The Breast 21 (2012) 77–82

Contents lists available at ScienceDirect

The Breast

journal homepage: www.elsevier.com/brst

Original article

The decline in breast cancer mortality in Europe: An update (to 2009)

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ARTICLE INFO

Article history:
Received 29 June 2011
Accepted 8 August 2011

Keywords:
Breast
Cancer
Europe
Mortality
Trends

ABSTRACT

We updated trends in breast cancer mortality in Europe up to the late 2000's. In the EU, age-adjusted (world standard population) breast cancer mortality rates declined by 6.9% between 2002 and 2006, from 17.9 to 16.7/100,000. The largest falls were in northern European countries, but more recent declines were also observed in central and eastern Europe. In 2007, all major European countries had overall breast cancer rates between 15 and 19/100,000. In relative terms, the declines in mortality were larger at younger age (−11.6% at age 20–49 years between 2002 and 2007 in the EU), and became smaller with advancing age (−6.6% at age 50–69, −5.0% at age 70–79 years). The present report confirms and further quantifies the persisting steady fall in breast cancer mortality in Europe over the last 25–30 years, which is mainly due to advancements in the therapy.

Introduction

Breast cancer mortality declined by over 15% in the European Union (EU) between the peak rate observed in the late 1980's and the rate in 2000, and the reduction was larger after 1995, i.e. over 2% per year.[1,2] The declines were larger in northern European countries, and smaller in France, Greece, Portugal and several central/eastern European countries which had lower rates in the past. This led to a leveling of breast cancer mortality across Europe. Breast cancer mortality was still rising in the Russian Federation up to 2000. Differences across age groups were observed, with larger declines in young and middle age than in elderly women.[1–3]

To provide a comprehensive picture of recent trends in breast cancer mortality in Europe, we updated the analysis of rates to 2009.

Material and methods

We abstracted official death certification data for breast cancer up to 2009 for 32 European countries from the World Health Organization (WHO) database as available on electronic support.[4] We excluded Albania, Macedonia and Republic of Moldova whose national coverage was below 90%; for the same reason we excluded several countries of the former Soviet Union. For Belgium and Slovakia data were available only up to 2005; for Denmark, Germany, the Russian Federation, and Ukraine up to 2006. The EU was defined as the 27 member states as in 2007, excluding Cyprus, whose data were available only for a few recent years. In a few countries, data were missing for one or more calendar years; no extrapolation was made for missing years.

During the calendar period considered (1970–2009) three different revisions of the International Classification of Diseases (ICD-8, ICD-9 codes : 174–175; ICD-10 code: C50) were used.[5–7] Classification of cancer deaths was re-coded, for all calendar periods and countries, according to the 10th Revision of the ICD.[7]

Estimates of the resident population, based on official censuses, were obtained from the same WHO database.[4] From the matrices of certified deaths and resident populations, we computed age-specific rates for each 5-year age group (from 0-4, 5–9, to 80–84 and ≥85 years) and calendar year. Age-standardized rates per 100,000 women – at all ages and at ages 20–49, 50–69, and 70–79 years – were computed using the direct method, on the basis of the world standard population.[8]

To identify significant changes in mortality trends for 6 major European countries and the EU as a whole, we performed joinpoint regression analysis using the "Joinpoint" software from the Surveillance Research Program of the US National Cancer Institute.[9] This analysis allows to identify years where a significant change in the linear slope of the trend (on a log-scale) is detected over the

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0960-9776/$ – see front matter © 2011 Published by Elsevier Ltd.
doi:10.1016/j.breast.2011.08.001

Table 1
Age-adjusted (world population) mortality rates from breast cancer per 100,000 women at all ages and at ages 20–49, 50–69, 70–79 in various European countries and in the European Union (EU) as a whole around 1997 (1995–99), 2002 (2000–04) and in 2007 (unless mentioned in parentheses), and corresponding percent changes in rates.

