Original article

Annals of Oncology 14: 490–495, 2003
DOI: 10.1093/annonc/mdg110

Mortality from major cancer sites in the European Union, 1955–1998

F. Levi[1]*, F. Lucchini[1], E. Negri[2], P. Boyle[3] & C. La Vecchia[1,2,4]

[1]*Unité d'Épidémiologie du Cancer and Registres Vaudois et Neuchâtelois des Tumeurs, Institut Universitaire de Médecine Sociale et Préventive, Centre Hospitalier Universitaire Vaudois, Lausanne, Switzerland;* [2]*Istituto di Ricerche Farmacologiche 'Mario Negri', Milano;* [3]*Division of Epidemiology and Biostatistics, European Institute of Oncology, Milano;* [4]*Istituto di Statistica Medica e Biometria, Università degli Studi di Milano, Milano, Italy*

Received 27 June 2002; revised 20 September 2002; accepted 22 November 2002

After long-term rises, over the last decade age-standardised mortality from most common cancer sites has fallen in the European Union (EU). For males, the fall was 11% for lung and intestines, 12% for bladder, 6% for oral cavity and pharynx, and 5% for oesophagus. For females, the fall was 7% for breast and 21% for intestines. There were also persisting declines in stomach cancer (30% in both sexes), uterus (mainly cervix, –26%) and leukaemias (–10%). Mortality rates for other common neoplasms, including pancreas for both sexes, prostate and ovary, tended to stabilise. The only unfavourable trends were observed for female lung cancer (+15%). Lung cancer rates in women from the EU are approximately one-third of those in the USA, and 50% lower than breast cancer rates in the EU. Lung cancer rates in European women have also tended to stabilise below the age of 75 years. Thus, effective interventions on tobacco control could, in principle, avoid a major lung cancer epidemic in European women.

Key words: cancer, European Union, mortality, time trends

Cancer mortality rates in the European Union (EU) peaked in 1988, and the fall in age-standardised rates between 1988 and 1997 has been greater than 9% in both sexes combined, corresponding to the avoidance of about 80000 deaths per year in the late 1990s [1].

We considered trends in mortality from eight major cancer sites in the EU between 1955 and 1994. There was some leveling off or decline for most cancer sites, with the main exception of lung cancer in women [2]. We have now updated these figures to 1998, on the basis of official death certifications provided by the World Health Organization (WHO). The EU was defined as the 15 member states in 1995–98 (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, The Netherlands, Portugal, Spain, Sweden, UK). Age-standardised rates (in 5-year age groups from 0–5 to 80–84 and ≥85 years) were based on the world standard population.

Table 1 and Figure 1 give long-term trends in mortality from major cancers in men. The fall in lung cancer has become appreciable, from the peak of 52.4 per 100000 in 1985–89 to 46.6 in 1995–98 (–11%). An 11% fall was also observed for colorectal cancer. While prostate cancer has tended to stabilise or moderately decline over the last few years, the fall in gastric cancer persisted, and was over 30% during the last decade alone. Pancreatic cancer rates tended also to decline, with a 3% decline over the last 5 years. Over the last decade, there has been a 12% decline in bladder cancer, and a greater than 5% decline in mouth or pharynx and oesophageal cancer.

**Correspondence to:* Dr F. Levi, Registre Vaudois des Tumeurs, CHUV-Falaises 1, CH 1011 Lausanne, Switzerland. Fax: +41-21-323-03-03; E-mail: fabio.levi@inst.hospvd.ch

Corresponding figures for women are given in Table 2 and Figure 2. Over the last decade there has been a decline of 7% for breast, 21% for intestines, 26% for uterus (cervix and corpus) and 31% for stomach cancers, and 11% for leukaemias. Mortality rates were stable for ovarian and pancreatic cancer, but there was a 15% rise in female lung cancer mortality. Lung is therefore approaching intestines as the second leading cause of cancer mortality in women in the EU. Female lung cancer rates are, however, still about 50% lower than breast cancer rates.

