



The decline in cancer mortality in the European Union, 1988–1996

F. Levi^{a,b,*}, F. Lucchini^a, E. Negri^b, C. La Vecchia^{c,d}

^a*Registre Vaudois des Tumeurs, Institut Universitaire de Médecine Sociale et Préventive, Centre Hospitalier Universitaire Vaudois, Falaises 1, 1011 Lausanne, Switzerland*

^b*Unité d'Epidémiologie du Cancer, Bugnon 17, 1005 Lausanne, Switzerland*

^c*Istituto di Ricerche Farmacologiche 'Mario Negri', Via Eritrea 62, 20157 Milan, Italy*

^d*Istituto di Statistica Medica e Biometria, Università degli Studi di Milano, Via Venezian 1, 20133 Milan, Italy*

Received 20 March 2000; received in revised form 1 June 2000; accepted 18 July 2000

Abstract

After the peak rate reached in 1988, moderate but steady declines were observed over the last decade in total cancer mortality rates in the European Union (EU). Such a decline was over 7% for both sexes combined over the period of 1988–1996 (i.e. from 147.0 to 136.4/100 000, world standard population). The declines in cancer mortality correspond to the avoidance of approximately 70 000 deaths in 1996 in the EU compared with the 1988 rates. The major determinants of these favourable trends were lung (−7.7%), stomach (−24.8%), intestines (−12.4%), breast (−7.1%), uterus, mainly cervix (−20.6%), and leukaemias (−8.3%) and, after 1992, a levelling off of prostate cancer rates. © 2000 Elsevier Science Ltd. All rights reserved.

Keywords: Epidemiology; Mortality; Neoplasms; Time trends; Europe

1. Introduction

Thanks to substantial investments over the last three decades, and particularly following the 1971 US National Cancer Act signed by President Nixon, appreciable progress has been made in our knowledge of the process of carcinogenesis. However, the impact of such progress on cancer incidence and mortality has been relatively limited. Total cancer mortality, in fact, has been rising steadily in the USA and in Europe up to the late 1980s, and has only subsequently levelled off [1–3].

The peak age- and sex-standardised cancer mortality rate in the European Union (EU) was registered in 1988, and overall cancer mortality declined by approximately 4% between 1988 and 1993 [1]. This pattern was similar to cancer mortality trends in the USA with a decline of 3% in both sexes combined observed between 1990 and 1995 [2,3], and approaching 4% in 1996 [4,5].

We have now updated our analysis of trends in cancer mortality for the European Union to 1996, on the basis of death certificates issued and population estimates for

the 15 countries of the EU obtained from the World Health Organization (WHO) database.

2. Patients and methods

Official death certification numbers for the 15 member countries of the EU were derived from the WHO database which are available electronically for the calendar period between 1988 and 1996.

During the calendar period considered, three different revisions of the International Classification of Diseases (ICD) were used [6–8]. Classifications of cancer deaths were thus re-coded for the whole calendar period considered, and all countries, according to the Ninth Revision (ICD-9). To improve the comparability of data from the different countries, we pooled together all intestinal sites, including the colon and rectum.

Estimates of the resident population, based on official censuses, were obtained from the same WHO database. From the matrices of certified deaths and resident populations, age-specific rates for each 5-year age group and calendar period were computed. Age-standardised, and age- and sex-standardised rates (for both sexes combined) were based on the world standard population [9]. Cancer proportional mortality — i.e. the

* Corresponding author. Tel.: +41-21-314-73-11; fax: +41-21-323-03-03.

E-mail address: fabio.levi@inst.hospvd.ch (F. Levi).

proportion of cancer deaths on all deaths — was also given.

3. Results

Age- and sex-standardised mortality rates resulting from all cancers, lung, stomach, intestines, breast, uterus (cervix and corpus), prostate, leukaemias, and all other neoplasms, together with the proportion of cancer deaths compared with the total mortality are given in Table 1 for the period of 1988–1996. Total cancer mortality declined by 7.2%, from 147.0 in 1988 to 136.4/100 000 in 1996. Lung cancer mortality declined by 7.7%, from 31.1 to 28.7/100 000. Despite these declines, cancer proportional mortality increased from 24.7 to 25.6%, due to the larger declines in other causes of death. Other neoplasms showing appreciable declines were stomach (from 10.5 to 7.9/100 000, –24.8%), intestines (from 17.0 to 14.9/100 000, –12.4%), female breast (from 22.4 to 20.8/100 000, –7.1%), uterus (cervix and corpus, from 6.3 to 5.0/100 000, –20.6%), and leukaemias (from 4.8 to 4.4/100 000, –8.3%). For prostate cancer, a levelling off was observed since 1992. No appreciable change was observed for all other neoplasms combined.

