

# Cancer mortality in central–eastern Europe: facts behind the figures

Lajos Döbrössy

An epidemiological assessment of the status and trends of cancer mortality shows that Europe is still divided by the rate of cancer death. Overall, cancer mortality in Europe has been steadily decreasing since the early 1990s. However, when the data are broken down, the burden of cancer in the central–eastern European countries is substantial, and mortality has actually continued to increase. Differences in lifestyle and environmental exposure are the most likely causes, and these are inevitably linked to political, social, and economic inequalities. For the time being, improvements in the health of the population are not a high priority for the new democratic governments. Even if attempts at cancer prevention are eventually realised, a major cancer burden will persist for many decades to come.

*Lancet Oncol* 2002; **3**: 374–81

Epidemiology is the study of the distribution and the determinants of a disease in specified populations. Epidemiological findings can be used to develop strategies for disease control.<sup>1</sup> Equally, cancer epidemiology is also the study of differences in incidence among population groups and the factors that affect these variations.<sup>2</sup>

Mortality data show that there are striking differences in the cancer burden between the societies of the European countries (figure 1), and that these differences will continue to exist in the predictable future. Furthermore, the current burden and trends are least favourable for central and eastern Europe.

This review has three aims: first, to describe the extent and nature of the cancer burden in Europe, particularly the central–eastern European (CEE) countries; second, to explore the possible reasons for regional variation in cancer burden; and third, to discuss what the future may hold for the CEE countries.

## Data accrual and analysis

### Measures of cancer burden

“Cancer burden” is a concept without formal definition, but it implies a quantity of a particular disease within a community. In this paper, age-standardised mortality rates are used as a measure of cancer burden. The use of incidence rates would have been more informative because they provide a direct measure of the probability of developing cancer and do not depend on either the biological aggressiveness of the tumour or the degree of medical intervention. However, the use of incidence data for regional estimates is severely limited by the poor coverage of the European cancer registries. (Cancer registries are generally



Figure 1. Geopolitical changes across Europe are affecting cancer mortality.

regarded as the only reliable source of incidence information.<sup>3,4</sup>)

### Source of data

Mortality data have been obtained from the statistical database of the European Regional Office of the World Health Organization (WHO).<sup>5</sup> This database contains national vital statistics from all member countries of WHO.

Data quality strongly influences the confidence with which conclusions can be drawn. In general, the quality of mortality data is only as good as the quality of death certification in any particular country, and similarly, mortality depends on the quality of medical care. Nevertheless, for many of the CEE countries, national mortality statistics provide the only source of data on cancer patterns and thus we must accept that the mortality data collected by the WHO database are reliable, complete, and commensurable for comparative analyses.

LD is the former Regional Adviser for cancer control in the European region of the World Health Organization. He is currently a special adviser for the World Bank's "Close the gap in public health" programme, and for the Hungarian Ministry of Health's "Secondary prevention of cancer" project.

Correspondence: Dr Lajos Döbrössy, Parti út 33. H-2181 Iklad, Hungary. Tel: + 36 28 403 228. Fax: + 36 28 403 228. Email: [dobrossy@freemail.hu](mailto:dobrossy@freemail.hu)

**Geographical breakdown**

The European Region of WHO includes all the countries of Europe. The WHO considers several additional countries, such as Israel and some central-Asian countries, which are not part of the geographically defined Europe, as member states of the European Region. Therefore, data from these countries are also included in the statistical database of the European Regional Office.

In this paper, the patterns and trends of cancer mortality are presented for Europe as a whole, and for its various geopolitical regions. Calculations have been made for: (1) the European average, which includes mortality data reported from all member countries; (2) the European Union (EU) average, which includes the member countries of the EU except Denmark, Finland, and Sweden; (3) the Nordic average (including Denmark, Finland, Iceland, Norway, and Sweden); and (4) the CEE average. (An analysis of the other WHO-defined European subregions, for example, the former Soviet republics, collectively grouped together as the New Independent States [NIS], countries of the central-Asian Regions, and Israel are beyond the scope of this paper.)

Interpretation of some of the averages calculated for the respective countries and geopolitical regions should take into account the substantial political change that has occurred in Europe, partly as a result of the gradual accession of some countries into the European Union, and partly because of the disintegration of the former “eastern bloc” and the Soviet Union. In some cases, inconsistencies result from the combination of data from ex-countries or present countries of the European region—eg, geographical changes in Czechoslovakia and Yugoslavia.