	Women															
	All ages				Age 20–49				Age 50–69				Age 70–79			
	1997	2002	2007	% change 2007/02	1995-99	2000-04	2007	% Change 2007/2002	1997	2002	2007	% change 2007/02	1997	2002	2007	% change 2007/02
Austria	19.8	17.8	15.8	−11.3	9.32	7.58	6.97	−7.99	64.6	58.7	52.5	−10.6	117.4	105.9	85.5	−19.3
Belarus (2000-03)	14.6	14.6	15.1	3.4	10.29	8.94	8.34	−6.77	50.8	52.1	58.1	11.5	61.0	69.2	57.1	−17.5
Belgium (2004, 2005)	24.7	20.5	20.3	−0.9	12.06	9.78	8.29	−15.24	84.8	68.1	71.3	4.7	133.9	114.4	118.2	3.3
Bulgaria	15.8	14.7	15.5	5.4	10.69	8.77	7.02	−19.92	50.7	50.1	54.8	9.4	77.8	73.4	87.5	19.3
Croatia	19.6	18.2	17.3	−5.1	11.29	8.43	8.75	3.80	59.0	57.9	54.1	−6.7	135.9	119.3	96.6	−19.0
Czech Republic	20.1	18.5	14.9	−19.5	8.29	6.54	5.65	−13.51	67.2	59.7	47.6	−20.3	128.6	127.7	94.4	−26.1
Denmark (2006)	27.1	24.0	21.0	−12.4	11.75	8.56	7.15	−16.44	94.0	84.2	70.0	−16.9	158.0	151.8	146.2	−3.7
Estonia	18.9	18.5	14.1	−23.8	11.42	10.24	7.89	−22.93	67.1	65.8	44.9	−31.8	84.8	91.2	86.1	−5.6
Finland	16.6	15.2	14.4	−5.1	9.57	7.63	6.90	−9.46	54.8	50.0	48.0	−4.1	87.4	90.3	85.8	−4.9
France	19.5	18.3	16.7	−8.8	10.02	9.18	8.09	−11.78	66.0	61.0	55.0	−9.8	104.1	102.6	96.4	−6.0
Germany (2006)	20.9	18.8	17.5	−7.0	10.48	8.31	6.94	−16.40	69.6	63.8	60.1	−5.8	118.6	110.2	106.9	−3.0
Greece	15.2	15.1	15.3	2.0	7.93	6.93	7.10	2.49	49.9	46.3	44.4	−4.2	82.6	96.0	96.1	0.0
Hungary	23.1	21.8	18.2	−16.3	11.84	10.64	8.14	−23.45	74.6	72.5	61.8	−14.8	129.8	121.8	109.2	−10.3
Ireland	24.5	22.6	18.7	−17.2	11.87	10.46	7.91	−24.34	86.5	78.1	62.7	−19.6	126.0	126.4	120.8	−4.4
Italy (2000–03)	18.9	17.5	16.2	−7.5	9.68	8.55	7.56	−11.65	62.7	58.4	53.9	−7.7	105.3	98.9	92.4	−6.6
Latvia	17.4	17.9	15.7	−12.0	12.11	10.39	9.46	−8.97	56.8	63.1	53.9	−14.6	87.1	86.3	80.8	−6.3
Lithuania	18.3	17.8	16.7	−6.3	12.06	10.21	8.26	−19.14	63.6	61.7	59.0	−4.3	79.6	94.5	91.2	−3.5
Luxembourg	18.2	18.1	13.6	−24.8	9.14	8.93	3.21	−64.02	57.5	56.9	49.8	−12.5	113.9	107.0	86.1	−19.6
Malta	26.5	21.2	19.6	−7.7	10.66	8.09	9.75	20.45	87.4	74.5	71.6	−3.9	154.1	135.5	92.6	−31.7
Netherlands	25.2	22.3	19.1	−14.2	12.70	11.43	8.94	−21.81	82.3	72.0	63.1	−12.3	142.1	122.6	105.8	−13.7
Norway	18.1	16.2	13.5	−16.5	9.82	8.06	6.44	−20.06	58.0	52.8	45.3	−14.2	101.2	91.0	69.7	−23.4
Poland (1995-96, 1999)	15.7	14.9	14.6	−2.4	9.11	7.54	6.23	−17.42	52.8	51.9	52.1	0.5	82.5	78.6	80.5	2.4
Portugal	16.7	15.1	14.0	−7.6	10.22	8.51	8.91	4.71	53.4	49.0	42.2	−13.9	85.0	80.4	72.5	−9.9
Romania	15.9	16.3	15.6	−4.3	10.20	9.39	7.73	−17.70	53.9	55.4	55.7	0.6	77.7	85.2	79.8	−6.4
Russian Federation (2006)	16.7	17.3	16.9	−2.4	11.27	10.03	8.74	−12.83	58.0	62.5	62.3	−0.4	73.7	79.9	80.4	0.7
Slovakia (2005)	17.8	17.3	15.3	−11.8	8.71	7.74	6.99	−9.65	60.0	59.7	54.5	−8.8	104.0	100.9	80.0	−20.7
Slovenia	20.6	19.2	16.4	−14.2	10.37	7.87	6.14	−21.98	68.6	64.6	50.6	−21.8	115.4	117.1	112.6	−3.8
Spain	16.0	14.1	12.8	−9.2	9.66	7.86	7.35	−6.51	51.6	45.2	40.0	−11.5	79.9	75.3	68.4	−9.2
Sweden	16.4	15.5	13.6	−12.4	8.53	7.55	6.21	−17.85	54.5	51.3	43.0	−16.2	86.7	88.3	83.5	−5.4
Switzerland	19.6	17.6	15.1	−14.2	8.99	7.26	5.51	−24.06	65.0	59.5	51.2	−14.1	116.2	107.5	102.9	−4.3
Ukraine (2006)	17.8	17.9	17.7	−0.9	13.05	11.47	10.76	−6.19	61.9	65.2	65.8	0.9	70.8	75.2	73.5	−2.3
United Kingdom	23.3	20.6	18.4	−10.8	12.09	10.20	9.04	−11.42	76.5	66.3	58.2	−12.2	132.8	119.3	110.2	−7.7
EU (2006)	19.7	17.9	16.7	−6.9	10.37	8.76	7.74	−11.59	65.2	59.5	55.6	−6.6	108.3	101.0	96.0	−5.0