Table 2 gives age-adjusted rates for all cancers, lung and intestinal (mainly colorectal) cancers in males and females separately. The fall in total cancer mortality was proportionally similar in males and in females (approximately 7%). However, different trends were observed in lung cancer (downwards in males, –10.4%; upwards in females; +7.4%), whereas intestinal cancer mortality declined more in females (–16.4%) than in males (–9.5%).

4. Discussion

The present update report confirms, and further quantifies, the existence of a moderate, but steady decline in cancer mortality for both sexes combined in the EU over the last decade. Such a decline was over 7% for the period 1988–1996, and hence corresponds — in first approximation, and based on age-specific rates — to the avoidance of approximately 70 000 deaths in 1996 in the whole EU compared with the expected figure derived from mortality rates registered in 1988.

There was substantial variation in cancer rates and trends across the EU, especially for lung and other tobacco-related neoplasms — whose rates were still upwards in some southern European countries for both sexes — as well as for alcohol-related neoplasms, stomach cancer, whose declines were variable in different countries, and breast cancer, whose declines were larger in the UK and other northern European countries [10–13].

In the USA, similar trends in total cancer mortality have been observed, but the major components of the decline in cancer mortality between 1991 and 1996 were estimated to be colorectum (22%), breast (21%), lung (19%) and prostate (13%) [14]. The major difference in the EU is thus the persistent importance of the fall in gastric cancer, whose rates were considerably higher than in North America. This contributes to the apparently larger proportional decline of total cancer mortality in the EU. Another relevant difference with the USA is the smaller reduction in prostate cancer mortality observed in the EU.

The recent favourable trends in cancer mortality within the EU are partly due to the decline in lung (and other tobacco-related) neoplasms in males, reflecting the

Table 1

Age-standardised and sex-standardised mortality rates per 100 000 (world standard population) resulting from selected cancers in the European Union over the period of 1988–1996^a

	All cancers	Lung	Stomach	Intestines	Breast ^b	Uterus ^c	Prostate	Leukaemias	All other neoplasms	CPM %
Year										
1988	147.0	31.1	10.5	17.0	22.4	6.3	15.5	4.8	39.4	24.7
1990	143.8	30.2	9.8	16.9	21.8	6.0	15.5	4.6	39.0	24.7
1992	142.8	30.0	9.1	16.9	21.6	5.7	15.6	4.6	39.3	25.6
1993	141.9	29.5	8.8	16.8	21.6	5.6	15.6	4.5	39.5	25.3
1994	139.4	29.3	8.4	15.2	21.2	5.3	15.6	4.4	40.0	25.8
1995	137.9	29.1	8.1	15.6	21.2	5.1	15.5	4.4	38.9	25.6
1996	136.4	28.7	7.9	14.9	20.8	5.0	15.4	4.4	39.3	25.6
Change in rate, 1988–96	–10.6 (–7.2%)	–2.4 (–7.7%)	–2.6 (–24.8%)	–2.1 (–12.4%)	–1.6 (–7.1%)	–1.3 (–20.6%)	–0.1 (–0.6%)	–0.4 (–8.3%)	–0.1 (–0.3%)	

CPM, cancer proportional mortality.

^a Data were available up to 1994 for Belgium and Italy, and up to 1995 for Denmark, Finland, France, Greece, Ireland, The Netherlands and Spain.

^b Females only.

^c Cervix and corpus.

Table 2

Age-standardised mortality rates per 100 000 (world standard population) from all cancers, lung and intestinal cancers by gender in the European Union over the period of 1988–1996^a

	All cancers		Lung		Intestines	
	Males	Females	Males	Females	Males	Females
Year						
1988	187.3	106.7	52.8	9.4	20.1	14.0
1990	183.5	104.1	51.1	9.3	20.0	13.6
1992	182.2	103.3	50.3	9.7	20.3	13.6
1993	180.6	103.1	49.3	9.8	20.3	13.4
1994	177.5	101.3	48.6	10.0	18.4	12.0
1995	175.6	100.2	48.2	10.1	18.8	12.4
1996	173.6	99.2	47.3	10.1	18.2	11.7
Change in rate, 1988–96	–13.7 (–7.3%)	–7.5 (–7.0%)	–5.5 (–10.4%)	+0.7 (+7.4%)	–1.9 (–9.5%)	–2.3 (–16.4%)