Although this paper focuses on the CEE countries (Albania, Bosnia-Herzegovina, Bulgaria, Croatia, Czech Republic, Hungary, Macedonia, Poland, Romania, Slovakia, Slovenia, and Yugoslavia), the Baltic countries (ie, Estonia, Latvia, and Lithuania) are not included in CEE average. The reason is that WHO groups these

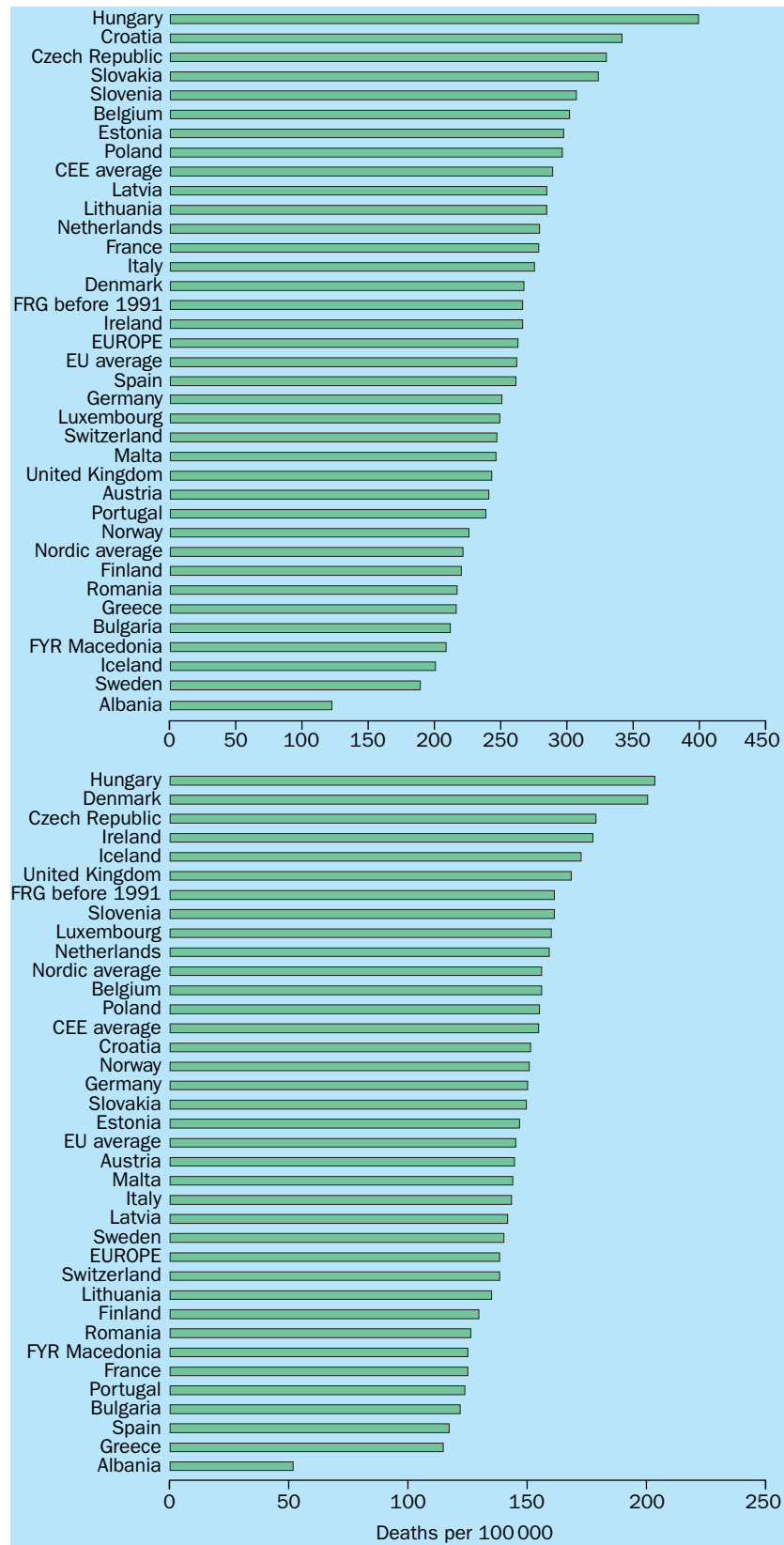


Figure 2. Variation in cancer mortality across Europe. Top panel: ranking order for all cancer types in 1997 per 100 000 male population. Bottom panel: ranking order for all cancer types in 1997 per 100 000 female population.

