Each year in Europe, cancer kills about 2 million people and more than 3 million new cases appear. Almost 6 million people are currently living with cancer.

The most common sites at which cancers appear are breast in women, prostate and lung in men and colon and rectum in both sexes. Cancer is responsible for more than one death in four. Lung cancer kills more people than any other cancer. More than 40% of cancer deaths in Europe are presently due to tobacco, diet and infections. Tobacco smoking - past and current - and unhealthy life-style habits, together with the increasing proportion of elderly people, will result in a doubling of the number of new cases by 2020, particularly in Southern and Eastern Europe. All over Europe, the five-year survival rate of cancer patients is between 30% and 60%. In recent decades, the survival rates from many types of cancer have improved substantially, except for cancers of the lung, pancreas and liver. Survival rates from cancer differ considerably from one country to another, indicating that in many places the cure rates could be improved.
Europe’s cancer burden

Cancer control programmes comprise two basic components: assessing the magnitude of the cancer burden and estimating the effect of avoiding exposure to identified causative agents.

Estimating the burden

The first step in implementing efficient cancer prevention strategies is to assess the magnitude of the cancer problem in the geographical area in which the strategies are to be implemented. Much work has been focused on quantifying patterns of mortality and incidence and, more recently, of the survival of cancer patients [1–3]. At the end of the twentieth century, almost 2.8 million new cases and 1.9 million deaths from cancer were being observed each year throughout Europe, placing cancer diseases as the second cause of death. The proportion represented by deaths from cancer among deaths from all causes varies from 24% in Eastern Europe to 27% in Southern Europe for males and from 21% in Eastern Europe to 29% in Northern Europe for females [4]. The relatively low frequency among women in Eastern Europe is related to the fact that they have a higher proportion of deaths from cardiovascular diseases. When the comparisons are restricted to people aged 45–64, the relative frequency increases to 45–50% for both sexes in almost all countries, placing cancer diseases as the first cause of premature deaths.

Estimating the burden

Geographical distribution

Time trends:
Incidence, incidence by site, mortality, and survival

Avoidable cancers

For the purposes of this chapter, Europe is divided into four regions:

Eastern: Belarus, Bulgaria, Czech Republic, Hungary, Moldova, Poland, Romania, Russian Federation, Slovakia, Ukraine. Northern: Denmark, Estonia, Finland, Iceland, Ireland, Latvia, Lithuania, Norway, Sweden, United Kingdom. Southern: Albania, Bosnia and Herzegovina, Croatia, Greece, Italy, Macedonia, Malta, Portugal, Slovenia, Spain, Federated Republic of Yugoslavia and Montenegro. Western: Austria, Belgium, France, Germany, Luxembourg, Netherlands, Switzerland
Geographical distribution

Figure 1 shows the incidence and mortality rates for males in Europe (standardized by age to the world population) [2] for all types of cancer except skin cancer other than melanoma. The incidence rates vary from 263 per 100,000 males in Northern Europe to 319 in Western Europe. The age-standardized mortality rate is lowest in Northern Europe (168) and highest (200) in Eastern Europe. There are, however, large variations within areas of Europe, as shown on the maps. The ratio of incidence/mortality, which gives a rough estimate of the proportion of cure, is highest (1.71) in Western Europe and lowest (1.45) in Eastern Europe.

The relative frequency of cancers at different sites also varies from one country to another and may partly explain the disparities in the incidence/mortality ratios for males. Each country should examine its own data and determine its priorities for cancer prevention and care. Nevertheless, some common goals can be identified for Europe. The most frequent cancers among men are those of the prostate, lung and colon and rectum in Northern and Western Europe; cancers of the lung, colorectum and bladder in Southern Europe; and cancers of the lung, stomach and colorectum in Eastern Europe (Figure 3).