study period.[10] The estimated annual percent change (APC) was then computed for each of the identified trends by fitting a regression line to the natural logarithm of the rates using calendar year as a regressor variable.

Results

Table 1 gives age-standardized mortality rates from breast cancer at all ages and at ages 20–49, 50–69 and 70–79 in selected European countries and in the EU as a whole around 1997 (1995–99), 2002 (2000–04), and in 2007, plus the corresponding percent changes in rates over the most recent quinquennium. In the EU as a whole, overall breast cancer mortality decreased by 6.9% between 2002 and 2007 (from 17.9 to 16.7/100,000). The largest falls were in northern European countries, including Scandinavia and the UK (where rates were originally high), but also in some central and eastern European countries, including the Czech Republic, Hungary, Poland, Romania and the Russian Federation, where rates have been upwards up to the mid/late 1990's. In 2007, the highest rate was in Denmark (21/100,000), and the lowest one in Spain (12.8/100,000); most major European countries, including the Russian Federation, had overall breast cancer rates between 15 and 19/100,000 (Fig. 1). In relative terms the declines in mortality were greater at younger age (−11.6% between 2002 and 2007 in the EU as a whole), and became smaller with advancing age (−6.6% at age 50–69, −5.0% at age 70–79), though in absolute terms they were similar at age 50–69 and 70–79, i.e. about 4–5/100,000 (Table 1).