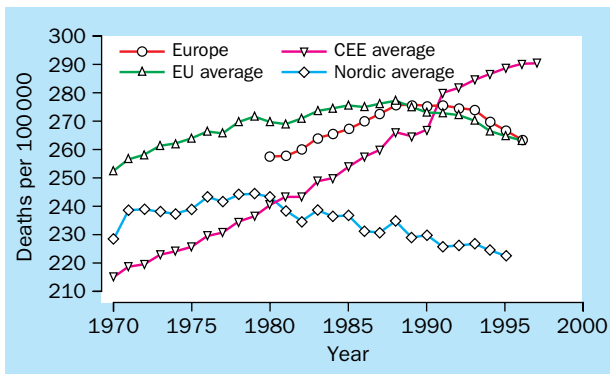


Figure 3. Trends in overall cancer mortality among male populations, 1970-77. Age-standardised mortality, all cancer types, all ages, per 100 000 people.

countries into an NIS average, so that trend analyses before the geopolitical changes in 1990 are possible. However, these technicalities do not prevent us from deriving some interesting conclusions about regional variation in cancer mortality within Europe.

### Cancer burden in Europe and the CEE countries

#### Overall cancer mortality

The cancer mortality rates in Europe vary widely from country to country (figure 2), for example, from 400 deaths per 100 000 in Hungary to 120 deaths per 100 000 in Albania. In 1997, ten of the 11 highest mortality rates in Europe for all types of cancer in male populations were seen in the CEE countries (figure 2, top). Hungary, Croatia, the Czech Republic, Slovakia, and Slovenia topped the list. The only EU country in this group was Belgium, which, during the 1980s had the highest cancer mortality of any European country. Among female populations, Denmark ranked between Hungary and the Czech Republic, and the highest rates occurred in Ireland, Iceland, and the UK. Most CEE countries were in the middle of the ranking (figure 2, bottom).

Changes in mortality over time show that rates are highly divergent within Europe (figure 3). The overall age-standardised mortality rates for the male population steadily increased in Europe as a whole during the 1970s, reaching a plateau in the mid-1980s; the increase, however, was most striking in the CEE countries. After 1980, the rates started to fall, first in the Nordic countries, and then in the countries of the EU. CEE is the only geopolitical region in Europe where the mortality continued to increase. Since the early 1990s, the highest mortality rates have been seen in the CEE countries—in stark contrast to the 1970s when the death toll was highest in western Europe.

Overall cancer mortality is lower for the female than the male population, and the trends also differ (figure 4). Mortality has been steadily declining since 1970 in all countries except the CEE region. In this part of Europe, rates are still increasing and will soon overtake those in the Nordic countries, which used to have the highest proportion of cancer deaths in Europe.

The CEE average includes all the mortality rates observed in the 12 countries of that region. Countries with

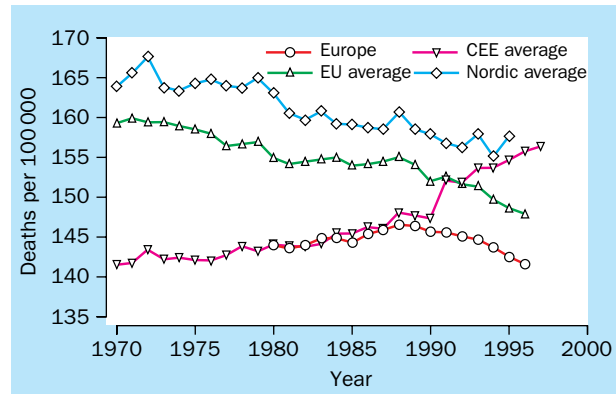


Figure 4. Trends in overall cancer mortality among female populations, 1970-77. Age-standardised mortality, all cancer types, all ages, per 100 000 people.

rates below the regional average are generally in the south—eg, Albania, Bulgaria, and Romania. This finding is consistent with the observation that mortality from several cancer types is low in southern (Mediterranean) countries compared with central and northern Europe,<sup>6</sup> but we should remember that most CEE countries, particularly Hungary, but also some of the more southerly countries, have increasing rates overall.

#### Premature death

Overall mortality is strongly influenced by the disease patterns of elderly people: most cancer deaths occur in people over 65 years of age. Therefore, the cumulative death rates of those people dying before their 65th year are considered as “rates of premature death”. The proportion of the population over 65 years old is increasing in most countries, and thus the practice of focusing on younger people in data analyses has been criticised because it may hide the importance of the cancer problem after the retirement age, particularly in terms of demand for care.

As figure 5 shows, below the age of 65, mortality rates in the European average have been in decline since the mid-1980s. In the CEE region, however, the rates continued to increase until 1991, before reaching a plateau, and are only now beginning to fall.