Among women, the rates of breast and colorectal cancers are high in all European regions; the rates for lung cancer are high in Northern and Western Europe, and high rates are seen for cancer of the corpus uteri in Southern Europe and for cervical cancer in Eastern Europe (Figure 4).

Time trends

Trends in cancer incidence

Data on the incidence of cancer are provided by cancer registries. Population-based cancer registration is a relatively recent development and remains restricted to certain countries or parts of countries. Incidence rates by country are frequently estimates derived from cancer mortality rates and the available incidence/mortality ratios.

As the incidence of cancer increases steeply with age, and because life expectancy is improving everywhere in Europe, the number of cancer cases is on the increase. At the same time, about one-third of new cancer cases are related either to greater exposure to risk factors or to the fact that more have been found by more intensive screening [5]. During the next 20 years, the impact of both ageing and increasing exposure to risk factors on the absolute numbers of cases will be quite dramatic.

Cancer incidence rates have generally increased in both males and females throughout Europe since the Second World War [6]. Three groups of trends have been observed over the past 20 years:

• In countries in Southern and Western Europe—Austria, Belgium, France, Germany, Luxembourg, Italy, Spain and Switzerland—men have experienced a large increase in the incidence of prostate cancer, a decrease or plateau in the incidence of lung cancer and a substantial decrease in the incidence of stomach cancer. Among women, the incidence of breast cancer continues to increase [7], lung cancer rates are rising especially for young women [8], and the incidences of stomach and cervical cancers are greatly decreasing. In both sexes, the
Incidence of and mortality from major cancers in men in Europe

- In Northern European countries—Ireland, the Netherlands, the Nordic countries and the United Kingdom—there has been a decrease in the incidence of lung cancer among men. In the Netherlands and the Nordic countries, there has been a dramatic increase among women, whereas in Ireland and the United Kingdom, women’s lung cancer rates have begun to fall [8]. The trends for other cancer sites are similar to those in southern and western Europe.

- In Eastern Europe and part of Southern Europe, the incidences of lung cancer in men and breast cancer in women are still increasing. For both sexes, the incidence of stomach cancers is still high, and for women the incidence of cervical cancers is also high.

Figure 3

Incidence of and mortality from major cancers in women in Europe

- Trends in incidence by cancer site
  The incidence of lung cancer is increasing alarmingly all over Europe, except in Ireland and the United Kingdom where the incidence has been decreasing since the 1980s [8]. Lung cancer incidence trends match the tobacco consumption trends of previous decades in each country. The incidence rates of colorectal cancers have been stable or slightly increasing, except among younger individuals in Denmark and the United Kingdom, where they are decreasing [6].

- The incidence of prostate cancer is increasing in all countries. This increase may, however, reflect the increased diffusion of screening cancer have been stable or slightly increasing, except among younger individuals in Denmark and the United Kingdom, where they are decreasing [6].
for prostate-specific antigen over the past 10 years [9] (Figure 5). Men have also had an increase in the incidence of cancers of the head and neck and oesophagus, except in France where the incidence of such cancers is clearly decreasing, consequent to the decrease in alcohol consumption over the past 20 years [10].

The incidence of breast cancer has increased by 1-3% per year over the past 30 years. Nevertheless, the rates have stabilized in England, France, Italy, Scotland and Wales, and have recently declined in Iceland and Sweden [7]. The incidence of cervical cancer has generally decreased, except in Eastern Europe and among young women in Germany, Norway and the United Kingdom. The decrease may be due in part to screening programmes. The incidence of stomach cancer has been decreasing for both men and women at an annual rate of 5% for the past 25 years, except in Greece, Italy, Portugal and most eastern European countries, where the decrease has been much smaller and more recent. An increase in the incidence of adenocarcinomas of the oesophagus and gastric cardia has been observed in the past few years in Denmark, Italy, Switzerland and the United Kingdom [11]. The incidence rates for melanoma, non-Hodgkin lymphoma and renal and thyroid cancers have been increasing in all parts of Europe. In Southern Europe, increase incidences of pancreatic and liver cancers have been observed.