Trends in age-standardised rates over the last decade in three separate age groups (as well as crude rates) are given in Table 3 for men and Table 4 for women; all neoplasms were considered except prostate. For most sites in males, except stomach, mouth or pharynx, and oesophagus, the falls were in proportional terms greater below the age of 55 years and at age 55–74 years compared with the elderly, although some decline was observed also at ≥75 years. The fall was smaller in crude than in age-standardised rates, reflecting the ageing of the population over the last decade. In women, the falls in breast and colorectal cancer were greater below the age of 75 years, while the rise in lung cancer was larger in the elderly. Ovarian cancer tended to decline in women <55 years old, but rise in the elderly.

These data have several limitations, including the fact that it is not possible to distinguish, on the basis of mortality data, between cervix and corpus uteri cancers (although the causes of the two neoplasms are largely different [3, 4]), since in several countries a large proportion of deaths are registered as 'uterus, unspecified'. Death certificates for other major neoplasms, however, are known to have been valid and comparable over the last few decades.

Table 1. Age-standardised (world standard population) mortality rates per 100 000 men for selected cancers in the European Union, 1955–98

Site	Calendar period									Change in rate (%)
	1955–59	1960–64	1965–69	1970–74	1975–79	1980–84	1985–89	1990–94	1995–98	1995–98/1985–89
Lung	29.87	36.76	42.42	46.05	49.94	52.11	52.39	49.82	46.57	–11.1
Intestines, mainly colorectum	16.58	16.91	17.95	18.69	19.34	19.87	20.08	19.85	17.78	–11.5
Prostate	11.07	12.16	12.79	12.93	13.50	13.91	15.01	15.52	15.28	1.8
Stomach	33.04	30.89	27.82	23.91	20.54	17.37	14.79	12.41	10.35	–30.0
Pancreas	4.31	5.09	5.87	6.29	6.69	7.21	7.39	7.34	7.19	–2.7
Bladder	4.51	5.28	6.03	6.48	6.86	7.26	7.37	7.16	6.47	–12.2
Mouth or pharynx	4.06	4.15	4.40	4.81	5.33	5.94	6.27	6.20	5.88	–6.2
Oesophagus	5.22	5.50	5.73	5.72	5.87	5.98	6.16	6.13	5.85	–5.0
Leukaemias	5.27	5.95	6.19	6.10	5.23	6.12	5.93	5.62	5.35	–9.8

Table 2. Age-standardised (world standard population) mortality rates per 100 000 women for selected cancers in the European Union, 1955–98

Site	Calendar period									Change in rate (%)
	1955–59	1960–64	1965–69	1970–74	1975–79	1980–84	1985–89	1990–94	1995–98	1995–98/1985–89
Breast	16.71	17.49	18.60	19.47	20.00	21.00	21.90	21.59	20.40	–6.8
Intestines, mainly colorectum	13.68	13.88	14.34	14.48	14.61	14.53	14.12	13.25	11.32	–19.8
Lung	4.43	5.09	5.76	6.19	6.97	7.96	8.93	9.61	10.25	14.8
Ovary	4.36	4.64	5.28	5.95	6.10	6.06	6.08	6.21	6.30	3.6
Uterus total	12.62	12.13	11.41	10.18	8.99	7.66	6.65	5.69	4.90	–26.3
Stomach	18.80	16.76	14.50	12.00	10.06	8.32	6.95	5.83	4.83	–30.5
Pancreas	2.81	3.19	3.55	3.70	3.89	4.30	4.60	4.69	4.68	1.7
Leukaemias	3.86	4.31	4.38	4.17	4.10	4.00	3.75	3.51	3.34	–10.9