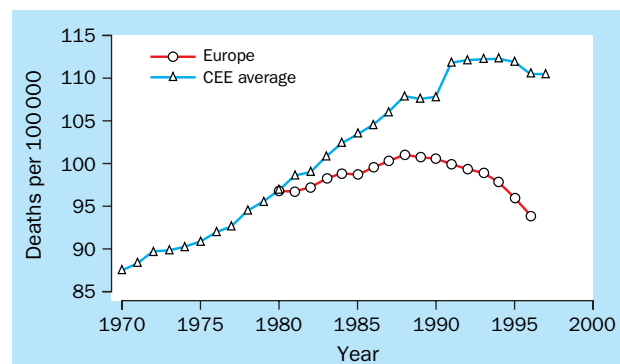


Figure 5. Premature cancer mortality in Europe and CEE countries, 1970-77. Age-standardised mortality, all cancer types, 0-64 years, both sexes, per 100 000 people.

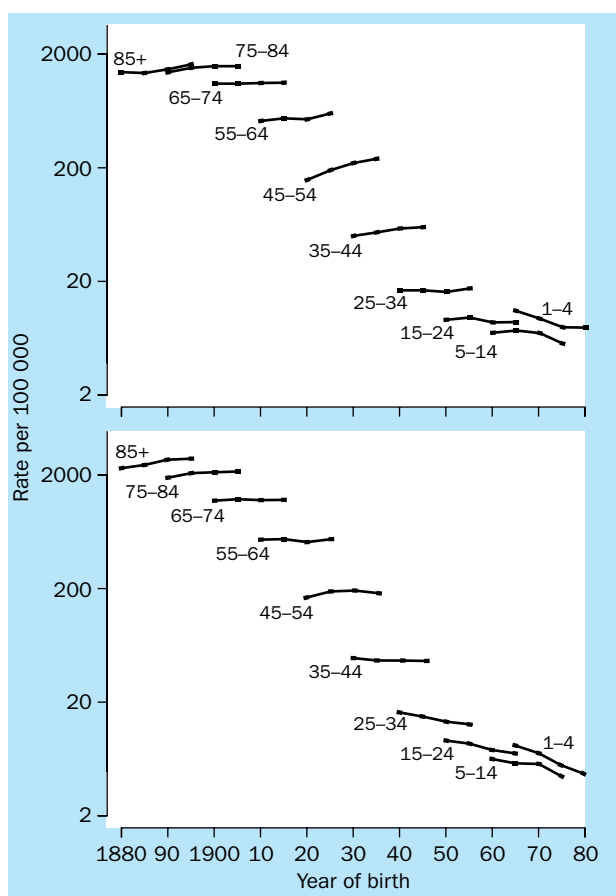


Figure 6. Age-specific cancer mortality in western and eastern Europe. Top panel: western Europe. Bottom panel: eastern Europe. (Until 1990, the United Nations included Bulgaria, Czechoslovakia, German Democratic Republic, Hungary, Poland, and Romania in "Eastern Europe")

**Age-specific mortality**

Age-specific death rates (in which both the numerator and denominator refer to the same age group, or birth cohort) provide a dynamic insight into the status of cancer death in Europe.<sup>7</sup> A cohort analysis of age-specific death rates in Europe carried out by WHO<sup>8</sup> has shown substantial regional differences (figures 6). In the CEE countries, cancer mortality has declined in the youngest age-groups (up to 24 years) but positive trends have not been seen in older-age groups. Conversely, in the rest of Europe, mortality rates have fallen in all age groups up to 54 years. On the basis of these analyses, the WHO report of 1990<sup>8</sup> predicted a decline in the overall cancer mortality for all of Europe, with the exception of the CEE countries. This forecast has now come true.

**Site-specific mortality**

Regional variations in site-specific mortality of cancers that are avoidable through primary and secondary prevention (ie, cancers of the lung, breast, and uterine cervix) are also seen throughout Europe (table 1).

Lung cancer is the largest contributor to the overall death toll in Europe: it is the leading cause of cancer death in men. Until the late 1980s, lung-cancer mortality for men was increasing in all regions, most notably western Europe (particularly Belgium and the Netherlands). However, the Nordic countries were an exception and showed the lowest rates. Since then, the situation has totally changed: mortality has started to decline in all parts of Europe except the CEE countries where the average death rate, although lower than in western Europe, has continued to increase. Currently, Hungary, Croatia, Poland, Slovakia, and the Czech Republic have the highest average rates, but one western European country—Belgium—is still among this group. Finland, Austria, and the UK are witnessing the greatest decreases.

