Munich Cancer Registry

- Survival
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- *Deutsch*

ICD-10 C50: Breast cancer (women)

Incidence and Mortality

Year of diagnosis	1998-2020
Patients	73,478
Diseases	77,358
Creation date	12/21/2021
Database export	12/20/2021
Population (females)	2.50 m

Munich Cancer Registry
Cancer Registry Bavaria - Upper Bavaria Regional Center
at Klinikum Grosshadern/IBE
Marchioninistr. 15
Munich, 81377
Germany

https://www.tumorregister-muenchen.de/en

https://www.tumorregister-muenchen.de/en/facts/base/bC50f_E-ICD-10-C50-Breast-cancer-women-incidence-and-mortality.pdf

Index of figures and tables

Global Statements about the statistics on the Internet −
Baseline Statistics (grey button), **Survival** (red button)

In these analyses, the clinics and physicians of Upper Bavaria and the city and county of Landshut[#], with a total of 4.69 million inhabitants, account for the frequency of cancer diseases[##] and the achieved long term results. Additionally, the long term survival evaluated by the Munich Cancer Registry (MCR) is compared with the results of the population-based registry in the USA (SEER), which is useful for checking the consistency of the data on an international level.

In comparing several tables, inconsistent figures may be detected. This is based on the fact that different patient cohorts are included in the base calculation, for example when proportions of multiple tumors or DCO-cases[###] are concerned. In other cases the individual tumor diagnosis is the basis for calculation, for example with incidence.

The foot notes describe the currentness of the data. The baseline statistics and survival data are updated annually. This yearly analysis comprises the Annual Report of the MCR.

Clinics and physicians have access to essentially more detailed data, with which they can check, compare and in the best case optimize their own data and results.

We would be pleased to receive corrections, critique and useful suggestions. Just send an e-mail to tumor@ibe.med.uni-muenchen.de.

Munich Cancer Registry, December 2021

[#] Base data has been collected since 1998. An increase in new diseases is apparent, which is an effect of two extensions in the MCR catchment area (from a base population of 2.65 million to 4.10 in 2002, and to 4.69 million in 2007).

[##] Due to the high frequency and good prognosis of non-malignant skin cancer (C44), no systematic ascertainment is performed for this diagnosis. C44 is not designated as a primary, but rather as a secondary tumor.

[###] DCO (death certificate only) identifies a cancer case that first becomes available to the MCR through the death certificate.

ICD-10 codes (ICD-10 2015) used for specifying cancer site

Code	Description
C50.-	Malignant neoplasm of breast
C50.0	Nipple and areola
C50.1	Central portion of breast
C50.2	Upper-inner quadrant of breast
C50.3	Lower-inner quadrant of breast
C50.4	Upper-outer quadrant of breast
C50.5	Lower-outer quadrant of breast
C50.6	Axillary tail of breast
C50.8	Overlapping lesion of breast
C50.9	Breast, unspecified

Sex: Female

INCIDENCE

Table 1

Cases with invasive cancer by year of diagnosis, proportions of DCO, further malignancies, deaths, and active follow-up (incl. DCO)

Year of diagnosis	All cases n	DCO cases n	Prop. DCO %	Prop. at least 1 further malign. prior + synchron. %	Prop. at least 1 further malign. after %	Prop. deaths %	Prop. actively followed %
1998	1922	114	5.9	13.5	10.4	62.3	95.6
1999	1958	94	4.8	12.7	10.2	58.3	94.9
2000	1972	83	4.2	13.0	9.9	57.4	96.5
2001	2004	97	4.8	13.2	9.6	53.5	94.7
2002	3386	268	7.9	13.1	9.4	57.8	95.9 #
2003	3163	243	7.7	13.1	9.0	56.6	95.3
2004	3267	197	6.0	13.2	8.7	52.0	94.8
2005	3376	195	5.8	13.3	8.3	50.9	95.4
2006	3332	135	4.1	13.5	7.9	46.5	93.8
2007	3673	189	5.1	13.6	7.5	46.4	94.0 #
2008	4062	172	4.2	13.8	7.0	41.9	96.9
2009	4124	190	4.6	14.0	6.5	41.4	97.5
2010	4028	173	4.3	14.2	6.0	38.7	97.2
2011	3939	168	4.3	14.5	5.5	35.4	96.9
2012	3975	134	3.4	14.7	5.1	33.8	96.6
2013	3909	157	4.0	14.9	4.7	32.1	97.1
2014	3799	148	3.9	15.2	4.2	29.3	96.3
2015	3827	153	4.0	15.4	3.6	26.5	95.6
2016	3689	165	4.5	15.6	3.1	24.8	99.5
2017	3682	142	3.9	15.8	2.8	19.6	99.3
2018	3598	82	2.3	16.0	2.3	15.3	99.4
2019	3543	10	0.3	16.2	1.8	9.9	99.4
2020	3130	1	0.0	16.3	1.3	5.5	99.7 ##
1998-2020	77358	3310	4.3	16.3	10.4	37.2	96.7

77,358 cases diagnosed 1998-2020 are related to a total of 73,478 patients. Currently, in 17,873 (24.3 %) of these 73,478 patients more than one malignancy of any cancer type has been registered. Hereby, groups of 14,730 / 2,577 / 566 (20.0 % / 3.5 % / 0.8 %) patients exist having 2 / 3 / 4+ malignancies.

