9</td>
<td>0.9</td>
</tr>
</tbody>
</table>

There is at least one intervention that can be afforded even by low-income countries.
United Kingdom

"The direct cost of obesity to the National Health Service is £0.5 billion [about US$0.9 billion] per year, while the indirect cost to the UK economy is at least £2 billion [about US$3.5 billion]."

– Liam Donaldson, Chief Medical Officer, 2003.

More than 4% of National Health Service spending was on stroke services in 2000.

Netherlands

The average total costs of care per patient for six months following a stroke were estimated at €16 000 in 2003. Stroke was estimated to be responsible for 3% of total health care costs in the Netherlands in 1994, and 7% of costs for the population aged 75 and over. Stroke ranked second on the list of most costly diseases for the elderly, after dementia, and these costs are expected to increase by 40% by 2015.

The cost of risk factors

Cumulative Medicare costs of treatment of cardiovascular disease in people aged 65 years to death, in the USA

<table>
<thead>
<tr>
<th>Year</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>US$18 604</td>
<td>US$11 711</td>
</tr>
</tbody>
</table>

Risk factors:
- high blood pressure
- high cholesterol
- cigarette smoking
- abnormal electrocardiograms
- a history of diabetes or previous heart attacks

US$38 044
US$38 059

<table>
<thead>
<tr>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 or more risk factors</td>
<td>3 or more risk factors</td>
</tr>
</tbody>
</table>

Expenditure on cardiovascular medications

Percentage of total annual drug expenditure

1989–1997

OECD countries

<table>
<thead>
<tr>
<th>Year</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>9.4%</td>
<td>9.8%</td>
</tr>
<tr>
<td>1991</td>
<td>10.7%</td>
<td>10.8%</td>
</tr>
<tr>
<td>1993</td>
<td>10.8%</td>
<td>11.0%</td>
</tr>
</tbody>
</table>

The economics of CVD

Global costs of heart disease medication

The number of people who die or are disabled by coronary heart disease and stroke could be halved with wider use of a combination of drugs that costs just US$14 a year.

WHO, 2002

Singapore

Average hospital costs for stroke were reported in 2000 as US$5000 per patient. Ward charges accounted for 38%, radiology 15%, doctors' fees 10%, medications 8%, therapy 7%.

Germany costs of coronary heart disease

US$26 billion

Total direct costs

Including:
- primary care
- clinical care
- rehabilitation

Total indirect costs

Lost productivity caused by short-term and long-term disability, death

Average cost per case: US$82 000

Expenditure on cardiovascular medications

Percentage of total annual drug expenditure

1989–1997

OECD countries

9.4% 9.8% 10.7% 10.8% 11.0%

1989 1991 1993 1995 1997

Aspirin remains the least expensive drug for secondary prevention.
“Keeping your body healthy is an expression of gratitude to the whole cosmos, the trees, the clouds, everything.”

Most Venerable Thich Nhat Hanh, Vietnamese Buddhist monk (1926-)
Research

"Science knows no country, because knowledge belongs to humanity, and is the torch that illuminates the world." Louis Pasteur, France (1822–1892)

From the description of how a heart muscle cell contracts to the elucidation of the human genome, scientific advances in basic, clinical, and population research in cardiovascular disease, and their global impact, have been phenomenal. New and improved treatments have become possible, and novel markers of future risk have been identified.

Yet several key challenges remain. There is a widespread lack of research capacity, standardized data, communication networks, and human and financial resources, especially in developing countries.

The MONICA (Multinational MONItoring of trends and determinants in CArdiovascular disease) Project involved teams from 38 populations in 21 countries from the mid-1980s to the mid-1990s, the largest such collaboration ever undertaken. It was set up to explain the diverse trends in cardiovascular disease mortality observed from the 1970s onwards. The project monitored a study population of 10 million men and women, aged 25 to 64 years.

MONICA was important in measuring levels and trends in cardiovascular diseases and their risk factors in different populations, in monitoring prevention policies in different countries, and in demonstrating the importance of the new acute and long-term treatments that were being introduced.
CVD research publications

Number of publications on cardiovascular disease indexed in Medline 1991–2001

- 1000 and above
- 500–999
- 100–499
- 10–99
- below 10
- no data

Top three countries

- 3769
- 2667

Only 8% of published cardiovascular research is from developing countries, although low- and middle-income countries shoulder 80% of the disease burden.

Research funding by the National Institute of Health in the USA

Spending on disease research 2003

<table>
<thead>
<tr>
<th>Disease</th>
<th>US$ million</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancer</td>
<td>$5432m</td>
</tr>
<tr>
<td>Neurasciences</td>
<td>$4711m</td>
</tr>
<tr>
<td>Women’s health</td>
<td>$3498m</td>
</tr>
<tr>
<td>Paediatric illnesses</td>
<td>$3066m</td>
</tr>
<tr>
<td>HIV/AIDS</td>
<td>$2716m</td>
</tr>
<tr>
<td>Ageing</td>
<td>$2286m</td>
</tr>
<tr>
<td>Mental health</td>
<td>$1762m</td>
</tr>
<tr>
<td>Biodefense</td>
<td>$1554m</td>
</tr>
<tr>
<td>Emerging infectious diseases</td>
<td>$1362m</td>
</tr>
<tr>
<td>Drug abuse</td>
<td>$1023m</td>
</tr>
<tr>
<td>Nutrition</td>
<td>$1016m</td>
</tr>
<tr>
<td>Diabetes</td>
<td>$910m</td>
</tr>
<tr>
<td>Stroke</td>
<td>$330m</td>
</tr>
</tbody>
</table>
The World Health Organization’s Cardiovascular Disease Programme is conducted through its Geneva headquarters, and regional and national offices worldwide. The World Heart Federation helps people achieve a longer, better life through prevention and control of heart disease and stroke, focusing on low- and middle-income countries.

In addition to the nongovernmental organizations (NGOs) highlighted here, there are many international NGOs – from the World Medical Association to Consumers International – that include cardiovascular disease control as part of their activities.

Only international and regional organizations are shown here. Not mentioned are the many national organizations, whose impact may extend outside their own country, such as the Centers for Disease Control and Prevention in the USA, the British Heart Foundation, and ThaiHealth in Thailand. Other national NGOs also work part time on CVD issues.

There are numerous other partners in a vast arena of varied but related interests, including organizations involved with women, youth, law, economics, human rights, religion and development.

The capacity of virtually all cardiovascular disease control organizations is inadequate to meet the challenge of the CVD epidemic.

World Conferences on Cardiovascular Diseases

World Congresses of Cardiology

<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>1974</td>
</tr>
<tr>
<td>2nd</td>
<td>1978</td>
</tr>
<tr>
<td>3rd</td>
<td>1982</td>
</tr>
<tr>
<td>4th</td>
<td>1986</td>
</tr>
<tr>
<td>5th</td>
<td>1990</td>
</tr>
<tr>
<td>6th</td>
<td>1994</td>
</tr>
<tr>
<td>7th</td>
<td>1998</td>
</tr>
<tr>
<td>8th</td>
<td>2002</td>
</tr>
<tr>
<td>9th</td>
<td>2006</td>
</tr>
</tbody>
</table>

International Conferences on Preventive Cardiology

<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>1985</td>
</tr>
<tr>
<td>2nd</td>
<td>1989</td>
</tr>
<tr>
<td>3rd</td>
<td>1993</td>
</tr>
<tr>
<td>4th</td>
<td>1997</td>
</tr>
<tr>
<td>5th</td>
<td>2001</td>
</tr>
<tr>
<td>6th</td>
<td>2005</td>
</tr>
</tbody>
</table>
Good control of blood pressure, blood cholesterol and blood sugar levels, and other cardiovascular risk factors is the key to reducing risks of heart disease and stroke. Personal behaviour and lifestyle choices can make a big difference to the risk of coronary heart disease and stroke. It is estimated that having a high-risk lifestyle may account for 82% of coronary events in women. Here we identify personal choices that can lower individual risk for heart disease and stroke. The choices apply to young people and adults alike.

**Personal choices in lifestyles and behaviour**

1. Take moderate physical activity for a total of 30 minutes on most days of the week.
2. Avoid tobacco use and exposure to environmental smoke; make plans to quit if you already smoke.
3. Choose a diet rich in fruits, vegetables and potassium, and avoid saturated fats and calorie-dense meals.
4. Maintain a normal body weight; if you are overweight, lose weight by increasing physical activity and reducing calorie intake.
5. Reduce stress at home and at work.