Trends in cancer mortality

Data on deaths from cancer (mortality rates) are derived from death certificates. In Europe, data are available in most countries since 1950. In the 15 Member States of the European Union (EU), a long-term rise in age-standardized mortality rates, which peaked in 1988, fell for males and females combined by 9% between 1988 and 1997 [12]. In some countries, however, and particularly in Eastern Europe, the trends in mortality rates are still rising [13], as illustrated in Figure 6. Long-term trends in mortality from major cancers among men in the EU are shown in Figure 7. The fall in mortality rates from lung cancer has been appreciable (-11%), from a peak of 52.4 per 100,000 men in 1985-89 to 46.6 in 1995-98 (Figure 8). A fall of 11% was also observed for deaths from colorectal cancer. In contrast to the increase in the incidence of prostate cancer, the mortality rates from cancer at this site have tended to stabilize or to decline somewhat over the past few years in some countries. The decrease in mortality from gastric cancer has persisted, with a fall of 30% during the past decade alone. Pancreatic cancer mortality rates have shown a decline of 3% in recent years. During the past decade, mortality rates have decreased by 12% for urinary bladder cancer and by over 5% for cancers of the mouth, pharynx and oesophagus. Corresponding figures for women in the EU are given in Figure 9. The mortality rates declined during the past decade, by 7% for breast cancer, 21% for colorectal cancer, 26% for uterine (cervix and corpus) cancer, 31% for stomach cancer and 11% for leukaemia. The mortality rates were stable for ovarian and pancreatic cancers, but there was a 15% rise in female deaths from lung cancer between 1985 and 1995 all over Europe, except in Ireland and the United Kingdom. Lung cancer is therefore approaching colorectal cancer as the second leading cause of mortality from cancer among women in the EU [12].
In all, the rates of death from most of the common cancers have shown favourable trends for both sexes over the past decade in the 15 Member States of the EU, but not in other European countries, particularly in Eastern Europe (Figures 10 and 11) [4,14].
In the EU, some of the decrease in mortality from leukaemia and breast cancer is due to therapeutic advances [15]. The decrease in death from breast cancer is attributable to earlier diagnosis and screening, which could account for the differences between countries (Figure 12). Screening is the major determinant of the persistent fall in mortality from cancer of the cervix uteri [16]. Improvements in food preservation and nutrition balance are probably the main determinants of the favourable trends in stomach cancer in both sexes (Figures 13 and 14). Mortality rates from several neoplasms that had shown long-term increases up to the mid-1980s in the EU have tended to level off over the past decade.

These include pancreatic cancer for both sexes and ovarian cancer. The main difference in cancer mortality rates between females and males in the EU is for lung and other tobacco-related cancers (Figures 15 and 16). Owing to declines in incidence in some countries, the mortality rates from lung cancer have decreased overall by more than 10% among men over the past 10 years. A similar fall was observed for urinary bladder cancer, which may also indicate decreased exposure to occupational carcinogens. With the exception of France, where there were large decreases [10], the decrease in mortality from cancers of the head and neck and oesophagus was smaller (3–5%). These cancers are strongly related to consumption of both alcohol and tobacco.

In contrast, except in Ireland and the United Kingdom, the rates of lung cancer mortality among women in the EU have risen by 15% over the past decade, following the increase in incidence which reflects the persistent spread of the tobacco epidemic among European women. In some northern European countries, mortality from lung cancer exceeds that from breast cancer.
With non-Hodgkin lymphomas in both sexes, lung cancer among women is therefore one of the few cancers that has shown an upwards trend in mortality rates in the EU. The rates for death from lung cancer among women in the EU (except for the high rates in Denmark, Ireland and the United Kingdom) are, however, still about one-third of those in the USA and 50% lower than the rates for death from breast cancer in the EU [12]. Integrated, effective interventions to reduce smoking should therefore still help European women to avoid the current tobacco-related cancer epidemic occurring presently in Denmark, Ireland, the United Kingdom and the USA.