**Table 1. Rates and trends of site specific cancer mortality in Europe, 1994–97<sup>5</sup>**

Region	Date	Lung cancer		Breast cancer	Cervical cancer	All cancers	
		Men	Women			Men	Women
Europe	1980	74.23	10.04	22.89	6.67	259.17	142.21
	1990	82.42	12.29	25.68	5.65	276.58	143.89
	1997	73.06	12.8	25.52	5.11	256.83	136.70
EU	1970	63.17	8.37	26.88	5.54	252.42	158.29
	1980	76.23	10.82	29.02	4.4	269.80	153.58
	1990	75.79	13.64	31.08	3.47	272.91	150.37
	1997	68.58	15.24	29	2.75	254.01	141.99
Nordic	1970	50.15	7.76	27.46	8.65	228.30	163.27
	1980	59.07	12.43	28.52	6.06	243.30	162.45
	1990	54.91	18.05	28.59	4.16	229.80	156.81
	1997	49.38	22.97	27.28	3.56	220.19	155.62
CEE	1970	52.20	7.78	16.38	9.90	215.24	138.95
	1980	72.24	10.31	20.63	9.19	246.48	142.33
	1990	85.82	12.59	23.23	9.02	270.39	144.81
	1997	87.38	14.96	23.74	8.9	282.66	148.85

Data are age-standardised mortality per 100 000 people.

For women, the reverse is true for both geographical distribution and trends of lung-cancer mortality: rates are highest, and rapidly increasing, in the Nordic countries—particularly in Denmark, Iceland, and the UK. The most rapid rates of increase, however, are again being seen in the CEE countries.

For the time being, lung cancer is the second most common cause of cancer death in women (breast cancer being the primary cause). However, lung-cancer mortality rates are rapidly increasing, and in some areas, such as Denmark and western Scotland, lung cancer has already taken over as the leading cause of cancer death in women. This serious warning sign may predict a future trend for the rest of Europe.

In general, breast cancer is still the most common type of cancer in women. The highest mortality rates are seen in the Nordic countries and the EU, but they are decreasing slightly. By contrast, the rates in CEE—although lower than the EU and Nordic averages—are still slowly, but steadily, increasing. The rate of increase, however, seems to have fallen in the past few years, but among the CEE countries, mortality from breast cancer in highest is Hungary.

Mortality from cervical cancer is very low and is decreasing in most European countries, especially the Nordic region, the Netherlands, and Luxembourg. This decrease has contributed to the slight reduction in overall female mortality in Europe. However, mortality is substantially higher in the CEE countries, although the rates are now beginning to fall in some areas (eg, Czech Republic, Poland, Slovenia), and level out, albeit at a high level, in others (eg, Hungary). Currently, the highest number of deaths from cervical cancer throughout the whole of Europe is seen in Romania.

### Summary

From 1970 until the mid-1980s, the prevalence of cancer in Europe continued to be a major health problem. Epidemiological data show very little success in curtailing the overall burden. However, a turning point was reached in the mid-1980s: both the overall and the site-specific European average mortality started to decline, particularly in the younger age-groups. These trends, however, were not seen throughout Europe; and cancer burden remains the heaviest, and continues to accumulate, in the CEE countries.

### Cancer burden in CEE countries: possible reasons for variation

There are two groups of factors that can provide the most likely explanation for the striking regional differences in cancer burden and trends in Europe—the difference in cancer risk and the difference in the effectiveness of cancer treatment.

### Environmental determinants of cancer

Over the past few decades, our perception of what constitutes cancer risk has gone through several phases. In 1964, a WHO expert committee first recognised that the majority of cancers occur as a result of environmental

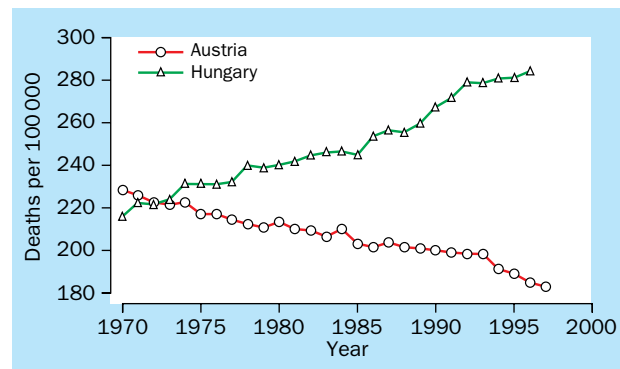


Figure 7. Overall cancer mortality in Austria and Hungary between 1970 and 1997. Age-standardised mortality, all cancer types, all ages, both sexes, per 100 000 people.

factors, as opposed to intrinsic or genetic factors.<sup>9</sup> Since then, this opinion has been consolidated by, among others, Doll and Peto.<sup>10</sup> The current view is that about 90% of all cancers are attributable to external causes and are therefore, theoretically, avoidable.