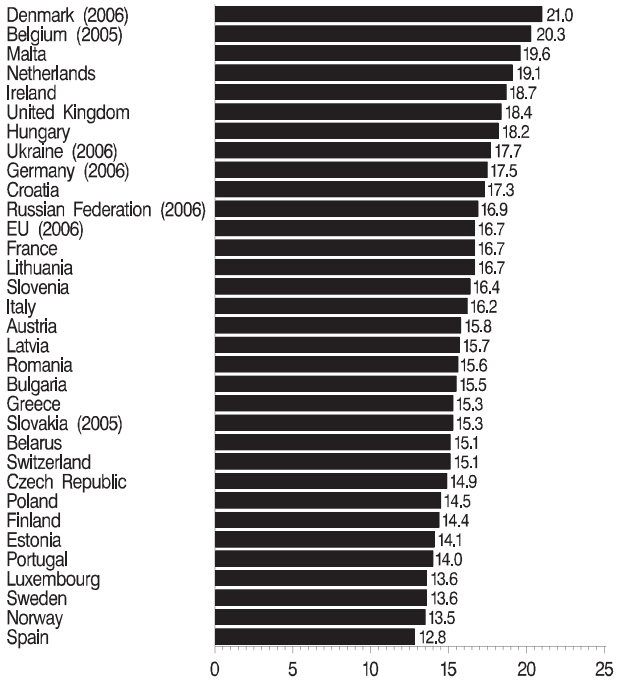

Fig. 1. Age-standardized (world population) death certification rates from breast cancer per 100,000 women in various European countries and the European Union (EU) as a whole in 2007.

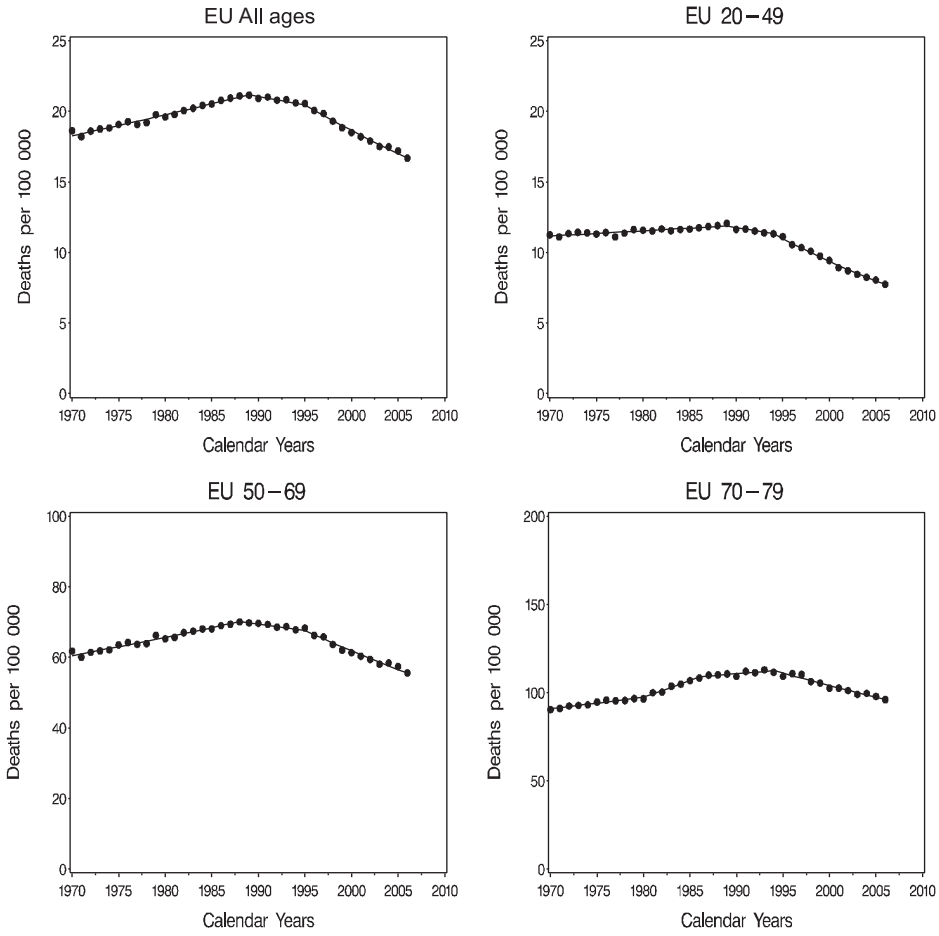

Fig. 2. Joinpoint analysis of trends in age-standardized (world population) mortality rates from breast cancer at all ages and at ages 20–49, 50–69 and 70–79, in the European Union as a whole, 1970–2006.