The increases of incident cases in 2002 and 2007 reflect the expansion to additional registry areas.

Please be aware that data of recent annual patient cohorts may not yet be fully processed. The years under evaluation can be retreived from the respective headings.

How to interpret:
In 2018, a subgroup of 3,598 cases has been diagnosed, of which 16.0 % previously and/or concurrently (synchronously) had at least one other malignancy of any cancer type. In 2.3 % of cases, at least one new malignancy has occurred during the follow-up period (all numbers refer to the date of the database export, see cover sheet).

Table 2

Incidence measures by year of diagnosis including DCO cases
(with respect to registry area expansion from 2.65 to 4.10 m as of 2002,
and from 4.10 to 4.94 m as of 2007, respectively)

Year of diagnosis	Cases n	Incidence raw	Incidence WS	Incidence ES	Incidence BRD-S
1998	1922	163.4	93.2	128.3	145.5
1999	1958	165.0	94.4	129.3	146.7
2000	1972	164.2	92.3	127.4	145.1
2001	2004	164.7	94.6	129.8	147.7
2002	3386	172.9	95.7	131.9	151.9
2003	3163	160.6	86.9	120.0	138.7
2004	3267	165.3	91.1	124.6	143.1
2005	3376	169.7	92.4	127.1	145.6
2006	3332	165.9	90.9	124.1	141.5
2007	3673	159.1	86.2	118.5	135.4
2008	4062	175.0	94.5	129.6	149.1
2009	4124	177.3	96.1	131.9	150.5
2010	4028	172.1	91.0	125.6	143.7
2011	3939	168.5	88.8	122.2	140.3
2012	3975	168.4	88.3	121.5	140.2
2013	3909	164.0	86.0	117.9	135.9
2014	3799	157.8	81.7	112.6	130.0
2015	3827	157.3	80.9	111.5	129.3
2016	3689	150.2	75.5	104.6	122.7
2017	3682	149.4	75.4	104.5	121.7
2018	3598	144.9	73.1	101.0	118.1
2019	3543	142.7	73.3	101.1	117.2
2020	3130	126.1	65.2	89.6	104.1
1998-2020	77358	160.3	85.4	117.5	135.3

The computation of the incidence measures includes all cancers, irrespective of first or subsequent malignancy.

Table 3

Age distribution parameters by year of diagnosis
(incl. DCO)

Year of diagnosis	Cases n	Mean	Std. dev.	Min.	Max.	10%	25%	Median 50%	75%	90%
1998	1922	62.5	13.9	28.4	97.5	45.4	52.9	60.9	72.9	82.7
1999	1958	62.2	14.1	23.9	99.3	43.9	52.5	61.3	73.0	81.4
2000	1972	63.0	14.0	20.4	100	44.8	53.2	61.9	74.0	81.7
2001	2004	62.4	13.9	24.3	97.7	44.3	52.7	61.5	72.9	81.2
2002	3386	64.0	14.3	21.5	99.4	45.3	53.8	63.4	74.9	82.6
2003	3163	64.2	14.5	24.4	105	44.1	54.1	64.0	75.6	82.9
2004	3267	63.7	14.5	18.8	98.9	44.6	53.5	63.9	74.4	83.3
2005	3376	64.2	14.1	21.7	102	45.2	54.8	64.1	74.1	83.2
2006	3332	63.6	14.2	23.3	102	44.0	53.5	64.6	72.9	82.7
2007	3673	64.2	14.4	20.7	103	44.7	53.3	64.8	73.9	83.9
2008	4062	64.0	14.1	21.6	109	44.8	53.6	64.9	73.5	82.6
2009	4124	63.9	14.0	25.0	109	45.3	53.4	64.5	73.5	83.1
2010	4028	64.5	14.1	25.2	105	45.9	53.4	65.2	74.3	84.0
2011	3939	64.4	14.3	21.7	102	45.6	52.8	64.8	74.5	84.0
2012	3975	64.3	14.2	23.9	101	45.6	52.8	64.9	74.9	82.8
2013	3909	64.4	14.5	23.8	108	45.6	52.6	64.8	75.1	83.9
2014	3799	64.7	14.2	21.5	106	46.2	52.8	65.3	75.4	83.1
2015	3827	64.7	14.3	22.7	101	46.2	52.7	65.7	75.9	83.0
2016	3689	65.3	14.5	23.4	103	46.4	53.6	66.7	76.7	82.8
2017	3682	65.3	14.4	17.2	104	46.6	53.5	66.2	76.9	82.9
2018	3598	65.3	14.4	23.4	100	46.1	53.9	66.4	77.3	83.2
2019	3543	64.9	13.9	21.2	98.8	46.7	53.9	65.6	76.1	82.8
2020	3130	64.6	14.2	27.2	104	45.6	53.1	65.0	76.5	82.6
1998–2020	77358	64.3	14.2	17.2	109	45.4	53.3	64.5	75.1	83.0