The interpretation of what “environmental” means has also changed substantially over the years.<sup>11</sup> Previously, the definition included the physical environment, such as natural carcinogens, man-made chemicals, occupational exposures, industrial processes and products, and man-made pollution. Lately, it has come to mean predominantly “personal environment”, or factors related to lifestyle, such as smoking, diet, alcohol consumption, sun exposure, and other culturally influenced factors, for example, sexual and reproductive behaviour.

The lifestyle concept has been further defined as “an aggregation of decisions by individuals that affect his or her health”, and as “a cluster of personal habits and behavioural patterns over which the individual may have control”.<sup>12</sup>

### Social roots to personal lifestyle

In an attempt to explain the regional variations in cancer burden in Europe, and to understand the root of the problem that the CEE countries have to face, there is one important question: to what extent is an individual responsible for his or her health?

One may argue that an individual who has adopted certain health-damaging personal habits, such as smoking, drinking, or an unhealthy diet, is largely responsible for his or her own resultant health. However, the victim’s behaviour is only the half the problem. The social, economic, political, and cultural environment in the country in which a person lives can not be ignored because it often influences their decisions. These conditions can limit the control that a person has over their own personal habits. The case of the two neighbouring countries, Austria and Hungary, exemplifies this point well. Historically, these countries have a lot in common and are similar in many ways. However, politically speaking, since 1955 they have been on opposite sides of the “barricade”. As figure 7 shows, until the late 1960s the overall cancer mortality in the two countries was

similar, but by the early 1970s mortality rates had substantially declined in Austria, while steadily continues to increase in Hungary. What happened?

### **Deterioration of eastern European health**

Up to the late 1960s, there was no evidence of health deterioration in the populations of the CEE countries. The cause-specific mortality from epidemic infectious diseases (including tuberculosis) had substantially fallen. Infant mortality had also declined and adult mortality had decreased moderately. Since then, however, the health of these countries has started to worsen. Mortality from non-communicable chronic diseases, cardiovascular diseases, and cancer has risen, and life expectancy has decreased by monumental proportions, leading a prominent Hungarian demographer to talk about a “health crisis east of the river Elbe”.<sup>13,14</sup>

The striking variations in the cancer load between western and eastern Europe can be attributed to the variations in cancer risk—both lifestyle-related and environmental—and can be largely explained by the social and economic inequalities rooted in the political realities that have undeniably existed among the various geopolitical regions of Europe.

### **Geopolitical trends in Europe: a widening gap**

In Europe, there have always been some built-in inequalities among the countries of the north, south, east, and west. However, the post-war political division of Europe widened the gap between the affluent and underprivileged countries enormously. Over the past 50 years, Europe has gone through dramatic political and socioeconomic changes. This time has been an exceptionally successful period in the history of the “West”. Over these decades, the western European nations have developed not only their own common market, but also many of their own social institutions, for example the “Europe against cancer” programme. The same period has not been as successful for the eastern European countries, where two-thirds of the European population live.

### **Inequalities**

The negative correlation between socioeconomic status and cancer mortality is well known.<sup>15</sup> A detailed analysis of the socioeconomic factors that have influenced the way of life in the CEE countries over the decades of political difference is beyond the scope of this paper. Moreover, in view of the short time that has elapsed since political change, comprehensive sociological analyses are still not available and therefore, we have to rely on empirical observations and anecdotal evidence, which are poorly substantiated by hard data.

However, an attempt can be made to summarise some of the main features that led to the deteriorating health in these countries during the earlier political regimes (P Makara, personal communication):

- *The value attached to human life.* This had become very low and an individual’s life was undervalued in many places. Societies in eastern Europe became amazingly tolerant towards smoking and drinking.

- *Living standards.* In comparison with western Europe, standards were low, and there was a wide gap between personal aspirations and fulfilment of one’s goals.
- *Social structure.* A large proportion of the population was underprivileged; the most important determinant of social status became the relationship to people in positions of influence and power. This hierarchical social stratification resulted in social and economic inequalities and the traditional social support systems became considerably weakened.

As a result, everyday life, including public, professional, and personal, was very stressful. Under those harsh conditions, the cheapest and easiest way of coping with the stress was to take the “delightful” risk of smoking, drinking, and enjoying unhealthy food. Although some of these comments are anecdotal, clearly, psychological factors also underlie the prevalence of lifestyle-related risk factors, deteriorating health, and high cancer mortality in the CEE countries.