**Personal actions for safeguarding cardiovascular health**

1. Discuss all questions with your health care provider.
2. Have regular check-ups from your health care provider.
3. Have your blood pressure and levels of blood sugar and cholesterol checked.
4. Follow your health care provider's instructions regarding physical activity, nutrition, weight management, and any medications you have been prescribed.
5. Know the signs and symptoms of heart attack and stroke and remember that both conditions are medical emergencies.
6. Know your blood pressure and cholesterol level, and keep them at the recommended levels through lifestyle changes and by taking any prescribed medication.
7. Lower your total fat and saturated fat intake in accordance with your health care provider's instructions.

**Young people**

1. Actions and choices for children and adolescents with cardiovascular disease, or risk factors, should be discussed with a paediatrician or health care provider.
2. Choose a diet containing a variety of fruits, vegetables, whole grains, dairy products, fish, legumes, poultry, and lean meat.
3. There is no need to restrict fat intake in children under two years of age.
4. For children over two years and adolescents, limit foods high in saturated fats (to less than 10% of daily calorie intake), cholesterol (to less than 300 mg per day), and trans-fatty acids.
5. Increase physical activity, and avoid tobacco use or exposure to environmental tobacco smoke.
Eat fruit and cereals
Percentage reduction in risk with each daily increment of 10 g of dietary fibre reported 2004

* all coronary events
* coronary deaths

Fibre intake: total dietary fibre, cereal, fruit

14% 27% 30%
10% 25%
16%

In the USA, people eat twice as much sugar and fat as recommended.

Reducing salt intake from 12 g per day to 3 g per day would reduce strokes by one-third and coronary heart disease by one-quarter.

Burning calories through physical activity is as important as watching what you eat.

In Japan, since the 1970s, the "10 000 Steps Project" has set a national daily exercise goal. To monitor steps walked, the average Japanese family today owns three pedometers.

Compared with less active people, moderately active and highly active individuals have a 20% and 27% respectively lower risk of stroke or stroke death.

People with low fitness are up to six times more likely to develop diabetes and high blood pressure.

The benefits of stopping smoking

<table>
<thead>
<tr>
<th>Time since last cigarette</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 minutes</td>
<td>Blood pressure and pulse rate drop to normal.</td>
</tr>
<tr>
<td>1 day</td>
<td>Probability of heart attack begins to decrease.</td>
</tr>
<tr>
<td>3 months</td>
<td>Circulation improves.</td>
</tr>
<tr>
<td>1 year</td>
<td>Excess risk of coronary heart disease is half that of a continuing smoker.</td>
</tr>
<tr>
<td>5 to 15 years later</td>
<td>Risk of stroke is reduced to that of people who have never smoked.</td>
</tr>
<tr>
<td>15 years later</td>
<td>Risk of coronary heart disease is similar to that of people who have never smoked, and the overall risk of death almost the same, especially if the smoker quits before illness develops.</td>
</tr>
</tbody>
</table>
"Thinking well is wise; planning well, wiser; doing well wisest and best of all."

Old Iranian proverb

Significant health gains in cardiovascular health can be made within short time spans, through public health and treatment interventions that have an impact on large segments of the population.

As shown here, there is a gap between what is known and what is done in practice, for both prevention and treatment of cardiovascular disease.

Governments are stewards of health resources, and have a fundamental responsibility to protect the health of citizens. Ministries of Health and the health profession can play various roles in reducing CVD, by making data available, educating the public, making treatments affordable and available, advising patients on healthy living practices, and advocating for policy and environmental change. These have been the essential messages of the International Heart Health Conferences and the related declarations on heart health.

UK dieticians promote the benefits for heart health of eating oily fish, more fruit and vegetables, and less saturated fat.
Medical professionals
Number of medical professionals working in noncommunicable disease control per 100,000 population
2007
WHO regions

<table>
<thead>
<tr>
<th>Region</th>
<th>Cardiologists</th>
<th>Primary Health Care Physicians</th>
<th>Nurses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>0.4</td>
<td>0.3</td>
<td>56</td>
</tr>
<tr>
<td>Americas</td>
<td>7</td>
<td>3</td>
<td>247</td>
</tr>
<tr>
<td>Eastern Mediterranean</td>
<td>3</td>
<td>6</td>
<td>191</td>
</tr>
<tr>
<td>Europe</td>
<td>6</td>
<td>81</td>
<td>685</td>
</tr>
<tr>
<td>South-East Asia</td>
<td>0.3</td>
<td>2</td>
<td>471</td>
</tr>
</tbody>
</table>

In Finland, community-based interventions, including health education and nutrition labelling, led to population-wide reductions in cholesterol, closely followed by a sharp decline in heart disease.

In Japan, government-led health education campaigns and increased treatment of high blood pressure levels have reduced low blood pressure levels in the population, stroke rates have fallen by more than 70%.

In New Zealand, the introduction of recognisable logos for healthy foods led many companies to reformulate their products. The benefits included greatly reduced salt content in processed foods.

In Mauritius, a change from palm oil to soya oil for cooking brought down cholesterol levels, but obesity was unaffected.

Antihypertensive drugs
Percentage of countries in each region where drugs are available, affordable to low-income groups, or manufactured locally
2001
WHO regions

<table>
<thead>
<tr>
<th>Region</th>
<th>Available</th>
<th>Affordable</th>
<th>Locally Manufactured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>70%</td>
<td>46%</td>
<td>7%</td>
</tr>
<tr>
<td>Americas</td>
<td>88%</td>
<td>92%</td>
<td>48%</td>
</tr>
<tr>
<td>Eastern Mediterranean</td>
<td>92%</td>
<td>64%</td>
<td>45%</td>
</tr>
<tr>
<td>Europe</td>
<td>100%</td>
<td>91%</td>
<td>91%</td>
</tr>
<tr>
<td>South-East Asia</td>
<td>71%</td>
<td>83%</td>
<td>83%</td>
</tr>
<tr>
<td>Western Pacific</td>
<td>96%</td>
<td>89%</td>
<td>30%</td>
</tr>
</tbody>
</table>

Use of medication in stroke and coronary heart disease
Percentage prescription of aspirin and statins to persons with established coronary heart disease and post-stroke in the WHO PREMISE demonstration project
2002
selected countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Aspirin</th>
<th>Statins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>29%</td>
<td>38%</td>
</tr>
<tr>
<td>Egypt</td>
<td>9%</td>
<td>38%</td>
</tr>
<tr>
<td>India</td>
<td>31%</td>
<td>31%</td>
</tr>
<tr>
<td>Indonesia Iran, Islamic Republic of</td>
<td>28%</td>
<td>28%</td>
</tr>
<tr>
<td>Pakistan</td>
<td>16%</td>
<td>38%</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>23%</td>
<td>28%</td>
</tr>
<tr>
<td>Turkey</td>
<td>89%</td>
<td>58%</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>78%</td>
<td>78%</td>
</tr>
<tr>
<td>Tunisia</td>
<td>78%</td>
<td>78%</td>
</tr>
</tbody>
</table>
“Education is the most powerful weapon which you can use to change the world.”
Nelson Mandela, South Africa (1918-)

For successful prevention and control of the cardiovascular disease epidemic, changes to policy, legislation and taxation are not enough. These interventions will not be effective if there is no public understanding, support and demand for them. Some areas lie beyond legislation – for example, the choice of food for families, the amount of salt added in cooking, whether or not to smoke – and here health education is essential to promote healthy choices.

Schools provide an ideal venue for health education. They can teach about risk factors, refusal skills, and the strategies of the tobacco and food industries. For example, young people can analyse how tobacco industry promotion attempts to manipulate them by equating smoking with growing up, freedom and being cool.

Increasing knowledge, and changing beliefs, attitudes and intentions, on their own are not enough to change behaviour. School programmes must also lead by example, by making healthy food available, providing exercise facilities, prohibiting tobacco use at all school facilities and events, and helping students and staff lose weight and quit smoking. Ideally, these activities should be part of a coordinated school health programme, reinforced by community-wide efforts.

The WHO Global School Health Initiative is designed to strengthen international, national and local support for effective school health programmes or “health-promoting schools”. Guidelines have been developed on various factors that affect health, such as tobacco, diet and physical activity.