Table 4

Age distribution by 5-year age group for period 2007-2020
(incl. DCO)

Age at diagnosis Years	Cases n	%	Cum.%
0-4			
5-9			
10-14			
15-19	1	0.0	0.0
20-24	20	0.0	0.0
25-29	182	0.3	0.4
30-34	527	1.0	1.4
35-39	1244	2.3	3.7
40-44	2717	5.1	8.9
45-49	4598	8.7	17.5
50-54	5763	10.9	28.4
55-59	5121	9.7	38.1
60-64	5944	11.2	49.3
65-69	6950	13.1	62.4
70-74	6067	11.5	73.9
75-79	5803	11.0	84.8
80-84	4035	7.6	92.4
85+	4006	7.6	100.0
All ages	52978	100.0	

Table 5

Age-specific incidence, DCO rate and proportion of all cancers for period 2007–2020

Age at diagnosis Years	Cases n	Age-spec. incidence	DCO rate n=1884 %	Prop. all cancers n=155051 %
0– 4		0.0		
5– 9		0.0		
10–14		0.0		
15–19	1	0.1		0.4
20–24	20	1.1		3.9
25–29	180	8.0	0.6	15.2
30–34	520	22.8		24.2
35–39	1235	54.3	0.5	35.2
40–44	2677	110.6	0.4	43.5
45–49	4502	172.9	0.5	48.1
50–54	5628	224.1	0.4	45.1
55–59	5000	229.6	0.7	37.5
60–64	5799	305.4	0.8	37.2
65–69	6756	372.6	1.1	35.6
70–74	5874	341.6	1.8	29.5
75–79	5559	370.2	3.4	28.5
80–84	3877	364.2	8.2	25.2
85+	3887	372.8	27.2	23.7
All ages	51515		3.7	33.2
Incidence				
Raw		153.4		
WS		80.4		
ES		110.5		
BRD-S		127.5		

The age-specific incidence characterizes the disease risk in a particular age group. The age distribution depends on the patient population frequency in each age group and reflects the tangible clinical picture of everyday patients care (see following chart).

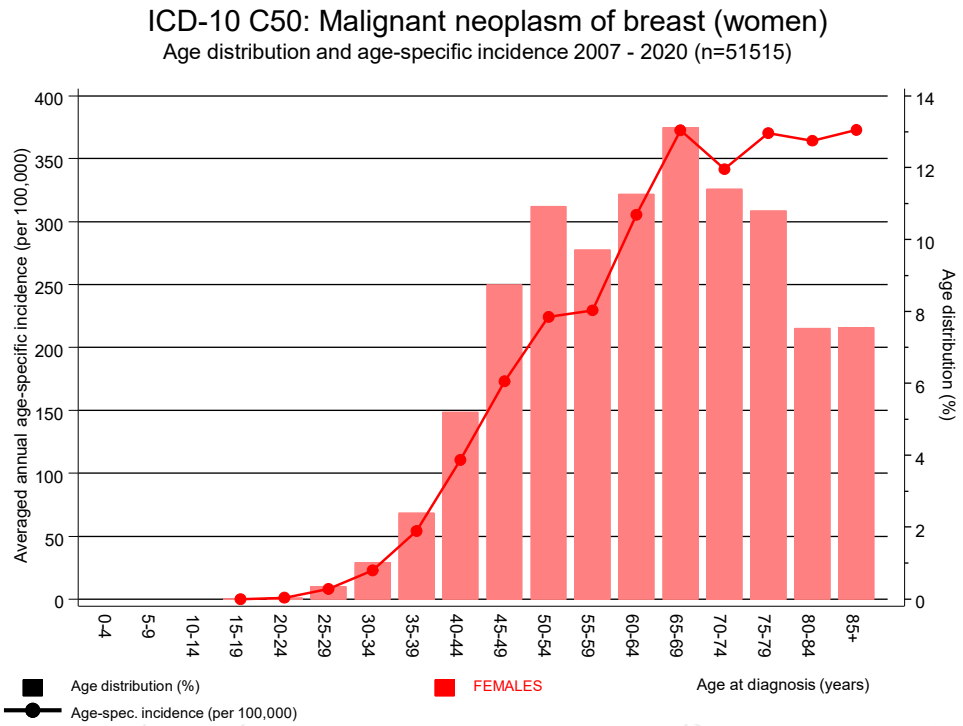

Figure 6. Age distribution (mean=64.5 yrs, median=65.2 yrs) and age-specific incidence.