### **Smoking prevalence**

Smoking represents the greatest lifestyle-related carcinogenic risk in most CEE countries. For example, in 1995, 47% of the male population of Hungary and 20% of the female population were smokers.<sup>16</sup> The age distribution of cigarette consumption is very unfavourable: more than half of all smokers are adolescents and young adults (15–29 years of age). Furthermore, cigarette consumption per person is high compared with other European countries.

### **Exposures from the physical environment**

The CEE countries suffer from many environmental and occupational health problems. Data on workplace exposure have been systematically collected in the Czech Republic and Slovakia; but very little information is available from Hungary, Romania, and Bulgaria. Data indicate that between 10% and 30% of the working population has been exposed to various occupational hazards, including chemical carcinogens. This exposure certainly contributed to excess cancer mortality, particularly lung cancer.<sup>17</sup> Occupational asbestos exposure, and especially the interaction between smoking and asbestos inhalation, has also been a major concern in these countries.<sup>18</sup>

In general, environmental neglect was quite common in the CEE countries, and measures to protect the environment were rarely considered, reflecting inadequacies in government policy at the time. Many of the harmful factors were caused by rapid development of heavy industry using obsolete technology. In addition, a lack of control on industrial pollution, increased air pollution caused by more motor traffic using poor-quality fuels and poorly tuned engines, and intensive agriculture, further contributed to the overall risk.

### **The future burden**

#### **Recent changes**

After the collapse of the socialist regimes in the 1980s and 1990s, many new countries with democratic constitutions were created throughout eastern Europe. The advent of these

new pluralistic societies brought about substantial change in the political, economic, and social structure. However, it also led, at least initially, to a severe economic downturn and an increase in social tension (a situation that caused the outbreak of war in several CEE countries). Economic polarisation of the societies has also been taking place. With the increase in privatisation and capitalisation, those people who managed to participate successfully in private enterprise are now reaping the benefit. But, in contrast, certain social strata are becoming poorer. These consequences are unfortunately inseparable from the transition from a centrally planned to a market-driven economy and the resultant social re-stratification. Furthermore, westernisation of large segments of the population, particularly the younger generations, has brought about additional changes in lifestyle—but whether this will have a positive influence on cancer risk is debatable.

However, the socioeconomic changes are likely to reduce cancer mortality substantially in the short term. There are several reasons for this conclusion:

- **Cancer control measures.** Cancer treatment varies greatly from western to eastern Europe. In June 1985, the ambitious “European against cancer” programme was launched in the countries of the European Community.<sup>19</sup> The development of this programme expressed the political will and the allocation of adequate financial resources to launch a full-scale attack on cancer in such areas as prevention, informatics, improved education, increased personnel training, and environmental protection. The message was simple: “certain cancers may be avoided”, and, “more cancers will be cured if detected early”.<sup>20</sup> Subsequently, preventable risk factors have been actively pursued in three key areas: action against tobacco use, promotion of healthy nutrition, and control of environmental hazards. In addition to improvements in public awareness, the initiative included legislation and regulatory measures on product control, advertising bans on certain products, improved food safety, targeted taxation and pricing policies, chemical safety initiatives, and improved protection of workers from occupational carcinogens. Furthermore, the advantages of early detection and early treatment have been actively promoted in the media.<sup>19</sup> Family doctors have also taken up the role of first-line interventionists in the war against cancer. Organised screening programmes have been established, and in some areas of western Europe, for example the Nordic countries, the effects of these programmes are now manifesting themselves in declining mortality rates.
- **Cancer control in the CEE countries.** The governments of the newly reformed CEE countries are currently engaged in programmes designed to aid reconstruction and modernisation of the economy, which include reconstruction of the decaying health-care services. However, provision of cancer treatment and prevention is not yet highly prioritised. Preventive services are virtually non-existent and insufficient. In some of the CEE countries, national cancer-control programmes have been established, but very little attention has been paid to

prevention. Healthy nutrition is rarely promoted, and public education about, for example, the harmfulness of smoking, is mostly carried out by the voluntary sector. Some antitobacco legislation has been passed, but improvements cannot be made without powerful regulation. Cancer prevention in the CEE countries will not be effective without the implementation of comprehensive legislation.

Secondary prevention is also insufficiently exploited. Early detection has yet to enter everyday medical practice. For example, although screening for cervical cancer is generally provided during routine gynaecological care, it is limited to those women who actively pursue this level of personal health care. Thus, there is an element of self selection, whereas most of the population, commonly those at higher risk, never receive screening. Physical examination of the breast (which is not a screening modality in itself, but is good for “down-staging”) is less widespread. Mammography screening is rarely available. In those countries where limited screening programmes are available (eg, Hungary), a suitable level of compliance is rarely achieved. As a result, many patients presenting with breast or colorectal cancer are diagnosed at a fairly advanced stage of disease when treatment success is limited.