The WHO Global School-based Student Health Survey is aimed at adolescents aged 13 to 15 years, and covers nine risk or protective factors. Survey results will provide information on trends over time, which is useful for formulation of risk reduction policies.

### World Heart Day

<table>
<thead>
<tr>
<th>World Heart Day</th>
<th>World Heart Federation event</th>
</tr>
</thead>
<tbody>
<tr>
<td>participating countries and territories 2003</td>
<td></td>
</tr>
</tbody>
</table>

#### Heart Health Declarations

See Milestones pp76-81 for further details

#### World Heart Day Themes

- 2000 Physical Activity
- 2001 A Heart for Life
- 2002 Nutrition and Physical Activity
- 2003 Women, Heart Disease and Stroke
- 2004 Children, Adolescents and Heart Disease
- 2005 Obesity

#### World Heart Day Activities 2001

- **Medical activities (e.g. blood pressure testing)**
  - 68.5% of countries
- **Activities to engage the public in physical activity**
  - 65% of countries
- **Scientific activities (e.g. conferences or workshops)**
  - 61% of countries
- **Activities to advocate for a heart healthy diet**
  - 35% of countries
- **Other activities (e.g. charity gala, dance, concert, carnival)**
  - 35% of countries

---

1992 Canada
The Victoria Declaration on Heart Health

2000 Canada
The Victoria Declaration on Women, Heart Disease and Stroke
The Catalonia Declaration: Investing in Heart Health

The Osaka Declaration: Health, Economics and Political Action: Stemming the Global Tide of Cardiovascular Disease

The Milan Declaration: Positioning Technology to Serve Global Heart Health

The Singapore Declaration: Forging the Will for Heart Health in the Next Millennium

Evaluation of World Heart Days 2000-2003

Giving up smoking: International Quit and Win

Number of participating countries and territories:
- 2000: 63
- 2001: 88
- 2002: 90
- 2003: 96

Number of website hits:
- 2000: 300,000
- 2001: 450,000
- 2002: more than 1,000,000
- 2003: more than 2,000,000

Number of participants:
- 1994: 60,000
- 1995: 70,000
- 1996: 200,000
- 1998: 420,000
- 2000: 674,000
- 2002: 1,000,000
- 2004: 1,000,000

Number of countries:
- 1994: 13
- 1996: 25
- 1998: 48
- 2000: 71
- 2002: 76
- 2004: 100

Lifelong health education is essential for improving heart health.

Up to 25% of participants in the International Quit and Win Campaign are off tobacco after one year.

Number of countries and territories is projected to increase each year.
Laws, treaties, policies and regulations have played important roles in the prevention and control of disease. Only governments can legislate for health warnings on cigarettes, introduce mandatory food standards and labelling, crack down on smuggling, set a “pro-health tax policy”, or implement national transport policy. Often governments are the main providers of health care; they decide how funding is allocated, from prevention programmes to treatment, research, and training.

The first international convention that relates specifically to cardiovascular disease is the WHO Framework Convention on Tobacco Control. It was adopted without dissent by the World Health Assembly in Geneva in May 2003, and is currently in the process of ratification. Once 40 countries have ratified the Convention, it will come into effect as a legally binding treaty among those countries. The Convention includes clauses on advertising bans, smoke-free areas, health warnings, taxation, smoking cessation and smuggling.

Cardiovascular disease plans worldwide
Percentage of countries by region with national plans for CVD prevention and control
2001
WHO regions

- **Africa**: 8%
- **Americas**: 30%
- **Eastern Mediterranean**: 53%
- **Europe**: 50%
- **South-East Asia**: 50%
- **Western Pacific**: 40%

"The welfare of the people is the ultimate law."
_Salus Populi Suprema Est Lex._
Cicero (106 BCE-43 BCE)
Smoke-free workplaces

Smoke-free areas in government buildings
2004 or latest available data

- smoking banned
- smoking restricted
- not regulated
- unknown

Smoking in private workplaces banned. Exceptions or limited restrictions may apply to restaurants, bars, and other venues.

First five countries to ratify the Framework Convention on Tobacco Control.

Legislation
Percentage of countries by region with tobacco, and food and nutrition legislation 2001
WHO regions

- tobacco
- food and nutrition

<table>
<thead>
<tr>
<th>Region</th>
<th>Tobacco Legislation</th>
<th>Food and Nutrition Legislation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>43%</td>
<td>22%</td>
</tr>
<tr>
<td>Americas</td>
<td>50%</td>
<td>66%</td>
</tr>
<tr>
<td>Eastern</td>
<td>75%</td>
<td>75%</td>
</tr>
<tr>
<td>Mediterranean</td>
<td>73%</td>
<td>73%</td>
</tr>
<tr>
<td>Europe</td>
<td>80%</td>
<td>84%</td>
</tr>
<tr>
<td>South-East Asia</td>
<td>89%</td>
<td>89%</td>
</tr>
<tr>
<td>Western Pacific</td>
<td>77%</td>
<td>77%</td>
</tr>
</tbody>
</table>

"If you do not repair your gutter, you will have your whole house to repair."
Old Spanish proverb

In 1931, Paul Dudley White noted that there was no specific treatment for coronary heart disease. He described the treatment of high blood pressure as "difficult and almost hopeless". Today, effective and relatively inexpensive medication is available to treat nearly all cardiovascular diseases, including high blood pressure.

Improvements in surgical techniques have led to safer operations. Effective devices have been developed, such as pacemakers, prosthetic valves, and patches for closing holes in the heart. Other developments have led to a wide array of interventions that often make surgery unnecessary.

Together, these advances in treatment improve quality of life and reduce premature death and disability. They also add to the rising costs of health care. Increasingly, high-technology procedures are chosen over less expensive, but nevertheless effective, strategies.

In addition, marked disparities in the quality of treatment can be seen in groups of different race, ethnicity, sex, and socioeconomic status. In essence, many patients who could benefit from treatment remain untreated, or inadequately treated. In future, increased emphasis needs to be placed on the appropriate use of proven treatments for everyone with coronary heart disease or stroke.

Patients reaching blood pressure and blood cholesterol goals during treatment
Percentage of people aged 70 years or below with established CVD who achieve blood pressure goal of less than 140/90 mmHg, or blood cholesterol goal of less than 5.0 mmol/l
2001 selected European countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Blood Pressure Goal</th>
<th>Blood Cholesterol Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>55%</td>
<td>23%</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>57%</td>
<td>28%</td>
</tr>
<tr>
<td>Finland</td>
<td>50%</td>
<td>28%</td>
</tr>
<tr>
<td>France</td>
<td>44%</td>
<td>28%</td>
</tr>
<tr>
<td>Germany</td>
<td>57%</td>
<td>28%</td>
</tr>
<tr>
<td>Greece</td>
<td>36%</td>
<td>36%</td>
</tr>
<tr>
<td>Hungary</td>
<td>63%</td>
<td>40%</td>
</tr>
<tr>
<td>Ireland</td>
<td>50%</td>
<td>46%</td>
</tr>
<tr>
<td>Italy</td>
<td>51%</td>
<td>43%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>56%</td>
<td>49%</td>
</tr>
<tr>
<td>Poland</td>
<td>52%</td>
<td>36%</td>
</tr>
<tr>
<td>Slovenia</td>
<td>38%</td>
<td>32%</td>
</tr>
<tr>
<td>Spain</td>
<td>60%</td>
<td>36%</td>
</tr>
<tr>
<td>Sweden</td>
<td>55%</td>
<td>36%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>49%</td>
<td>47%</td>
</tr>
</tbody>
</table>

Cardiac rehabilitation
Percentage of people with established coronary heart disease advised to participate in cardiac rehabilitation
2001 selected European countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Participation Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain</td>
<td>4%</td>
</tr>
<tr>
<td>Italy</td>
<td>17%</td>
</tr>
<tr>
<td>Finland</td>
<td>18%</td>
</tr>
<tr>
<td>Greece</td>
<td>20%</td>
</tr>
<tr>
<td>Poland, United Kingdom</td>
<td>35%</td>
</tr>
<tr>
<td>France</td>
<td>37%</td>
</tr>
<tr>
<td>Hungary</td>
<td>44%</td>
</tr>
<tr>
<td>Ireland</td>
<td>54%</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>56%</td>
</tr>
<tr>
<td>Germany</td>
<td>59%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>61%</td>
</tr>
<tr>
<td>Belgium</td>
<td>63%</td>
</tr>
<tr>
<td>Sweden</td>
<td>67%</td>
</tr>
<tr>
<td>Slovenia</td>
<td>71%</td>
</tr>
</tbody>
</table>

