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Original article

Trends and predictions to 2020 in breast cancer mortality in Europe

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ABSTRACT

Objectives: We analyzed trends in mortality from breast cancer in women in 36 European countries and the European Union (EU) over the period 1970–2014, and predicted numbers of deaths and rates to 2020.
Materials and methods: We derived breast cancer death certification data and population figures from the World Health Organization and Eurostat databases. We obtained 2020 estimates using a joinpoint regression model.
Results: Overall, EU breast cancer mortality rates (world standard) declined from 17.9/100,000 in 2002 to 15.2 in 2012. The predicted 2020 rate is 13.4/100,000. The falls were largest in young women (20–49 years, −22% between 2002 and 2012). Within the EU, declines were larger in the United Kingdom (UK) and other northern and western European countries than in most central and eastern Europe. The UK has the second lowest predicted breast cancer mortality rate in 2020 (after Spain), starting from the highest one in 1970. Breast cancer mortality is predicted to rise in Poland, where the predicted 2020 rate is 15.3/100,000. We estimated that about 32,500 breast cancer deaths will be avoided in 2020 in the EU as compared to the peak rate of 1989, and a total of 475,000 breast cancer deaths over the period 1990–2020.
Conclusion: The overall favourable breast cancer mortality trends are mainly due to a succession of improvements in the management and treatment of breast cancer, though early diagnosis and screening played a role, too. Improving breast cancer management in central and eastern Europe is a priority.

1. Introduction

After long term rises, breast cancer mortality has been declining in most of Europe since the mid or late 1980's [1]. The declines were earlier and larger in northern Europe, where breast cancer rates were originally highest [2,3]. This led to a levelling of breast cancer mortality across Europe, although substantial differences were still evident; among major countries overall mortality rates were between 21/100,000 women in Denmark and 12.8 in Spain around 2007 [4,5]. The favourable trend in breast cancer mortality over the last few decades is essentially due to advancement in diagnosis and treatment which have steadily accumulated over this period, though incidence has declined in recent generations as well [6,7].

To provide an updated and comprehensive picture of recent trends and patterns in breast cancer mortality across Europe, we considered the most recent mortality data (up to 2014 in most countries) and provided predictions to 2020 [8] for select larger European countries and the whole European Union (EU).

2. Materials and methods

We retrieved official death certification data for breast cancer from the World Health Organization (WHO) database [9], from 1970 to 2014 (or the most recent available year), for European countries.

In some countries, data were missing for one or more calendar years. We did not extrapolate missing data, except for the calculation of the EU rates, where we used the nearest available data, for the few missing data in single countries. We considered the EU as

Abbreviations: EU, European Union; UK, United Kingdom; WHO, World Health Organization; ICD, International Classification of Diseases; APC, annual percent changes; AAPC, average annual percent change; PIs, prediction intervals.

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defined on May 2017, i.e. including 28 countries.

During the calendar period considered, three Revisions of the International Classification of Diseases (ICD) were used (8th, 9th and 10th) [10–12]. There was, however, no relevant change in breast cancer certification.

We derived resident population estimates, based on official censuses, from the WHO database [9]. When population data were missing, we obtained them from Eurostat [13].

Using the certified deaths and the resident population matrices, we calculated age-specific mortality rates for each 5-year age group (from 0 to 4 to 85 + years) and calendar year or quinquennium. We computed age standardized (world population) rates, using the direct method, at all ages and at ages 20–49, 50–69 and 70–79 years.

In order to identify significant changes in mortality trends for the EU overall, we performed joinpoint regression models [14], allowing up to three joinpoints, and estimated annual percent changes (APC) for each trend segment identified by the model, as well as the average annual percent change (AAPC) over the whole period [15,16].

We obtained breast cancer predicted deaths and rates to 2020 for France, Germany, Italy, Poland, Spain, and the United Kingdom (UK) (the largest EU countries), and for the EU as a whole, as follows: we identified the most recent joinpoint trend segment from the joinpoint model [14], and applied a linear regression model to mortality data for each 5-year age group over the identified trend segment extrapolating the predicted age-specific certified number of deaths. We estimated 95% prediction intervals (PIs) using a standard error accounting for the variability of the new observation [17]. We then computed predicted standard death rates with 95% PIs using the predicted age-specific deaths counts and the predicted population data from Eurostat [13].