^a Data were available up to 1994 for Belgium and Italy, and up to 1995 for Denmark, Finland, France, Greece, Ireland, The Netherlands and Spain.

downward trends in smoking prevalence over the last few decades [11]. Lung cancer mortality in females was increased between 1988 and 1996, likely reflecting the relatively stable smoking prevalence in women in the 1950s and 1960s [15]. Moreover, there was a persistent fall in gastric cancer mortality rates and a more recent decline in intestinal cancer rates. This possibly relates, at least in part, to improvements in diet [16–18]. The larger declines for intestinal cancer in women than in men may also be, at least in part, due to a favourable effect of hormone replacement therapy on colorectal cancer risk [19].

Some of the declines are attributable to improved screening and early diagnosis for colorectal, breast, cervical, prostatic cancer and skin melanoma. Indeed, mortality due to cervical cancer is still appreciably declining in middle aged and elderly women in the EU. Furthermore, an impact of screening has also been demonstrated and quantified for breast cancer. Data are, however, still inadequate to provide quantitative estimates of the potential impact of screening and early diagnosis on other common neoplasms, mainly including skin, colorectum and prostate [20–22].

Furthermore, there have been substantial advancements made in the therapy for leukaemias, including childhood acute lymphoblastic leukaemias, but also leukaemias in the young and middle aged up to 60 years. Advances have also been made in the treatment of a few other neoplasms [12,16]. These include childhood cancers, testicular cancer, other germ cell neoplasms and Hodgkin's disease [23]. Furthermore, appreciable advancements in breast cancer survival have been observed over the last few years following the increase in screening and the resultant earlier diagnosis, but also through improved treatment, including essentially widespread adoption of polychemotherapy regimens and hormonal therapy [24–26].

The declines in breast cancer mortality in the EU, as in the USA, were in fact largely due to a number of advancements not only in screening, but also in diagnosis and treatment [10]. These declines may approach 25–30% between 1950 and 2000 in the USA and the UK [10], but are smaller for the whole EU, indicating the scope for further advancements. Likewise, the decline in prostatic cancer mortality between 1991 and 1997 was 16% in the USA compared with rates in 1986, while in the EU only a small decline was observed after 1992 [27–29], again indicating the potential scope for intervention.

For most other common neoplasms, there is little basis for suggesting any substantial advancement in treatment and consequently in long-term survival [30–32], but it is still possible that, on the basis of death certification alone, minor declines in mortality rates are missed because of increases in incidence. However, trends in mortality remain the most adequate indicator of the impact of advancements on cancer control on a population scale [33].

Acknowledgements

Supported by the Swiss League against Cancer and the Italian Association for Cancer Research.

References

1. Levi F, La Vecchia C, Negri E, Lucchini F. Declining cancer mortality in European Union. *Lancet* 1997, **349**, 508–509.
2. Cole P, Rodu B. Declining cancer mortality in the United States. *Cancer* 1996, **78**, 2045–2048.
3. Bailar JC, Gornik HL. Cancer undefeated. *N Engl J Med* 1997, **336**, 1569–1574.
4. Wingo PA, Ries LAG, Giovino GA, et al. Annual report to the Nation on the status of cancer, 1973–1996, with a special section