Proportion of people with high blood pressure receiving treatment:
1 in 4 in Finland, Germany, Spain and Sweden; 1 in 3 in Canada and Italy; 1 in 2 in the United States.
### Types of treatment

Selected medication, devices and operations

<table>
<thead>
<tr>
<th>Medication used in treatment of</th>
<th>Devices</th>
<th>Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 High blood pressure</td>
<td>Pacemakers</td>
<td>Coronary artery bypass</td>
</tr>
<tr>
<td>2 Coronary heart disease</td>
<td>Implantable defibrillators</td>
<td>Balloon angioplasty</td>
</tr>
<tr>
<td>3 Heart failure</td>
<td>Coronary stents</td>
<td>Valve repair and replacement</td>
</tr>
<tr>
<td>4 Arrhythmia (heart rhythm disorders)</td>
<td>Prosthetic valves</td>
<td>Heart transplantation</td>
</tr>
<tr>
<td>5 Blood clotting disorders</td>
<td>Artificial valves</td>
<td>Artificial heart operations</td>
</tr>
</tbody>
</table>

### Simple secondary prevention medication treatments

Percentage reduction in two-year risk of heart attack, stroke or death from CVD in patients with previous coronary heart disease or stroke 2002

<table>
<thead>
<tr>
<th>Medication</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE inhibitors</td>
<td>25%</td>
</tr>
<tr>
<td>aspirin</td>
<td>25%</td>
</tr>
<tr>
<td>beta-blockers</td>
<td>25%</td>
</tr>
<tr>
<td>lipid-lowering</td>
<td>30%</td>
</tr>
</tbody>
</table>

**all four drugs** 75%

### Trends in cardiovascular operations and procedures in the USA

Number of operations and procedures 1981–2001

<table>
<thead>
<tr>
<th>Year</th>
<th>Heart catheterization</th>
<th>Open heart surgery</th>
<th>Coronary artery bypass surgery</th>
<th>Carotid endarterectomy</th>
<th>Cardiac pacemakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>416</td>
<td>159</td>
<td>73</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>1986</td>
<td>222</td>
<td>370</td>
<td>83</td>
<td>67</td>
<td>82</td>
</tr>
<tr>
<td>1991</td>
<td>370</td>
<td>407</td>
<td>83</td>
<td>67</td>
<td>93</td>
</tr>
<tr>
<td>1996</td>
<td>518</td>
<td>518</td>
<td>83</td>
<td>67</td>
<td>93</td>
</tr>
<tr>
<td>2001</td>
<td>1241</td>
<td>1314</td>
<td>1241</td>
<td>1314</td>
<td>1241</td>
</tr>
</tbody>
</table>

In the USA, only 24% of people aged 20 years and above with blood cholesterol of 240 mg/dl or above are receiving drug treatment.
"Let my heart be wise,
It is the gods' best gift."

Euripides Medea, 431 BCE
The future

"I never think of the future - it comes soon enough."
Albert Einstein (1879-1955)

Unlike Einstein, we have to think of the future, and plan now, to reduce the numbers of deaths from coronary heart disease and stroke.

Predictions are by their nature speculative. Nevertheless, this much is certain: the global epidemic of cardiovascular disease is not only increasing, but also shifting from developed to developing nations.

Action can work. There are currently about 800 million people with high blood pressure worldwide. Studies now indicate that in North America, Western Europe, and the Asia-Pacific region, each 10 mmHg lowering of systolic blood pressure is associated with a decrease in risk of stroke of approximately one-third, in people aged 60 to 79 years. Globally, if diastolic blood pressure (DBP) can be reduced by 2%, and by 7% in those with DBP over 95 mmHg, a million deaths a year from coronary heart disease and stroke could be averted by 2020 in Asia alone.

No matter what advances there are in high-technology medicine, the fundamental message is that any major reduction in deaths and disability from CVD will come from prevention, not cure. This must involve robust reduction of risk factors.

"Unless current trends are halted or reversed, over a billion people will die from cardiovascular disease in the first half of the 21st century. The large majority will be in developing countries and much of the life years will be lost in middle age. This would be an enormous tragedy, given that research in the last half of the 20th century showed that cardiovascular disease was largely preventable."

Anthony Rodgers, Clinical Trials Research Unit, University of Auckland, New Zealand, 2004
### Risk Factors

<table>
<thead>
<tr>
<th>Factor</th>
<th>by 2010</th>
<th>by 2020</th>
<th>by 2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smokers Number</td>
<td>1.3 – 1.4 billion</td>
<td>1.4 – 1.6 billion</td>
<td>1.4 – 1.8 billion</td>
</tr>
<tr>
<td>Diabetes Number</td>
<td>221 million</td>
<td>300 million</td>
<td>366 million</td>
</tr>
<tr>
<td>Obesity-Related</td>
<td>15%</td>
<td>20%</td>
<td>25%</td>
</tr>
<tr>
<td>Complications Percentage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health care spending</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>in the USA, people aged</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 to 69 years</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Treatment

<table>
<thead>
<tr>
<th>Category</th>
<th>by 2010</th>
<th>by 2020</th>
<th>by 2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miscellaneous</td>
<td>Full personal medical records</td>
<td>Health systems driven by</td>
<td>Patients' knowledge of their</td>
</tr>
<tr>
<td></td>
<td>stored on smart card.</td>
<td>primary health care</td>
<td>own health equals that of</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to ensure universal access</td>
<td>doctors in the 1990s.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to quality health care</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>services.</td>
<td></td>
</tr>
<tr>
<td>Investigation</td>
<td>Instantaneous computer language</td>
<td>Instantaneous computer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>translation enables patients</td>
<td>language translation enables</td>
<td></td>
</tr>
<tr>
<td></td>
<td>to be understood by doctors</td>
<td>patients to be understood</td>
<td></td>
</tr>
<tr>
<td></td>
<td>in any country.</td>
<td>by doctors in any country.</td>
<td></td>
</tr>
<tr>
<td>Genomics</td>
<td>Minuscule computer, with</td>
<td>Minuscule computer, with</td>
<td></td>
</tr>
<tr>
<td></td>
<td>microarrays, and</td>
<td>microarrays, and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>transmitted electronically</td>
<td>transmitted electronically</td>
<td></td>
</tr>
<tr>
<td></td>
<td>to diagnostic centres, often</td>
<td>to diagnostic centres, often</td>
<td></td>
</tr>
<tr>
<td></td>
<td>in another country.</td>
<td>in another country.</td>
<td></td>
</tr>
<tr>
<td>Artificial body parts</td>
<td>CVD-modifying genes</td>
<td>Genetic manipulation to</td>
<td></td>
</tr>
<tr>
<td>developed</td>
<td>identified.</td>
<td>prevent and treat CVD,</td>
<td></td>
</tr>
<tr>
<td>High technology</td>
<td></td>
<td>including post-operative</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>prevention of re-stenosis</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>of arteries.</td>
<td></td>
</tr>
<tr>
<td>Medication</td>
<td>Six-drug “polypill” will</td>
<td>Six-drug “polypill” will</td>
<td>Drugs developed to raise</td>
</tr>
<tr>
<td></td>
<td>reduce CVD by more than</td>
<td>reduce CVD by more than</td>
<td>HDL-cholesterol (as effective</td>
</tr>
<tr>
<td></td>
<td>80% if taken by everyone</td>
<td>80% if taken by everyone</td>
<td>as effective as statins are</td>
</tr>
<tr>
<td></td>
<td>aged 55 and older, and</td>
<td>aged 55 and older, and</td>
<td>today for lowering LDL-</td>
</tr>
<tr>
<td></td>
<td>everyone with existing CVD.</td>
<td>everyone with existing CVD.</td>
<td>cholesterol).</td>
</tr>
</tbody>
</table>

### Action

<table>
<thead>
<tr>
<th>Category</th>
<th>by 2010</th>
<th>by 2020</th>
<th>by 2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>New causal factors</td>
<td>All newborn babies discharged</td>
<td>Bio-engineered tissues</td>
<td></td>
</tr>
<tr>
<td>discovered for heart</td>
<td>home with CD-ROM containing</td>
<td>available for all heart and</td>
<td></td>
</tr>
<tr>
<td>disease, including</td>
<td>unique genomic maps, with</td>
<td>vascular structures.</td>
<td></td>
</tr>
<tr>
<td>bacteria and viruses.</td>
<td>summaries of CVD, of which</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>they may be at increased</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>risk.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>External glucose sensor</td>
<td>Vaccine produced to switch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>will drive insulin pumps</td>
<td>off nicotine receptors.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>to deliver continuous</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>microdoses of insulin.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WHO Conventions and Goals</td>
<td>Convention on Food ratified</td>
<td>Convention on universal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(covering content, labelling,</td>
<td>access to essential</td>
<td></td>
</tr>
<tr>
<td></td>
<td>taxation, advertising.)</td>
<td>preventive health care, and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>principles of equity in</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>quality care delivery.</td>
<td></td>
</tr>
</tbody>
</table>
BCE–1852

Milestones in knowledge of heart and vascular disorders

Palaeolithic era Spain Oldest anatomical drawing in El Pindal cave of a mammoth with a dark smudge at the shoulder, which is thought to represent the heart.