3. Results

Table 1 gives the age-standardized mortality rates from breast cancer at all ages and at ages 20–49, 50–69 and 70–79 years for 36 European countries and the EU as a whole around 2002 (2000–2004 quinquiennium), 2007 (2005–2009 quinquiennium) and 2012 (single year), with the percent changes between 2012 and 2002.

Table 1
Age-standardized (world population) mortality rates per 100,000 women from breast cancer at all ages and at ages 20–49, 50–69 and 70–79 in various European countries and in the European Union (EU) as a whole around 2002 (2000–2004), 2007 (2005–2009) and in 2012 (unless indicated in parentheses), and corresponding change in rates.

	All ages				20–49				50–69				70–79			
	2002	2007	2012	% change (2012/02)	2002	2007	2012	% change (2012/02)	2002	2007	2012	% change (2012/02)	2002	2007	2012	% change (2012/02)
European Union																
EU	**17.94**	**16.44**	**15.19**	**−15.3**	**8.77**	**7.57**	**6.86**	**−21.8**	**59.46**	**54.43**	**48.83**	**−17.9**	**101.23**	**95.54**	**93.93**	**−7.2**
Austria	17.81	15.85	14.07	−21.0	7.58	6.21	5.74	−24.3	58.61	52.43	42.31	−27.8	105.95	94.07	98.62	−6.9
Belgium	21.49	19.61	17.25	−19.7	10.06	8.21	7.04	−30.0	73.25	65.88	55.74	−23.9	118.03	120.76	108.65	−7.9
Bulgaria	14.74	15.81	16.31	10.7	8.77	8.03	7.68	−12.4	50.03	55.04	57.96	15.9	73.36	85.00	84.00	14.5
Croatia	18.19	17.38	18.39	1.1	8.43	7.38	8.18	−3.0	57.86	55.90	54.45	−5.9	119.32	107.53	121.77	2.1
Czech Republic	18.46	15.41	13.40	−27.4	6.54	5.57	4.68	−28.4	59.57	49.26	42.18	−29.2	127.68	105.69	95.96	−24.8
Denmark	24.02	20.40	17.47	−27.3	8.56	6.86	6.39	−25.4	83.98	66.92	55.91	−33.4	151.77	148.15	121.10	−20.2
Estonia	18.26	15.55	15.93	−12.8	10.14	7.43	6.02	−40.6	64.71	55.37	58.75	−9.2	90.19	82.14	82.39	−8.6
Finland	15.19	14.26	13.97	−8.0	7.63	6.39	6.42	−15.9	49.98	48.10	47.91	−4.1	90.28	87.52	80.72	−10.6
France	18.29	16.98	15.23	−16.7	9.18	8.32	7.09	−22.8	60.87	56.09	48.95	−19.6	102.56	96.71	91.57	−10.7
Germany	18.81	17.08	16.05	−14.7	8.31	6.89	6.32	−23.9	63.67	57.82	51.95	−18.4	110.21	106.14	108.00	−2.0
Greece	15.05	14.65	13.95	−7.3	6.93	6.32	6.49	−6.3	46.26	44.10	42.48	−8.2	96.03	89.54	85.84	−10.6
Hungary	21.78	18.69	17.78	−18.4	10.64	8.36	7.89	−25.8	72.40	63.08	57.89	−20.0	121.75	113.42	116.09	−4.6
Ireland	22.61	20.50	18.12	−19.9	10.46	9.51	8.82	−15.7	77.93	66.49	55.78	−28.4	126.43	124.95	114.66	−9.3
Italy	17.52	16.02	14.87	−15.1	8.55	7.41	7.09	−17.1	58.36	52.97	47.23	−19.1	98.92	92.05	89.43	−9.6