- on lung cancer and tobacco smoking. *J Natl Cancer Inst* 1999, **91**, 675–690.
5. Rosenthal DS. Changing trends. *CA-A Cancer J Clin* 1999, **48**, 1–4.
6. World Health Organization. *International Classification of Disease*, 8th revision. Geneva, World Health Organization, 1967.
7. World Health Organization. *International Classification of Diseases*, 9th revision. Geneva, World Health Organisation, 1977.
8. World Health Organization. *International Statistical Classification of Diseases and Related Health Problems*, 10th revision. Geneva, World Health Organization, 1992.
9. Doll R, Smith PG. Comparison between registries: age-standardized rates. In Waterhouse JAH, Muir CS, Shanmugaratnam K, et al, eds. *Cancer Incidence in Five Continents*, Vol. IV. IARC Scientific Publ No 42. Lyon, International Agency for Research on Cancer, 1982, 671–675.
10. Peto R, Boreham J, Clarke M, Davies C, Beral V. UK and USA breast cancer deaths down 25% in year 2000 at ages 20–69 years. *Lancet* 2000, **355**, 1822.
11. Levi F, Lucchini F, Negri E, Boyle P, La Vecchia C. Cancer mortality in Europe, and an overview of trends from 1955 to 1994. *Eur J Cancer* 1999, **35**, 1477–1516.
12. Levi F, Lucchini F, Boyle P, Negri E, La Vecchia C. Cancer incidence and mortality in Europe, 1988–92. *J Epidemiol Biostat* 1998, **3**, 295–373.
13. Coleman MP, Estève J, Damiecki P, Arslan A, Renard H. *Trends in Cancer Incidence and Mortality*. IARC Scientific Publ No 121, Lyon, International Agency for Research on Cancer, 1993, 806 pp.
14. Hankey BF, Ries LA, Kosary CL, et al. Partitioning linear trends in age-adjusted rates. *Cancer Causes Control* 2000, **11**, 31–35.
15. Franceschi S, Naett C. Trends in smoking in Europe. *Eur J Cancer Prev* 1995, **4**, 271–284.
16. Levi F. Cancer prevention: epidemiology and perspectives. *Eur J Cancer* 1999, **35**, 1046–1058.
17. Trichopoulos D, Li FP, Hunter DJ. What causes cancer? *Sci Am* 1996, **Sept**, 50–57.
18. Harvard Center for Cancer Prevention. Harvard report on cancer prevention. *Cancer Causes Control* 1996, **7**, S1.
19. Franceschi S, La Vecchia C. Colorectal cancer and hormone replacement therapy: an unexpected finding. *Eur J Cancer Prev* 1998, **7**, 427–438.
20. Cuzick J. Screening for cancer: future potential. *Eur J Cancer* 1999, **35**, 685–692.
21. Cristofolini M, Bianchi R, Boi S, et al. Effectiveness of the health campaign for the early diagnosis of cutaneous melanoma in Trentino, Italy. *J Dermatol Surg Oncol* 1993, **19**, 117–120.
22. La Vecchia C, Lucchini F, Negri E, Levi F. Recent declines in worldwide mortality from cutaneous melanoma in young and middle age. *Int J Cancer* 1999, **81**, 62–66.
23. La Vecchia C, Levi F, Lucchini F, Garattini S. Progress of anticancer drugs in reducing mortality from selected cancers in Europe: an assessment. *Anti-Cancer Drugs* 1991, **2**, 215–221.
24. Early Breast Cancer Trialists' Collaborative Group. Polychemotherapy for early breast cancer: an overview of the randomised trials. *Lancet* 1998, **352**, 930–942.
25. Early Breast Cancer Trialists' Collaborative Group. Tamoxifen for early breast cancer: an overview of the randomised trials. *Lancet* 1998, **351**, 1451–1467.
26. Fisher B, Costantino JP, Wickerham DL, et al. Tamoxifen for prevention of breast cancer: report of the National Surgical Adjuvant Breast Project P-2 Study. *J Natl Cancer Inst* 1998, **90**, 1371–1388.
27. Tarone RE, Chu KC, Brawley OW. Implications of stage-specific survival rates in assessing recent declines in prostate cancer mortality rates. *Epidemiology* 2000, **11**, 167–170.
28. Levi F, Lucchini F, Negri E, La Vecchia C. Recent trends in prostate cancer mortality in the European Union. *Epidemiology* 2000, in press.
29. Oliver SE, Gunnell D, Donovan JL. Comparison of trends in prostate-cancer mortality in England and Wales and the USA. *Lancet* 2000, **355**, 1788–1789.
30. Berrino F, Capocaccia R, Estève J, et al. *Survival of Cancer Patients in Europe: the EUROCARE study*. IARC Scientific Publ No. 151. Lyon, International Agency for Research on Cancer, 1999.
31. Richards MA, Stockton D, Babb P, Coleman MP. How many deaths have been avoided through improvements in cancer survival? *Br Med J* 2000, **320**, 395–398.
32. Levi F, Randimbison L, Te VC, Franceschi S, La Vecchia C. Trends in survival for patients diagnosed with cancer in Vaud, Switzerland, between 1974 and 1993. *Ann Oncol* 2000, in press.
33. Welch HG, Schwartz LM, Wolosin S. Are increasing 5-year survival rates evidence of success against cancer? *J Am Med Assoc* 2000, **283**, 2975–2978.