Fig. 2 and Table 2 give the results of the joinpoint regression analysis for breast cancer mortality (at all ages and in the 3 age groups) in the EU between 1970 and 2006. At all ages, breast cancer rates rose by 0.8% per year between 1970 and 1989, declined by 0.6% per year between 1989 and 1995, and by 1.8% per year thereafter. The trends were similar in other age groups, although over the last decade the declines were stronger in the younger age group (APC = −3.2% between 1994 and 2006).

The corresponding results of the joinpoint regression analysis in 6 major European countries are shown in Fig. 3 and Table 3. Rates declined since the late 1980's in Germany and the UK, since the early 1990's in France, Italy and Spain, and since the mid 1990's in Poland. The declines over the most recent period were around 1.5–1.8% per year in France, Germany, and Italy, 2.3–2.4% in Spain and the UK, and only 0.2% in Poland.

Discussion

The present report shows the persistence of a steady fall in breast cancer mortality in Europe over the last 25–30 years. Similar trends were observed in the USA.[11,12] From its peak in the late 1980's, overall breast cancer mortality declined by over 20% in the EU, and the fall approached 38% in the UK, a high mortality country in the past.[1,13] Mortality has been recently declining in countries of central/eastern Europe also (including Romania and Russia), where rates had been upwards up to the mid/late 1990's. Thus, mortality from breast cancer became more homogenous across Europe, with overall rates between 14 and 19/100,000 women in most countries (including central and eastern European ones and Russia which had unexpected low rates in the past).

Table 2
Joinpoint analysis for breast cancer mortality in women at all ages and at ages 20–49, 50–69 and 70–79, in the European Union as a whole, 1970–2006.

	Trend 1		Trend 2		Trend 3		Trend 4	
	Years	APC	Years	APC	Years	APC	Years	APC
All ages	1970–1989	0.8[a]	1989–1995	−0.6[a]	1995–2006	−1.8[a]		
Age 20–49	1970–1989	0.3[a]	1989–1994	−0.9[a]	1994–2006	−3.2[a]		
Age 50–69	1970–1988	0.8[a]	1988–1995	−0.5[a]	1995–2006	−1.8[a]		
Age 70–79	1970–1980	0.7[a]	1980–1986	1.9[a]	1986–1994	0.4[a]	1994–2006	−1.3[a]

APC: Estimated annual percent of change.
[a] Significantly different from 0 ($p < 0.05$).