2698–2598 BCE China Huang Ti, the Yellow Emperor, was thousands of years ahead of his time in writing in Nei Ching (Canon of Medicine): “The blood current flows continuously in a circle without a beginning or end and never stops” and “all the blood is under control of the heart”. He also recorded the association between salt intake and a “hardened pulse”.

1550 BCE Egypt Papyrus Ebers stated that after death the heart becomes the witness of the body’s behaviour during life. To avoid incriminating testimony, the Egyptians buried the heart separately from the body.

600 BCE Greece Alcmaeon noted empty arteries in animals after death and inferred that arteries normally contained air.

400 BCE Greece Hippocrates, the Father of Medicine (460–370 BCE), challenged the belief that illness was caused by the gods; he believed illness was caused by an imbalance of the four bodily humours: yellow bile, black bile, blood, and phlegm. He was also the first to recognize stroke.

310–250 BCE Egypt Erasistratus described the heart, veins, arteries and valves, but claimed that arteries contained “pneuma” (air or spirit or soul), which was replaced each time a person breathed; when an artery was cut, blood rushed in as the pneuma escaped.

131–201 CE Graeco-Roman physician Claudius Galen, with knowledge gained from animals killed by Roman gladiators, described the heart and the movement of blood in the arteries, but claimed that the liver was the centre of the circulation and that the blood passed from the right to the left side of the heart.

980–1037 Persia Avicenna (Ibn Sina) stated that the heart is located centrally to all organs of the body, and that the left side of the heart was created as a store of spirit and soul.


1452–1519 Italy Leonardo da Vinci incorrectly drew the liver as the centre of circulation. But he stated “vessels in the elderly through the thickening of the tunics, restrict the transit of the blood.” This is one of the earliest descriptions of arteriosclerosis.


1510–1559 Padua, Italy Matteo Reaoldo Colombo described the heart valves.

1525–1603 Rome, Italy Andrea Cesalpino noted that the circulation system is a closed system, and was the first in modern times to coin the term “blood circulation”.

1553–1619 Padua, Italy Hieronymus Fabricius demonstrated valves in veins, which help to “prevent dilatation of veins”.

1555 Padua, Italy Andreas Vesalius (1514–1564) stated that the heart, and not the liver, was the centre of the circulation.

1559 Italy Riva di Trento discovered that there are two coronary arteries, each supplying blood to half of the heart.

1628 England William Harvey (1578–1657), a physician, published his thesis that the heart pumped blood around the body, in De Motu Cordis.

mid-1600s Switzerland Jacob Wepfer found that patients who died with “apoplexy” had bleeding in the brain. He also discovered that a blockage in one of the brain’s blood vessels could cause apoplexy.

1706 France Anatomy professor Raymond de Vieussens first described the structure of the heart’s chambers and vessels.

1712–1780 England John Fothergill both forecast the role of psychosocial factors and advised
that a restricted diet “might greatly retard the progress” of coronary heart disease.

1677–1761 **England** Stephen Hales, an English clergyman and scientist, first measured blood pressure by inserting a brass tube into the artery of a horse. This was a scientific experiment, published in 1733, demonstrating that the heart exerts pressure in order to pump blood. The horse died.

1745–1827 **Italy** Alessandro Volta discovered that electric energy was produced by heart muscle contractions.

1749–1832 **England** Edward Jenner, better known for smallpox vaccine, made the essential link between angina pectoris and disease of the coronary arteries.

1752–1832 **Italy** Antonio Scarpa described arterial aneurysm.

1772 **England** William Heberden (1710–1801) described angina pectoris: “they who are afflicted with it, are seized while they are walking (especially if it be uphill, and soon after eating) with a painful and most disagreeable sensation in the breast, which seems as if it would extinguish life if it were to increase or to continue; but the moment they stand still, all this uncasiness vanishes”. He was also the first to write about hyperlipidaemia as a risk factor when he noticed that the serum of an obese patient who suddenly died was “thick like cream”.

1775 **Scotland** John Hunter (1728–1793), a surgical pathologist, wrote “in a sudden and violent transport of anger, he fell down and expired immediately”, illustrating the importance of emotion, stress and anger in precipitating coronary death. Hunter himself suffered from angina pectoris and died suddenly after a violent argument with a hospital colleague.

1785 **England** William Withering described the use of digitalis in coronary heart disease in his monograph *An Account of the Foxglove*. Foxglove had been used for centuries by American Indians.

1791 **Italy** Luigi Galvani discovered that electrical stimulation of a frog’s heart led to contraction of the cardiac muscle.

1799 **England** Caleb Hillier found something hard and gritty in the coronary arteries during an autopsy and “well remembered looking up to the ceiling, which was old and crumbling, conceiving that some plaster had fallen down”. He discovered, however, that the vessels had hardened, and stated that “a principle cause of the syncope anginosa is to be looked for in disordered coronary arteries”.

1815 **England** London surgeon Joseph Hodgson claimed inflammation was the underlying cause of atherosclerosis and it was not a natural degenerative part of the ageing process.

1815 **France** M.E. Chevreul named the fatty substance extracted from gallstones “cholesterol” from the Greek “khole” (bile) and “steros” (solid).

1819 **France** Rene Theophile Laennec (1781–1826), invented the stethoscope. He rolled paper into a cylinder while examining a young woman with cardiac symptoms as he was reluctant to apply his ear to the chest.

1838 **France** Louis René Lecanu showed that cholesterol was present in human blood.

1841 **Austria** Carl Von Rokitansky championed the thrombogenic theory, proposing that deposits observed in the inner layer of the arterial wall derived primarily from fibrin and other blood elements rather than being the result of a purulent process. This theory came under attack from Rudolf Virchow.

1843 J. Vogel showed that cholesterol was present in atherosclerotic plaques.

1844 **Denmark** First pathology report of plaque rupture in a coronary artery in Bertel Thorvaldsen, the celebrated neoclassical Danish artist and sculptor, who died of sudden cardiac death in the Royal Theatre in Copenhagen.

1850 Ventricular fibrillation first described.

1850s Ophthalmoscope invented, allowing direct visualization of arteries at the back of the eye.

1852 **England** Fatty material in the coronary arteries described by Sir Richard Quain, which he attributed to nutrition. He linked the fatty heart to “anguid and feeble circulation, a sense of uncasiness and oppression in the chest, embarrassment and distress in breathing, coma, syncope, angina pectoris, sudden death...”
1856 Germany Rudolf Virchow, a Pole, believed that disease occurred at cellular level, and also described cerebral emboli causing stroke. Virchow also emphasized the societal causes of disease as “disturbances of human culture”.

1867 England Lauder Brunton, pharmacologist, discovered that amyl nitrite relieved angina.

1872 France Gabriel Lippmann invented the capillary electrometer, the precursor of the electrocardiograph.

1893 Holland Willem Einthoven (1860–1927) introduced the term electrocardiogram or ECG/EKG; distinguished five deflections – PQRST (1895); constructed the first electrocardiograph in 1901, which weighed 270 kg, occupied two rooms and required five people to operate it; transmitted the first ECG from hospital to his laboratory 1.5 km away via telephone cable (in 1905); published the first normal and abnormal ECGs (1906) and won the Nobel Prize (1924).

1895 Germany Physicist Wilhem Konrad Roentgen (1845–1923) discovered X-rays, which are still used to visualize the heart.