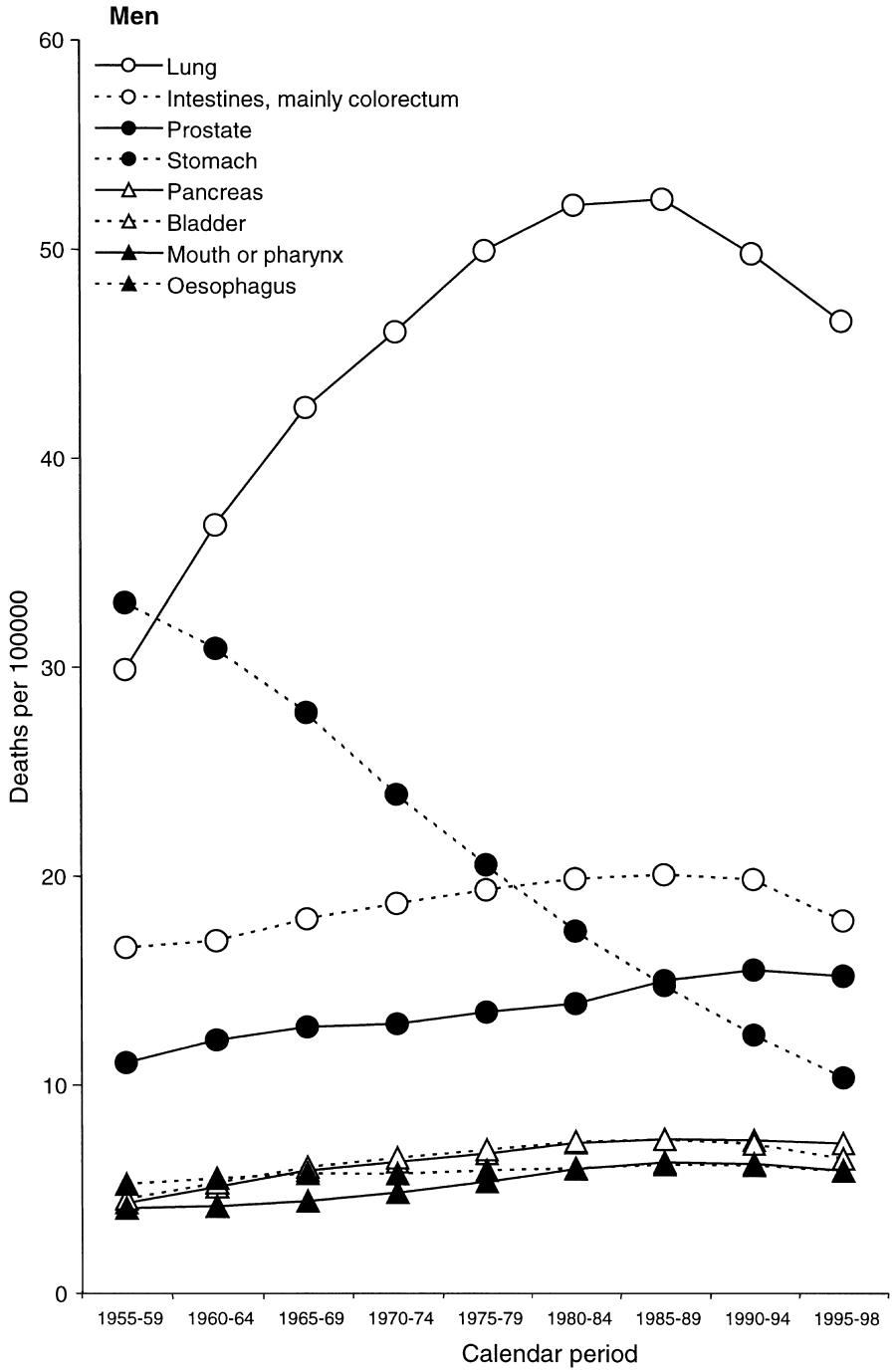

Figure 1. Trends in age-standardised (world standard population) mortality rates per 100 000 men for selected cancers in the 15 countries of the European Union, 1955–98.

Thus, most common cancers showed favourable trends for both sexes over the last decade in the EU, as in the USA [5]. Some of these, including the fall in mortality from leukaemias and breast cancer, particularly evident in the middle-aged population, are partly or largely due to therapeutic advancements [6–10].

The decline in breast cancer in some countries of the EU is partly attributable to screening and earlier diagnosis [8, 9]. These are also the major determinants of the continuing fall in mortality from cervix uteri cancer [4]. Improvements in food preservation, diet and nutrition are the main determinants of the favourable trends in stomach cancer in both sexes [11], and probably also in intestinal cancer [12], the fall of which started in the late 1970s, and has been appreciably greater for females than for males.