**Trends in survival from cancer**

In the EU, the rates of long-term (5-10 years) survival from many types of cancer have improved considerably over the past few decades, because of advances in early detection and treatment. Other reasons are probably mainly survival from cancer, are attributable mainly to new treatments. For breast cancer, early detection and improvements in treatment are the main explanations of the increased survival. Nevertheless, no progress has been made in the prognoses for lung, liver or pancreatic cancers. Figure 17 presents 5-year survival rates from cancers at various sites, estimated from the numbers of incident cases in 1985 and 1989 in the EU [3].

The Eurocare-2 study [3] showed that European populations vary considerably in their rates of survival from cancer, possibly indicating that cancer care facilities could be improved in some areas. The rates for tumours with a good prognosis generally appear to be lower in Eastern Europe than in other areas. This study showed that the significant factors that influence survival rates are: the proportion of the gross national product spent on health, the per cent unemployment, the number of hospital beds, the number of computed tomography scanners available per million population, life expectancy at birth, and sex. For most tumours that affect both sexes, women survive longer than men, probably partly due to greater body awareness, which leads to earlier diagnosis. These findings indicate that inequality of access to and availability of health facilities may contribute to inter-country differences in survival.

### Avoidable cancers

The second fundamental step in any cancer control programme, after the magnitude of the cancer problem has been assessed, is to estimate the expected effect, expressed as the number of cases or deaths that could theoretically be prevented by avoiding exposure to causative agents. As mentioned above, the first step is to quantify the proportion of the cancer burden that can be explained by known causes. These figures provide the baseline of maximum achievable benefit relative to the total burden. In most cases, however, the probable impact will be smaller, as it depends on whether the exposure can be modified and, if so, on the efficacy of the intervention in reducing the prevalence of the exposure.

It has been known for a long time that risks for cancer are determined by the environment in general, health behaviour and external factors. This is illustrated, for example, by the observation in 1713 of an excess risk for breast cancer among nuns and the observation in 1795 of an excess risk for scrotal cancer among chimney sweeps. Data on cancer-causing agents accumulated during the 1970s, and these are reviewed in the Monographs on the Evaluation of Carcinogenic Risks to Humans of the International Agency for Research on Cancer (IARC). Many of the agents evaluated were industrial chemicals, and the evidence on carcinogenicity for many of them came from experiments in animals. Interest therefore naturally arose in quantifying the contribution of these agents to the causation of human cancer. In 1979, Higginson and Muir [17] analysed data on cancer incidence from 1973, to identify the lowest observed rate for each cancer site. On the basis of this analysis, they reached the conclusion that ‘80% of all cancers are due to environmental causes and are therefore in principle preventable.’

The first comprehensive quantification of the causes of human cancer was performed in 1981 by Doll and Peto [18], who quantified the contributions of various causes to cancer deaths in the population of the USA under 65 years of age. They identified two major causes: tobacco smoking and diet. Tobacco smoking was estimated to be the cause of 35% of all cancers. The evidence that diet was the other major cause was mostly indirect, however, and the data were often inconsistent. It was thus assumed that diet was responsible for somewhere between 10% and 70% of human cancers, with 30% as the best point estimate. Since that time, few new causes of cancer have been identified. Identification of the role of human papillomaviruses (HPVs) in cervical cancer has nonetheless further increased the perspectives for cancer control through immunisation, which were opened by the finding that hepatitis B virus and otherviruses were associated with cancer. In areas such as nutrition, which once appeared to be promising, little definitive evidence amenable to primary prevention has been obtained. Table 1 lists the main groups of factors that have been shown consistently to increase the risks for cancers at specified sites. Not all the identified causes of cancer are equally modifiable. For example, women who have their first child after the age of 35 have twice the risk for breast cancer as women who have their first child before the age of 30. A distinction must therefore be made between identified causes of cancer and avoidable causes of cancer. There is, of course, no clear line between the two, as it depends on the extent to which we find our environment modifiable.