1896 Italy Scipione Riva-Rocci invented the sphygmomanometer to measure blood pressure.

1897 The introduction of modern aspirin. In one of life’s little ironies, Bayer’s first aspirin advertisements said that the drug did “not affect the heart”.

1906 Germany M. Cremer, first oesophageal ECG by a professional sword swallower. First fetal ECG from the abdominal surface of a pregnant woman.

1907 England First case report of atrial fibrillation by Arthur Cushny, professor of pharmacology at University College, London.

1912 James B. Herrick described heart disease resulting from hardening of the arteries.

1912 First human cardiac catheterization (no X-ray visualization) by Frizt Bleichroeder, E. Unger and W. Loeb.

1915 USA Establishment of organization in New York City, which became the American Heart Association.

1920 USA First ECG of acute myocardial infarction by Harold Pardee.

1923 USA First operative widening of scarred cardiac valve by E. Cutler and S.A. Levine.

1925 United Kingdom Widening of narrowed mitral valve by Souter, who stretched the valve ring with his fingers.

1928 United Kingdom Sir Alexander Fleming discovered penicillin, which is used to treat rheumatic fever.

1928 “Apoplexy” divided into categories based on the cause of the blood vessel problem, and replaced by the term “cerebral vascular accident (CVA)”.

1929 Germany First documented right heart catheterization in human by Werner Forssmann using radiographic techniques.

1931 USA First description of the use of exercise to provoke attacks of angina pectoris by Charles Wolferth and Francis Wood.

1931 USA First artificial cardiac pacemaker, which stimulated the heart by transthoracic needle, developed by Dr Albert Hyman.

1937 USA First prototype heart-lung machine built by physician John Heysham Gibbon, and tested on animals. He performed the first human open heart operation in 1953 using the machine.

1938 USA First human heart surgery, first surgical correction of a congenital heart defect: closure of patent ductus arteriosus performed by surgeon Robert E. Gross.

1944 China First repair of patent ductus arteriosus in China.

1944 USA First operation on “blue baby” (Fallot’s tetralogy) at Johns Hopkins.

1944 USA/Sweden First repair of coarctation of aorta by Crafoord and Grose.

1947 USA First defibrillation of human heart during cardiac surgery, by Claude Beck in Cleveland.

1948 USA “Blind finger” closed heart surgery for mitral stenosis reintroduced by Dr Dwight Harken and Dr Charles Bailey.
1948 USA California physician Lawrence Craven noticed that 400 of his male patients who took aspirin for two years had no heart attacks. By 1956, he had chronicled the health of 8000 patients taking aspirin and found no heart attacks in the group.

1948 USA Start of the Framingham Heart Study where, for the first time, a large cohort of healthy men and women were studied prospectively.

1949 USA Portable Holter Monitor invented by Norman Jeff Holter to record ambulatory ECG.

1950 The International Society of Cardiology established, later joined with International Cardiology Federation and renamed World Heart Federation.

1950 Canada First pacemaker invented by John Hopps.

1952 USA First prosthetic valve implanted in aorta by surgeon Charles Hufnagel.

1952 USA First successful human open heart surgery under hypothermia by Walton Lillehei and John Lewis, who implanted the first synthetic valve in a five-year-old girl who had been born with an atrioseptal defect (hole in her heart).

1952 USA External cardiac pacemaker designed by Paul Zoll.

1953 USA First demonstrated coronary artery disease among young US soldiers killed in action in Korea (later observed in the casualties of the Viet Nam War too) by William F. Enos, Robert H. Holmes and James Beyer.

1954 United Kingdom First carotid endarterectomy by Eastcott, Pickering and Rob.

1954 India Called on WHO to address the coming epidemic of cardiovascular disease in developing countries.

1955 United Kingdom First reported mitral valve replacement by Judson Chesterman.

1955 WHO established Cardiovascular Diseases programme.

1956 USA First report of the successful ending of ventricular fibrillation in humans by externally applied countershock published by Dr Paul Zoll.

1957 First battery-powered external pacemaker.

1958 USA Seymour Furman inserted a pacemaker in a patient who lived for 96 days.

1958 Sweden Internal long-term cardiac pacing by Åke Senning.

1958 Start of development of a selective coronary angiography procedure by Mason Sones.

1959 WHO established Cardiovascular Diseases programme.

1960 USA First replacement of heart valve with Starr-Edwards mechanical valve, developed by Albert Starr (left) and Lowell Edwards.

1960 USA First use of external cardiac massage to restart a heart by J.R. Jude.

1961 USA First direct current defibrillation with external paddles by Bernard Lown and Borough Berkowitz.

1960s First human implant of totally implantable pacemaker.

1964 USA First transluminal angioplasty performed on a narrowed artery in the leg by Charles T. Dotter.

1965 USA Michael DeBakey and Adrian Kantrowitz implanted mechanical devices to help a diseased heart.

1967 South Africa First whole heart transplant from one person to another by Dr Christian Barnard.

1967 USA Saphenous vein coronary bypass graft by Dr Rene Favaloro.

1967 Framingham, USA Physical inactivity and obesity found to increase the risk of heart disease.
1969 USA First use of artificial heart in human by Denton Cooley.

1972 USA The Stanford Three Community Study started (later becoming The Stanford Five-City Project); this showed a 23% reduction in coronary heart disease risk caused by community-based interventions that change lifestyle-related risk factors such as physical activity, dietary habits and tobacco use.

1977 Framingham, USA Effects described of triglycerides and LDL and HDL cholesterol on heart disease.

1978 Framingham, USA Psychosocial factors found to affect heart disease.

1979 South Africa Coronary Risk Factor Study community prevention trial resulted in reduction of smoking, blood pressure and composite coronary heart disease risks.

1981 Framingham, USA Filter cigarettes found to carry as much risk for coronary heart disease as unfiltered cigarettes.


1982 USA First permanent artificial heart, designed by Robert Jarvik, and implanted by Willem DeVries, in a 61-year-old man.

1983 USA List of 246 coronary risk factors published by Hopkins and Williams (list now much longer).

1980s Minimization of random error for the reliable assessment of cardiovascular treatments by introduction of large-scale "mega-trials" (at instigation of Sir Richard Peto).

1986 France First coronary stent implanted by Jacques Puel and Ulrich Sigwart.

1987 Japan M. Okada used a laser to burn channels in the heart muscle to help revascularize the heart in patients with coronary heart disease.

1988 Framingham, USA High blood cholesterol levels found to correlate directly with risk of death in young men.

1988 Framingham, USA High levels of HDL-cholesterol found to reduce risk of death.

1988 ISIS-2 trial shows emergency treatment for heart attacks with aspirin and fibrinolytic "clot-busting" drugs saves lives.

1988 Framingham, USA Isolated systolic hypertension found to increase risk of heart disease.

1988 Framingham, USA Cigarette smoking found to increase risk of stroke.

1990 Randomized trials showed that lowering blood pressure lowers the risk of stroke.

1990 United Kingdom Meta-analysis of trials by Clinical Trial Service Unit (CTSU) in Oxford showed
that lowering blood pressure lowers the risk of coronary disease.

1991 China Tianjin CVD Intervention Programme community prevention trial led to the creation of non-smoking environments and increased sales of low-sodium seasonings.

1992 Canada The Victoria Declaration on Heart Health affirmed that CVD is largely preventable, that there is the scientific knowledge to eliminate most CVD, and that the public health infrastructure and capacity to address prevention were lacking.

1990s USA Hostility (including traits such as anger, cynicism, and mistrust), a major component of type A behaviour, shown to be associated with an increased risk of heart attack and other cardiac complications in healthy persons and patients with coronary heart disease.


mid-1990s Scandinavia, United Kingdom, USA Remarkable improvement in survival of coronary heart disease patients treated with statins.

1995 Spain The Catalonia Declaration: Investing in Heart Health, and its follow-up convention in 1997, emphasized the importance of investments in heart health and provided examples of many successful CVD prevention programmes worldwide.

1998 USA Hypertension gene in men identified.

1998 New advances: gene therapy grows new blood vessels to the heart; strong confirmation that "superspirin" IIb/IIa receptor blocker drugs prevent blood clots; the importance of inflammation in cardiovascular disease recognized; study on the deadly effects of smoking fewer than 10 cigarettes per day.