It is also of interest that, over the last decade, mortality from several neoplasms which had showed long-term rises up to the mid-1980s in the EU, has tended to level off. These include, among others, cancers of the pancreas for both sexes, and prostate and ovary, mainly in middle age, reflecting different cohort

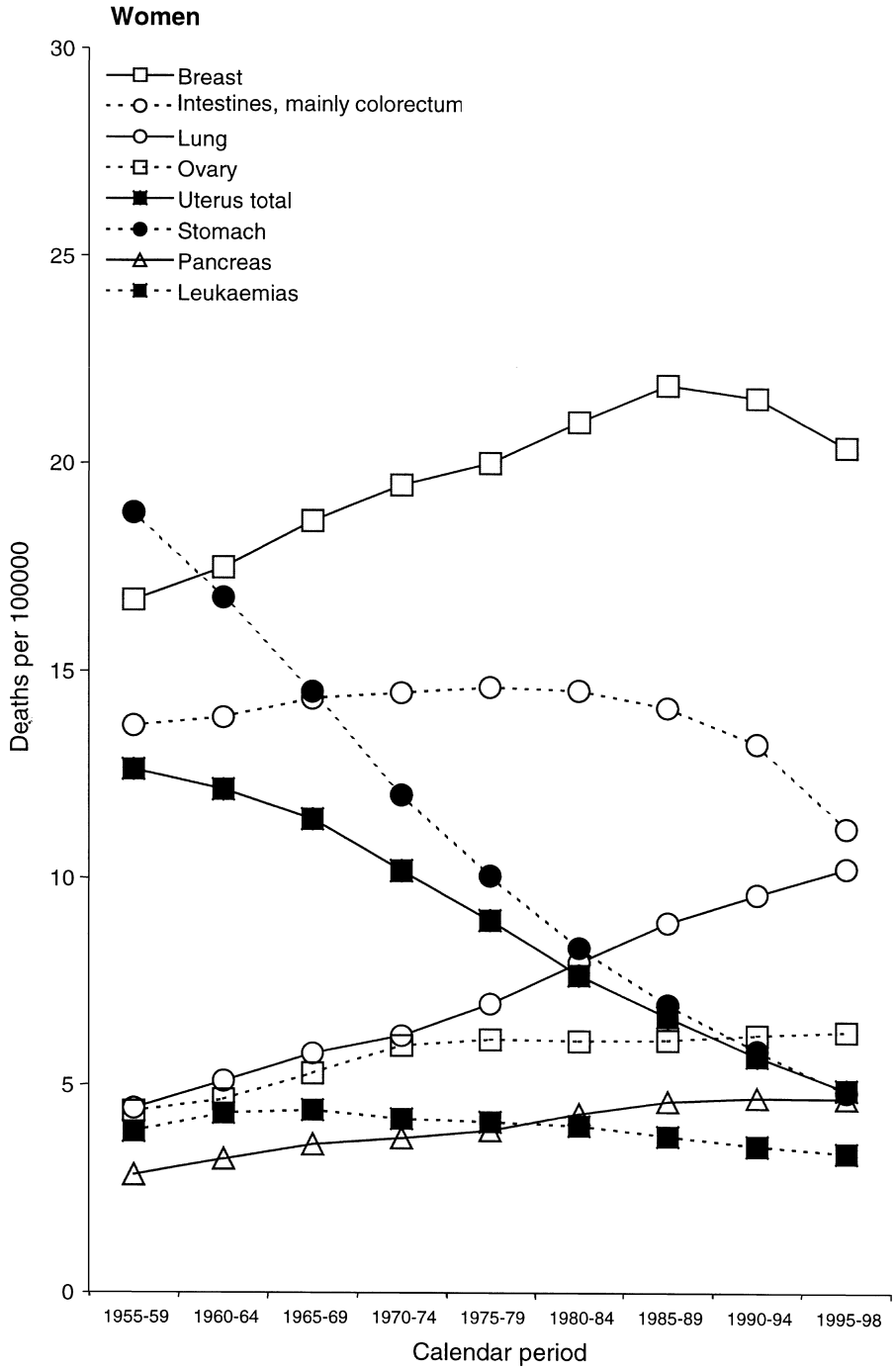

Figure 2. Trends in age-standardised (world standard population) mortality rates per 100 000 women for selected cancers in the 15 countries of the European Union, 1955–98.

patterns for these neoplasms [13]. For ovarian cancer, the favourable trends in young and middle-aged women have been related to oral contraceptive use in the generations born after 1930 [14].