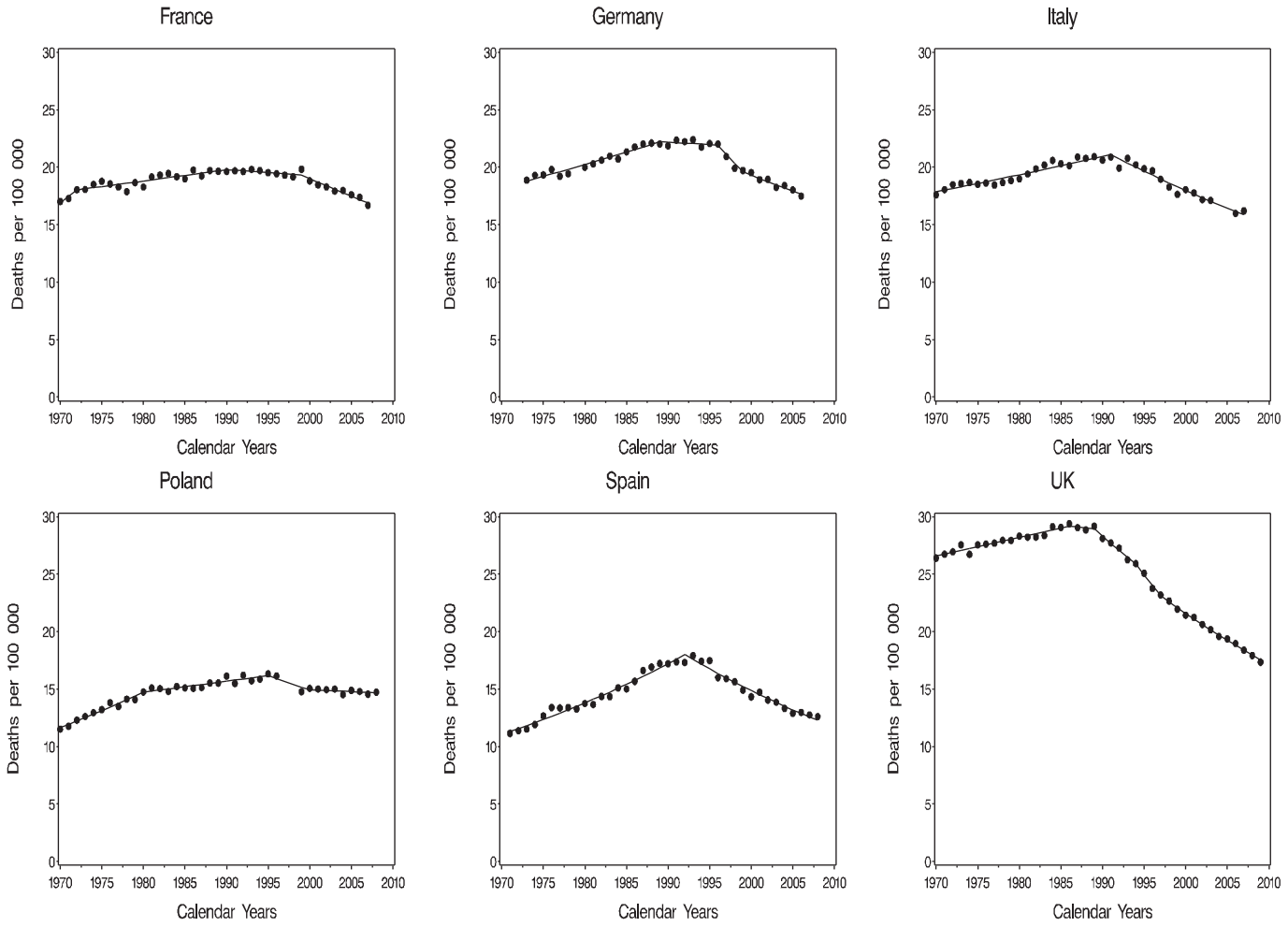

Fig. 3. Joinpoint analysis of trends in age-standardized (world population) mortality rates from breast cancer for women at all ages, in 6 major European countries, 1970–2009.

In most European countries, the fall was observed in all age groups, though it was proportionally larger in women below age 50 years (−36% in EU women between the peak in 1989 and 2006).

The major contribution to the favorable breast cancer mortality is largely due to the advancements in breast cancer treatment, including wider adoption of adjuvant antiestrogens therapy and chemotherapy, but also advancements in radiotherapy and surgery.[14–17] Selective estrogen receptor modulators (as tamoxifen or raloxifen) have also been suggested for primary prevention of breast cancer,[18] although the chemopreventive use of these drugs has been uncommon, and its impact on mortality is likely to be limited. The improvement in 5-year relative survival from breast cancer in several European countries supports a role of advancements in treatment on breast cancer mortality rates, although changes in survival may have been partly influenced by the introduction of breast cancer screening, with consequent increase in breast cancers with a better prognosis.[19]

The quantification of the role of earlier diagnosis and screening on breast cancer mortality trends is still under debate.[14,20–22] In several European countries, mammography screening (both organized and opportunistic) for breast cancer became widespread in the 1990's, generally in the age group 50–69 years.[14,23] However, the fall in breast cancer mortality started earlier (or was concomitant with) the introduction of screening, and, even in recent calendar periods, declines in breast cancer mortality were observed in women below age 50 (and over age 70), too, i.e. in the age group

Table 3
Joinpoint analysis for breast cancer mortality in women at all ages, in 6 major European countries, 1970–2009.