Latvia	18.02	17.65	15.96	−11.4	10.51	9.73	7.70	−26.7	63.34	62.24	55.67	−12.1	87.13	86.70	90.47	3.8
Lithuania	17.82	16.84	15.85	−11.1	10.33	8.56	8.88	−14.0	61.83	59.58	54.30	−12.2	93.42	89.27	88.85	−4.9
Luxembourg	17.55	15.01	13.65	−22.2	8.36	4.42	4.40	−47.4	55.03	50.82	44.44	−19.2	105.73	102.48	79.74	−24.6
Malta	21.24	19.80	16.32	−23.2	8.09	8.22	7.87	−2.7	74.34	73.32	49.47	−33.5	135.53	89.57	72.46	−46.5
Netherlands	22.29	19.73	17.61	−21.0	11.43	9.56	7.95	−30.4	71.86	64.70	57.87	−19.5	122.59	106.22	101.44	−17.3
Poland	14.91	14.61	14.18	−4.9	7.54	6.59	5.90	−21.8	51.80	51.67	50.55	−2.4	78.63	79.38	82.87	5.4
Portugal	15.04	13.59	13.87	−7.8	8.52	7.68	8.47	−0.6	48.91	43.70	42.42	−13.3	80.40	71.47	70.38	−12.5
Romania	16.31	15.78	14.75	−9.6	9.39	7.86	6.75	−28.1	55.29	55.05	50.95	−7.8	85.18	86.19	89.22	4.7
Slovakia	17.44	15.19	16.02	−8.1	7.72	6.08	5.13	−33.5	60.19	53.26	53.65	−10.9	100.92	91.23	114.96	13.9
Slovenia (2010)	19.15	17.43	16.54	−13.6	7.87	6.54	6.59	−16.3	64.54	54.87	51.23	−20.6	117.07	112.35	102.64	−12.3
Spain	14.05	12.68	11.56	−17.7	7.86	7.35	6.35	−19.2	45.11	39.35	35.16	−22.1	75.28	68.14	66.91	−11.1
Sweden	15.49	14.17	12.91	−16.7	7.55	6.14	6.23	−17.5	51.25	47.23	40.12	−21.7	88.31	85.41	78.99	−10.6
UK	20.60	18.39	16.37	−20.5	10.20	8.80	7.90	−22.5	66.18	58.51	50.49	−23.7	119.33	109.37	98.89	−17.1
Non-EU countries																
Belarus (2011)	14.56	13.88	12.98	−10.9	8.94	7.48	6.25	−30.1	52.10	53.25	50.28	−3.5	69.21	59.87	64.32	−7.1
Iceland (2009)	15.24	17.23	13.23	−13.2	5.89	7.76	4.16	−29.4	54.10	56.58	35.16	−35.0	84.18	125.01	160.49	90.7
Norway	16.18	13.66	11.74	−27.4	8.06	6.30	4.99	−38.1	52.76	45.16	34.70	−34.2	91.04	77.56	83.82	−7.9
Republic of Moldova	17.03	17.85	16.28	−4.4	10.68	8.70	7.41	−30.6	62.91	68.78	61.26	−2.6	68.88	88.10	87.33	26.8
Russian Federation (2011)	17.33	17.12	16.45	−5.1	10.03	8.95	7.97	−20.5	62.45	62.52	59.81	−4.2	79.85	82.43	86.52	8.4
Serbia	20.78	21.02	20.88	0.5	11.74	9.63	10.02	−14.7	72.67	75.14	72.03	−0.9	101.19	115.35	120.96	19.5
Switzerland	17.58	15.95	14.13	−19.6	7.26	6.10	4.74	−34.7	59.41	52.92	46.43	−21.8	107.54	109.90	94.85	−11.8
TFYR Macedonia (2010)	17.42	16.35	19.37	11.2	10.32	7.69	8.69	−15.8	58.74	58.08	72.32	23.1	87.08	89.45	98.55	13.2
Ukraine	17.90	17.74	17.16	−4.1	11.47	10.61	8.83	−23.0	65.20	65.45	63.34	−2.9	75.24	77.49	88.08	17.1

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