The main difference between cancer mortality for females and males has been observed for lung and other tobacco-related neoplasms. Lung cancer rates, after long-term rises, declined by over 10% in European males during the last decade, and a similar fall was observed for bladder cancer, which may also indicate decreased exposure to occupational carcinogens [15]. The fall was smaller (i.e. ~5%) for oral and pharyngeal and oesophageal cancers, which are strongly related to alcohol as well as to tobacco consumption [16–18].

Lung cancer rates, in contrast, have risen by 15% in European women over the last decade. Although the rise was smaller than the 28% observed during the previous decade, this reflects the persisting spread of the tobacco-related (lung) cancer epidemic in European women, and again underlines the importance of urgent intervention to control tobacco smoking in women. The obser-

Table 3. Trends in age-standardised (world standard, in selected age groups) and crude mortality rates per 100 000 men for selected cancers in the European Union between 1985–89 and 1995–98

Site	Age 0–54 years			Age 55–74 years			Age ≥75 years			All ages, crude		
	1985–89	1995–98	Change in rate (%)	1985–89	1995–98	Change in rate (%)	1985–89	1995–98	Change in rate (%)	1985–89	1995–98	Change in rate (%)
Lung	10.55	8.93	–15.4	278.47	233.85	–16.0	532.34	482.38	–9.4	81.57	77.11	–5.5
Intestines, mainly colorectum	3.52	2.76	–21.6	87.78	77.51	–11.7	346.73	284.42	–18.0	33.06	31.19	–5.7
Prostate	0.35	0.34	–2.9	51.81	47.12	–9.1	432.1	445.4	3.1	27.42	30.68	11.9
Stomach	2.79	1.85	–33.7	66.59	44.45	–33.2	235.47	161.15	–31.6	24.2	16.06	–33.6
Pancreas	1.67	1.50	–10.2	35.84	33.63	–6.2	90.93	86.22	–5.2	11.64	12.02	3.3
Bladder	0.65	0.51	–21.5	32.76	25.84	–21.1	146.96	136.71	–7.0	12.55	12.07	–3.8
Mouth or pharynx	3.01	2.71	–10.0	27.71	25.47	–8.1	37.03	29.35	–20.7	8.92	8.61	–3.5
Oesophagus	1.93	1.69	–12.4	29.99	27.64	–7.8	55.82	51.16	–8.3	9.28	9.28	0.0
Leukaemias	2.65	1.99	–24.9	19.58	17.92	–8.5	75.6	72.38	–4.3	8.75	8.52	–2.6

Table 4. Trends in age-standardised (world standard, in selected age groups) and crude mortality rates per 100 000 women for selected cancers in the European Union between 1985–89 and 1995–98

Site	Age 0–54 years			Age 55–74 years			Age ≥75 years			All ages, crude		
	1985–89	1995–98	Change in rate (%)	1985–89	1995–98	Change in rate (%)	1985–89	1995–98	Change in rate (%)	1985–89	1995–98	Change in rate (%)
Breast	11.07	9.39	–15.2	88.83	79.33	–10.7	168.89	161.5	–4.4	40.24	39.4	–2.1
Intestines, mainly colorectum	2.90	2.19	–24.5	59.28	45.28	–23.6	250.16	191.51	–23.4	34.85	29.67	–14.9
Lung	2.28	2.93	28.5	47.03	47.7	1.4	80.02	95.27	19.1	18.06	21.43	18.7
Ovary	2.42	2.10	–13.2	28.65	31.54	10.1	45.04	62.2	38.1	11.41	14.15	24.0
Uterus total	2.85	2.05	–28.1	28.5	18.78	–34.1	59.85	48.23	–19.4	12.95	10.21	–21.2
Stomach	1.53	1.09	–28.8	27.45	17.97	–34.5	130.92	84.61	–35.4	17.6	12.82	–27.2
Pancreas	0.81	0.78	–3.7	21.89	20.65	–5.7	69.68	71.54	2.7	10.92	11.79	8.0
Leukaemias	1.97	1.43	–27.4	11.6	10.66	–8.1	40.87	39.66	–3.0	7.19	7.1	–1.3

vation that the rises were apparently smaller below the age of 75 years is, however, encouraging in terms of cohort effects in female lung cancer rates. Together with non-Hodgkin's lymphomas in both sexes [19], female lung cancer remains one of the few neoplasms showing upward mortality rates in the EU over the last decade.