1998 Singapore The Singapore Declaration: Forging the Will for Heart Health in the Next Millennium.

2000 Canada The Victoria Declaration on Women, Heart Disease and Stroke addressed the importance of science and policy in action and the need to tackle gender disparities in health. It called upon all stakeholders to join forces and take appropriate action to control the cardiovascular disease epidemic.

2000 First World Heart Day, which has become a global annual event.

2000 The entire human genome is mapped.

2000 WHO 53rd World Health Assembly endorsed Global strategy for noncommunicable disease (NCD) prevention and control, which outlines major objectives for monitoring, preventing and managing NCDs with special emphasis on major NCDs with common risk factors and determinants — cardiovascular disease, cancer, diabetes and chronic respiratory disease.

2001 Japan The Osaka Declaration: Health, Economics and Political Action: Stemming the Global Tide of Cardiovascular Disease emphasized the global nature of the CVD burden and highlighted the need to address economic and political factors in order to tackle CVD.

2002 United Kingdom The Heart Protection Study showed that statins could benefit people with diabetes and those with cholesterol levels previously considered low.

2002 USA NASA's Commercial Invention of the Year Award given for the DeBakey Ventricular Assist Device, based on space shuttle technology, and developed by Michael DeBakey (above) and NASA engineer David Saucier. The pump, used to treat heart failure, was one-tenth the size of previous heart-assist devices, and was first used in a patient in 2000.

2003 Switzerland WHO Framework Convention on Tobacco Control adopted at the 56th World Health Assembly.

2003 Switzerland The World Health Report: "Shaping the Future" highlighted CVD as the first of three growing threats that make up the "neglected global epidemics". The report called for action at the national and global levels to prevent and control CVD.

2004 Switzerland WHO Global Strategy on Diet, Physical Activity and Health endorsed by World Health Assembly.

2004 Italy Milan Declaration on Heart Health: Positioning Technology to serve Global Heart Health.
"Live as if you were to die tomorrow. Learn as if you were to live forever."

Mahatma Gandhi (1869–1948)
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Glossary of terms used in this publication

ACE inhibitors: angiotensin-converting-enzyme inhibitors. Drugs used to treat high blood pressure, and to aid healing after a heart attack.

Angina (angina pectoris): pain or discomfort in the chest that occurs when part of the heart does not receive enough blood. Typically, it is precipitated by effort and relieved by rest.

Angioplasty: a non-invasive surgical procedure used to open up blockages in blood vessels, particularly the coronary arteries that feed the heart. Often performed with either a balloon or a wire mesh (stent).

Anticoagulant: medication that delays the clotting (coagulation) of blood.

Arrhythmia: a change in the regular beat or rhythm of the heart. The heart may seem to skip a beat, or beat irregularly, or beat very fast or very slowly.

Arteriosclerosis: a general term for the hardening of the arteries.

Asymptomatic: without symptoms. This term may apply either to healthy persons or to persons with preclinical (prior to clinical diagnosis) disease in whom symptoms are not yet apparent.

Atherosclerosis: one form of arteriosclerosis, where the hardening and narrowing of the arteries is caused by the slow build-up of fatty deposits on the inside lining.

Atrial fibrillation: a common heart rhythm disorder in which the two small upper chambers of the heart (the atria) quiver instead of beating effectively. This quivering makes the heart less efficient, allows blood to pool and form clots, and predisposes to stroke.

Blood pressure: the force of the blood pushing against the walls of arteries. Blood pressure is given as two numbers: systolic pressure (the pressure while the heart is contracting) and diastolic pressure (the pressure when the heart is resting between contractions).

Body mass index (BMI): a measure of weight in relation to height. It is calculated as weight (in kilograms) divided by the square of height (in metres). A BMI of less than 25 is considered normal, 25–30 is overweight, and greater than 30 defines obesity.

Cardiovascular disease (CVD): any disease of the heart or blood vessels, including stroke and high blood pressure.

Carotid stenosis: narrowing of the carotid arteries, the main arteries in the neck that supply blood to the brain.

Cerebrovascular disease: also called a stroke or the brain equivalent of a heart attack. A condition in which a blood vessel in the brain bursts or is clogged by a blood clot, leading to inadequate blood supply to the brain and death of brain cells.

Cholesterol: a waxy substance that circulates in the bloodstream.

Cholesterol plaques: deposits of fat, cholesterol, cellular waste products, calcium and other substances that build up on the inner lining of an artery.

Congestive heart failure: a condition in which the heart cannot pump enough blood to meet the needs of the body’s other organs.

Coronary artery bypass surgery (CABG): A type of heart surgery that re-routes blood around clogged arteries — or “bypasses” them — to improve the supply of blood and oxygen to the heart.

Coronary heart disease: heart disease in which the coronary arteries are narrowed and the supply of blood and oxygen to the heart therefore decreased. Also called coronary artery disease or ischaemic heart disease. It includes heart attack and angina.

Developing country, high mortality: a developing country with high child mortality and high or very high adult mortality.

Developing country, low mortality: a developing country with low child mortality and low adult mortality.

Diabetes mellitus: a chronic disease due to either insulin deficiency or resistance to insulin action or both, and associated with hyperglycaemia (elevated blood glucose levels).

Direct costs: costs associated with an illness that can be attributed to a medical service, procedure, medication, etc., such as X-ray examination, pharmaceutical drugs (for example, insulin), surgery, or a clinic visit.

Disability adjusted life years (DALYs): a measure of overall burden of a disease by combining the years of potential life lost due to premature death and the years of productive life lost due to the disability. One DALY is one lost year of healthy life.
Epidemic: the occurrence in a community or region of cases of an illness, specific health-related behaviour, or other health-related events clearly in excess of what would normally be expected.

Health: a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity.

HDL (high-density lipoprotein) cholesterol: the so-called "good cholesterol". HDL helps remove cholesterol from the blood vessels. High levels of blood HDL protect against heart disease.

Heart attack (myocardial infarction): death of part of the heart muscle as a result of a coronary artery becoming completely blocked, usually by a blood clot (thrombus), resulting in lack of blood flow to the heart muscle and therefore loss of needed oxygen.

Heart failure: see Congestive heart failure.

High blood pressure: a systolic blood pressure of 140 mmHg or greater or a diastolic pressure of 90 mmHg or greater.

Homocysteine: an amino acid produced by the body. Elevated levels of homocysteine in the blood can damage blood vessels and disrupt normal blood clotting, and possibly increase the risk of heart attack, stroke, and peripheral vascular disease.

Indirect costs: costs associated with an illness that occur because an individual or family members cannot work at their usual jobs, because of premature death, sickness, or disability.

Ischaemic heart disease: see Coronary heart disease.

LDL (low-density lipoprotein) cholesterol: the so-called "bad cholesterol". High levels of LDL put people at risk of heart attack.

Lipid: fat or fat-like substance, such as cholesterol, present in blood and body tissues.

MET: metabolic equivalent; a measure of energy expenditure. One MET/min is the amount of energy expended while sitting quietly at rest for one minute.

Obesity: a condition characterized by excessive body fat. Usually defined as a body mass index greater than 30.

Peripheral vascular disease: disease of certain blood vessels outside the heart or disease of the lymph vessels, for example the arteries supplying the limbs, which leads to inadequate blood supply and claudication (intermittent pain on exercise such as walking).

Physical activity: bodily movement that substantially increases energy expenditure.

Premature death: death that occurs at an age earlier than the average life expectancy for the population.

Primary prevention: a strategy that helps to prevent the onset of a disease or condition in people who are at risk but do not already have the disease or condition. Examples are promotion of exercise in the general population, smoking prevention in young people, and also the treatment and control of high blood pressure as a strategy for primary prevention of stroke.

Rheumatic heart disease: damage to the heart valves and other heart structures from inflammation and scarring caused by rheumatic fever. Rheumatic fever begins with a sore throat due to streptococcal infection.

Secondary prevention: a strategy that helps to prevent recurrent disease or complications in people who already have the disease. For example, the use of a daily dose of aspirin by heart attack survivors is an effective strategy for preventing a second heart attack.

Sedentary: denotes a person who is relatively inactive and has a lifestyle characterized by a lot of sitting.

Stent: a device used to support tissues while healing takes place. A stent can keep "tube-shaped" structures, such as blood vessels, open after a surgical procedure. An intraluminal coronary artery stent is a small, self-expanding, stainless steel mesh tube, which is placed within a coronary artery to keep the vessel open.