Country	Trend 1		Trend 2		Trend 3		Trend 4		Trend 5	
	Years	APC	Years	APC	Years	APC	Years	APC	Years	APC
France	1970–1972	3.3	1972–1990	0.5[a]	1990–1999	−0.3	1999–2007	−1.7[a]		
Germany	1973–1989	1[a]	1989–1996	−0.2	1996–1999	−3.7[a]	1999–2006	−1.5[a]		
Italy	1970–1991	0.8[a]	1991–2007	−1.8[a]						
Poland	1970–1980	2.4[a]	1980–1995	0.6[a]	1995–2000	−1.6[a]	2000–2008	−0.2		
Spain	1971–1992	2.2[a]	1992–2008	−2.4[a]						
UK	1970–1986	0.6[a]	1986–1989	−0.3	1989–1994	−2.2[a]	1994–1997	−3.7[a]	1997–2009	−2.3[a]

APC: Estimated annual percent of change.
[a] Significantly different from 0 ($p < 0.05$).

not covered by organized screening programs.[3,24] Thus, screening mammography is only one – and probably not the major – determinant of the declines in breast cancer rates.[14,20,21]

Risk factors for breast cancer (mainly reproductive and hormonal factors[25]) are unlikely to have affected mortality trends, since they have not favorably changed over the last decades. Thus, in most Europe, parity has decreased and age at first birth increased; breastfeeding has become less frequent; while the use of hormone replacement therapy (HRT) has been increasing in several countries until the early 2000's. The drop in HRT use after 2002 – following the report of the Women's Health Initiative study[26] – has been linked to the fall in breast cancer incidence in the USA,[27,28] as well as in some (western and northern) European countries where HRT was more widely used.[29] The impact of the reduction in HRT use on breast cancer mortality is, however, difficult to quantify.[22,30] Among other modifiable risk factors for breast cancer, overweight/obesity[31–33] has become more frequent in several – though not all – European countries,[34,35] while physical activity[33] and alcohol consumption[36] did not show favorable changes in women from many European countries. Thus, incidence from breast cancer, if anything, has been increasing up to the early 2000's, with some leveling off over more recent years only.[19,37]

There are potential problems of reliability and validity of death certification for breast cancer, which may vary across countries, calendar period and age group.[38,39] However, breast death certification is sufficiently reliable to permit meaningful inference on trends for most European countries, including those from western Europe, but also major central and eastern European countries, particularly under the age of 65 years. Part of the declines in the UK may be due to changes in coding and registration introduced in the mid 1990's,[40] and some under-recording of cancer deaths was reported for the Russian Federation in the late 1980's and 1990's, due to a fall in precision of coding of causes of death particularly in elderly living in rural areas.[41] Still, breast cancer is easy to diagnose in comparison to several other neoplasms. Greater caution is required for a few new national entities for which no long term trend was available. In these countries, breast cancer diagnosis and certification may be influenced by changed availability of diagnostic techniques and accuracy of death certification. Such changes in diagnosis and certification are, however, unlikely to explain the recent consistent fall in mortality rates across Europe.

Conclusion

In conclusion, trends in breast cancer mortality have been favorable over the last few decades in most Europe, mainly as a result of advancements in therapy. Such favorable patterns were larger in young and middle-age women, suggesting that overall trends in breast cancer mortality are likely to further improve in the near future.[42–44]

Role of the funding source

The sponsor had no role in data analysis and interpretation.

Conflict of interest

The authors have no conflict of interest to declare.

Authorship

CB supervised data analysis and interpretation, and drafted the manuscript; PB abstracted and analyzed data from the World Health Organization database; LC and EN gave useful suggestions for data interpretation and manuscript drafting; FL and CLV had the original study concept and design, and contributed in drafting the manuscript. All authors critically revised and approved the final version of the manuscript.

Acknowledgements

This work was conducted with the contribution of the Italian Association for Cancer Research, the Swiss League against Cancer, and the Swiss Foundation for Research against Cancer.

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