Lung cancer rates in European women are, however, still about one-third of those in US women, and 50% lower than breast cancer rates in the EU. An integrated and effective intervention to reduce the smoking epidemic in European women should help stop the tobacco-related lung cancer epidemic in the EU reaching the size now registered in the USA [20, 21].

Acknowledgements

This work was supported by the Swiss League against Cancer and the Italian Association for Cancer Research.

References

1. Levi F, Lucchini F, Negri E, La Vecchia C. Cancer mortality in the European Union, 1988–97: the fall may approach 80 000 deaths per year. Int J Cancer 2002; 98: 636–637.
2. Levi F, Lucchini F, La Vecchia C, Negri E. Trends in mortality from cancer in the European Union, 1955–94. Lancet 1999; 354: 742–743.
3. Parazzini F, La Vecchia C, Bocciolone L, Franceschi S. The epidemiology of endometrial cancer. Gynecol Oncol 1991; 41: 1–16.
4. Levi F, Lucchini F, Negri E et al. Cervical cancer mortality in young women in Europe: patterns and trends. Eur J Cancer 2000; 36: 2266–2271.
5. Howe HL, Wingo PA, Thun MJ et al. Annual report to the Nation on the status of cancer (1973 through 1998), featuring cancers with recent increasing trends. J Natl Cancer Inst 2001; 93: 824–842.
6. Levi F, Lucchini F, Negri E et al. Trends in mortality from leukemia in subsequent age groups. Leukemia 2000; 14: 1980–1983.
7. Fisher B, Costantino JP, Wickermann 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.
8. Peto R, Boreham J, Clarke M et al. UK and USA breast cancer deaths down 25% in year 2000 at ages 20–69 years. Lancet 2000; 355: 1822.
9. Levi F, Lucchini F, Negri E, La Vecchia C. The fall in breast cancer mortality in Europe. Eur J Cancer 2001; 37: 1409–1412.
10. Garattini S, La Vecchia C. Perspectives in cancer chemotherapy. Eur J Cancer 2001; 37 (Suppl 8): S128–S147.
11. La Vecchia C, Franceschi S. Nutrition and gastric cancer with a focus on Europe. Eur J Cancer Prev 2000; 9: 291–295.
12. Fernandez E, Bosetti C, La Vecchia C et al. Sex differences in colorectal cancer mortality in Europe, 1955–1996. Eur J Cancer Prev 2000; 9: 99–104.
13. La Vecchia C, Negri E, Levi F et al. Cancer mortality in Europe: effects of age, cohort of birth and period of death. Eur J Cancer 1998; 34: 118–141.
14. La Vecchia C. Epidemiology of ovarian cancer: a summary review. Eur J Cancer Prev 2001; 10: 125–129.
15. Negri E, La Vecchia C. Epidemiology and prevention of bladder cancer. Eur J Cancer Prev 2001; 10: 7–14.
16. Franceschi S, Talamini R, Barra S et al. Smoking and drinking in relation to cancers of the oral cavity, pharynx, larynx and esophagus in Northern Italy. Cancer Res 1990; 50: 6502–6507.
17. Franceschi S, Levi F, La Vecchia C et al. Comparison of the effect of smoking and alcohol drinking between oral and pharyngeal cancer. Int J Cancer 1999; 83: 1–4.
18. Zambon P, Talamini R, La Vecchia C et al. Smoking, type of alcoholic beverage and squamous-cell oesophageal cancer in northern Italy. Int J Cancer 2000; 86: 144–149.
19. Levi F, Lucchini F, Negri E, La Vecchia C. Trends in mortality from non-Hodgkin's lymphomas. Leuk Res 2002; 26: 903–908.
20. Jemal AJ, Chu KC, Tarone RE. Recent trends in lung cancer mortality in the United States. J Natl Cancer Inst 2001; 93: 277–283.
21. WHO. Tobacco or health: a global status report. Geneva: World Health Organization 1997; 485.