In 1997, the number of avoidable cancers was estimated for the Nordic countries [19] on the basis of data on cancer incidence, as all the Nordic countries have high-quality, nationwide cancer registers. In addition, data on the prevalence of exposure to cancer risk factors were used. Diet was not included in the estimation owing to uncertainty about the associated risk estimates and the lack of detailed data on food intake, and all liver cancers were attributed to excessive alcohol consumption. The estimates are listed in Table 2. A total of 27% of all cancers were estimated to be preventable.
avoidable, with tobacco smoking as the main contributor. Some cases of liver cancer in (mostly Southern) Europe may be caused by infection with hepatitis B virus. This is the background for the recent EU recommendation for hepatitis B virus immunization programmes [20]. IARC has since estimated that more than 40% of cancer deaths in Europe are presently due to tobacco, diet and infections [21]. The estimates given above are for cancers that can be avoided by changing exposure, which is usually considered to be primary prevention. Another control measure is secondary prevention in the form of early detection by screening and early diagnosis. The aim of early detection is to reduce mortality from cancer. Some cancer screening tests also detect precancerous lesions, thereby leading to prevention of the development of invasive tumours. Cervical dysplasia is detected by Pap smear and it has been estimated that 91% of squamous-cell carcinomas of the cervix uteri can be avoided by Pap smear screening every third year [22]. There is increasing evidence that removal of adenomas detected in the large bowel by flexible sigmoidoscopy and colonoscopy [23] decreases the incidence of colorectal cancer [23], and adenomas. Cancers at some sites can therefore be avoided by screening. The following chapters discuss the various possibilities for decreasing cancer risks and decreasing mortality due to these diseases.

The following chapters discuss the various possibilities for decreasing cancer risks and decreasing mortality due to these diseases.

### Table 1

<table>
<thead>
<tr>
<th>Factors that increase risks for cancer at the indicated sites</th>
<th>Cancer group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active and passive tobacco smoking</td>
<td>Lung, oral cavity, pharynx, larynx, oesophagus, urinary bladder, stomach, pancreas, liver, kidney</td>
</tr>
<tr>
<td>Diet, excess body weight, little physical activity</td>
<td>Colon, breast after menopause, endometrium, kidney</td>
</tr>
<tr>
<td>Alcohol consumption</td>
<td>Head and neck, oesophagus, liver, breast</td>
</tr>
<tr>
<td>Reproductive history</td>
<td>Breast, cervix, endometrium, ovary</td>
</tr>
<tr>
<td>Occupational exposures</td>
<td>Lung, urinary bladder, kidney, skin, larynx, haematopoietic system</td>
</tr>
<tr>
<td>Ionising radiation, ultraviolet radiation</td>
<td>All malignant neoplasms, skin, brain and nervous system</td>
</tr>
<tr>
<td>Infectious agents</td>
<td>Liver, stomach, cervix uteri, testis, genital organs, haematopoietic system, urinary bladder</td>
</tr>
</tbody>
</table>

### Table 2

| Proportions of all cancers avoidable in the Nordic countries annually, around the year 2000, both sexes |
|---|---|
| Environmental or lifestyle factor | % |
| Tobacco smoking | 14.2 |
| Passive smoking | 0.1 |
| Alcohol consumption | 1.1 |
| Occupation | 1.7 |
| Radon | 0.2 |
| Man-made ionising radiation | 1.9 |
| Solar radiation | 4.2 |
| Obesity (body mass index > 30) | 8.6 |
| Infection with human papillomavirus or Helicobacter pylori | 2.6 |
| Total | 26.6 |

Source: Dohm et al.[59]

### Key references