Finally, the health-care system needs reorganisation. There is a shortage of health-care personnel (especially nurses), diagnostic imaging equipment, and radiotherapy resources. Access to chemotherapeutic regimens could also be improved. The key problem that is widening the gap in morbidity and mortality between the CEE countries and western Europe, however, is the delay in referral and the advanced stage of disease at diagnosis.

#### **The time factor**

Changes in regional cancer mortality statistics take time. The period may elapse between the exposure to a carcinogenic agent and the clinical manifestation of a cancer varies. For example, the development of a smoking-related cancer can take upwards of 15–20 years. Thus, the prevailing smoking habits 15–20 years ago are still influencing the current mortality rate. Any effects of antismoking measures or improved health-care provision on cancer mortality will not occur for several decades.

#### **Conclusion**

Europe is divided by the probability of dying from cancer: mortality rates and trends are worse in the CEE countries, and the gap is widening. The division is due to multifactorial differences between the various geopolitical regions. There is no doubt, however, that the worst is now over. Epidemiological data suggest that the unfavourable trends

#### **Search strategy and selection criteria**

Data presented in this paper were obtained from the Health for All database, regularly published by the Regional Office for Europe of WHO (electronic availability of data is indicated in reference 5). Data published later than 2000 were excluded, and only references published in English were included.

will continue initially, but given the current political and social will of the CEE countries, a gradual improvement in the overall cancer burden over the coming decades is possible.

#### References

- MacMahon B, Pugh TF. *Epidemiology: principles and methods*. Boston: Little Brown 1970.
- Fraumeni JF jr, Devesa SS, Hoover RN, Kinlen LJ. Epidemiology of Cancer. In: DeVita, VT Jr, Hellman S, Rosenberg SA, (Eds). *Cancer: principles and practice of oncology*, 4<sup>th</sup> ed. Philadelphia: Lippicott, 1993: 150–81.
- Parkin DM, Pisani P, Ferlay J. Estimates of the worldwide incidence of 25 major cancers in 1990. *Int J Cancer* 1999; **80**: 827–41.
- Parkin DM, Whelan SL, Ferlay J, et al (Eds). *Cancer incidence in five continents, volume VII*. Lyon: IARC Press, 1997.
- WHO Regional Office for Europe: Health for All statistical database, 1999. <http://hfabd.who.dk/hfa>, accessed May 2002.
- Levi F, Maisonneuve P, Filiberti RR, et al. Cancer incidence and mortality in Europe. *Soz Pravitivmed* 1989; **Suppl 2**: 8–82.
- Doll R. Are we winning the fight against cancer? An epidemiological assesment. *Eur J Cancer* 1990; **26**: 500–08.
- Van Oyen HJ, Döbróssy L. Subregional variations in age and sex specific cancer mortality in the WHO European Region. In: Proceedings "Urban life and Cancer". Hamburg: International Association of Cancer Registries, 1990: 69–82.
- WHO expert committee on prevention of cancer. *Technical Report Series, No 276*. Geneva: WHO, 1964.
- Doll R, Peto R. *The causes of cancer: quantitative estimates of avoidable risk of cancer in the United States today*. Oxford: Oxford University Press, 1981.
- Tomatis L, (Ed). *Cancer: causes, occurrence, and control*. Lyon: IARC Press, 1990.
- Lalond, M: A new perspective on the health of Canadians: a working document. Canada: Information Canada, 1974.
- Foster DP, Józán P. Health in eastern Europe. *Lancet* 1990; **335**: 458–60.
- Józán P. Health crisis east of the Elbe: a consequence of modernisation? *ACP News* 1996.
- Kogevinas M, Pearce N, Susser M, Boffetta P. *Social inequalities and cancer*. Lyon: IARC Press, 1997.
- Eckhardt S. Reflections on oncology in Central and Eastern Europe. *Ann Oncol* 1999; **10** (suppl 6): S3–S7.
- Fabiánova E, Szeszenia-Dabrowska N, Kjaerheim K, Boffetta P. Occupational cancer in Central European Countries. *Environ Health Perspect* 1999; **108** (suppl 2): 279–82.
- Albin M, Magnani C, Kestev S, et al. Asbestos and cancer: an overview of current trends in Europe. *Environ Health Perspect* 1999. **107** (suppl 2): 289–98.
- Commission of the European Communities: Europe against cancer. Luxembourg: Office for Official Publications of the European Communities, 1990.
- Boyle P. European code against cancer. *Eur J Cancer* 1995; **9**: 1395–405.