Stroke: the brain equivalent of a heart attack. A condition in which a blood vessel in the brain bursts (haemorrhagic stroke) or is clogged (embolic or ischaemic stroke) by a blood clot. This leads to inadequate blood supply to the brain and death of the brain cells, and usually results in temporary or permanent neurological deficits.

Transient ischaemic attack (TIA): small stroke-like event, which resolves in a day or less. It is often a warning sign of an impending stroke.

Triglyceride: the chemical form in which most fat exists in food and in the body.
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Deaths from cardiovascular diseases
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Global deaths from CVD

Rheumatic heart disease in children

Deaths from rheumatic fever and rheumatic heart disease in the Aboriginal and non-Aboriginal populations of Australia

Clipboard

Text


PART 2 RISK FACTORS

3 Risk factors

Leading risk factors

Contributory factors

Clipboard

Text
4 Risk factors start in childhood and youth

Maps: Early starters; Clipboard
Detailed country information available at: http://www.cdc.gov/tobacco/global/GYTS.htm

Overweight trends in the USA
CDC, National Center for Health Statistics. Health, United States, 2003 with Chartbook on trends in the health of Americans. Hyattsville, MD, 2003. BMI at or above the sex-age-specific 95th percentile
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Overweight youth

Wow: USA

Clipboard
http://www.who.int/hpr/gs.facts.shtml

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5 Risk factor: blood pressure

Maps: Blood Pressure
http://www.who.int/ncd_surveillance/infobase/

High blood pressure in the USA
http://www.cdc.gov/nchs/data/hus/hus02.pdf

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South Africa Demographic and Health Survey 1998

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Map: Cholesterol
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Wow: USA
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Cardiovascular risks of passive smoking


Smokers don’t know the risks of heart attack

Wow: USA

Wow: China

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8 Risk factor: physical inactivity

Map: Physical activity levels
Non-EU countries


EU countries


Sitting

Physical activity

Physical inactivity by social class in India

Singapore keeps moving

Transport

The global fleet

Wow: Being physically active... Text
Wow: Worldwide, physical inactivity...

Wow: In 1997, in China...
Matters of scale: November/December 1997. Driving up CO_.

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Renner M. Live online discussions. Five hundred million cars, one planet – Who's going to give? 8 August 2003
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Cervero R. Shapeless, spread out, skipped over and scattershot — sprawl sweeps the globe. The World Paper,

9 Risk factor: obesity
Maps: Body mass index
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Geneva, WHO
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Apple shape at higher risk of CVD than pear shape


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10 Risk factor: diabetes

Map: Prevalence of diabetes; Diabetes prevalence and trends; Clipboard

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11 Risk factor: socioeconomic status

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Prevalence of high blood pressure by income in Trinidad and Tobago

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Clipboard
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12 Women: a special case?

Smoking

No time to walk

Walking reduces coronary heart disease

Hormone replacement therapy

Clipboard

Text


PART 3 THE BURDEN

13 Global burden of coronary heart disease

Map: Healthy years of life lost to coronary heart disease
Mortality and burden of disease estimates for countries provided by Colin Mathers (Evidence and Information for Policy, WHO) from analyses prepared for The World Health Report 2003.

Disease burden in men; in women

Clipboard; Text
http://www.medscape.com/viewarticle/420877?We bLogicSession=Pj4P2w61r1rYWKbLSDskpUMbsjmJ xtWvxSNaGHCvd2ranocYJpC|42976445789882471 33/184161393/6/7001/7001/7002/7002/7001/-1

Text

14 Deaths from coronary heart disease

Map: Deaths from coronary heart disease
Mortality and burden of disease estimates for countries provided by Colin Mathers (Evidence and Information for Policy, WHO) from analyses prepared for The World Health Report 2003.

Deaths from coronary heart disease compared with other causes

Change of heart
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15 Global burden of stroke

Map: Healthy years of life lost to stroke
Mortality and burden of disease estimates for countries provided by Colin Mathers (Evidence and Information for Policy, WHO) from analyses prepared for The World Health Report 2003.

Stroke in young people

Oral contraceptives

Wow: United Kingdom
Wow: Stroke burden, 2020

Clipboard

Text


16 Deaths from stroke
Map: Struck down
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Stroke compared with other causes of death; Wow: Worldwide...

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Price of weekly dose of medication


The cost of risk factors


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Wow: Aspirin

PART 4 ACTION

18 Research

Map: CVD research publications; Regional research

Clinical trials
Search by authors, 24 February 2004.

Research funding by the National Institute of Health in the USA

Wow: United Kingdom


Clipboard


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20 Prevention: personal choices and actions

Personal choices in lifestyles and behaviour; Personal actions for safeguarding cardiovascular health

Young people

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Noncommunicable disease prevention and control; Availability of equipment; Medical professionals; Antihypertensive drugs

Use of medications in stroke and coronary heart disease

Wows: Finland; Japan; New Zealand; Mauritius

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22 Health education

Map: World Heart Day

World Heart Day: themes; activities; Evaluation of


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23 Policies and legislation

Map: Smoke-free workplaces

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Cardiac rehabilitation; Patients reaching blood pressure and blood cholesterol goals during treatment

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Wow: Proportion of people...


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25 Future
DALYs; Deaths
Risk factors


Economic costs

Action


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Cardiothoracic Surgery Network:
http://www.ctsnet.org/
Chain of Hope:
http://www.chainofhope.org
Children's HeartLink:
http://www.childrensheartlink.org/
Children's Hearts:
http://www.childrenshearts.org.uk
Clearinghouse for Tobacco Control (South East Asia):
http://www.prn2.usm.my/pages/about.asp
Coeurs pour Tous (Hearts for All):
http://www.cptg.ch/fr/start.htm
Congenital Heart Information Network:
http://www.tch.in.org

Congress of Neurological Surgeons:
http://www.neurosurgeon.org
Consortium for Southeastern Hypertension Control (COSEHC):
http://www.coschc.org/
East Meets West:
http://www.eastmeetswest.org
Eastern Mediterranean Network on Heart Health, (EMNHH):
http://emnhh.homestead.com/files/index.htm
The Endocrine Society:
http://www.endo-society.org/
European Association for Cardiothoracic Surgery:
http://www.eacts.org/
European Heart Institute:
http://www.european-academy.at
European Heart Network:
http://www.ehnheart.org/index2.asp
EMASH European Medical Association on Smoking and Health:
http://emash.globalink.org/
ENSH European Network for Smoke-free Hospitals:
http://ensh.free.fr/
ENSP European Network for Smoking Prevention:
http://www.esnp.org
European Network of Young People and Tobacco:
http://www.ktl.fi/enypat/
European Network of Quitlines:
http://www.quitlines-conference.com/
European Society for Noninvasive Cardiovascular Dynamics:
http://www2.mf.uni-lj.si/~esnicvd/
European Society of Cardiology:
http://www.escardio.org/
European Society of Hypertension:
http://www.eshonline.org/
European Stroke Initiative:
European Union of Non-smokers:
http://www.globalink.org/tobacco/docs/eu-docs/uecn.htm
Framework Convention Alliance (FCA):
http://www.ftc.org/
G8 Telematics Heart Health Project:
http://www.med.mun.ca/g8hearthealth/
Gift of Life International Inc.:
http://www.giftoflifeinternational.org/
Global Connection International:
http://www.gcworld.org
Global Cardiovascular Infobase (in English and Spanish):
http://www.cvidinfobase.ca/
Global Healing: http://www.globalhealing.org
Global Health Information Network:
http://www.healthnet.org/
Global Partnerships for Tobacco Control:
http://www.essentialaction.org/tobacco/
Globalink, IJACC International Union against Cancer:
http://www.globalink.org/
Healing the Children:
http://www.healingchildren.org
Heart Care International:
http://www.heartcareintl.org
HeartGift Foundation:
http://www.heartgift.org/index.html
The Heart of a Child Foundation – Little Hearts on the Mend:
http://www.heartsonthemend.org
Heart-to-Heart International:
http://www.hearttoheart.org/
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"Heart disease and stroke rob too many people of precious years of quality life. This one-of-a-kind atlas serves as a key resource for those on the frontlines of health." Dr Julie Gerberding, Director, Centers for Disease Control and Prevention, Atlanta, Georgia, USA

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Heart disease can no longer be seen as the problem of overworked, overweight middle-aged men; in today’s world, we are all – women and children too – at risk. One in three deaths worldwide – 17 million deaths each year – is due to cardiovascular disease.

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