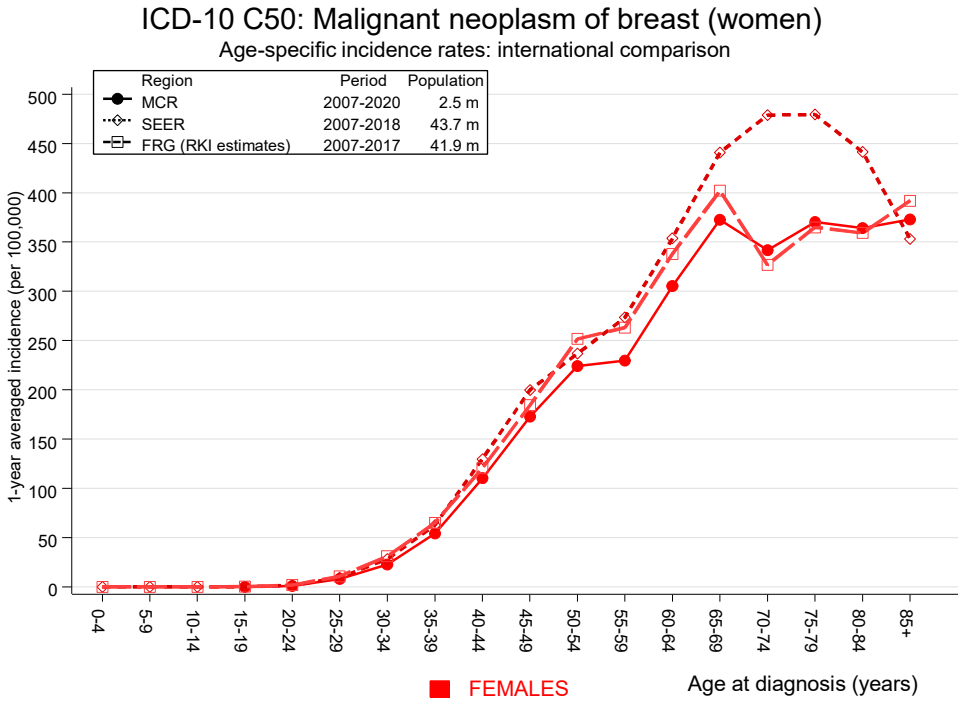

Figure 6a. Age-specific incidence in MCR registry areas compared to Germany (FRG, RKI estimates) and SEER (Surveillance, Epidemiology, and End Results, USA).

Reference:

Estimated age-specific patient population of Germany, latest update: 16 March 2021. German Centre for Cancer Registry Data, Robert Koch Institute (RKI), based on data of the population based cancer registries. http://www.krebsdaten.de. Last access: 08/17/2021
Surveillance, Epidemiology, and End Results (SEER) Program SEER*Stat Database: Incidence - SEER 21 Regs Research Data, released April 2021, based on the November 2020 submission. http://www.seer.cancer.gov.

Table 7

Standardized incidence ratio (SIR, with 95% confidence limits), excess absolute risk (EAR) and DCO rate of further malignancies for period 1998–2020

Diagnosis		Observed n	Expected n	SIR	CI 95%	CI 95%		EAR	DCO %
C03–C06	Oral cavity	39	20.6	1.9	1.3	2.6	#	0.5	2.6
C07–C08	Salivary gland	18	5.4	3.3	2.0	5.3	#	0.4	5.6
C09–C10	Oropharynx	35	15.8	2.2	1.5	3.1	#	0.6	
C15	Oesophagus	60	23.3	2.6	2.0	3.3	#	1.1	10.0
C16	Stomach	236	108.1	2.2	1.9	2.5	#	3.8	8.5
C17	Small intestine	44	19.0	2.3	1.7	3.1	#	0.7	
C18	Colon	578	312.4	1.9	1.7	2.0	#	7.8	7.3
C19–C20	Rectum	201	131.1	1.5	1.3	1.8	#	2.1	6.0
C21	Anus/canal	43	19.8	2.2	1.6	2.9	#	0.7	2.3
C22	Liver	73	41.2	1.8	1.4	2.2	#	0.9	21.9
C23–C24	Bile	82	45.1	1.8	1.4	2.3	#	1.1	14.6
C25	Pancreas	322	151.5	2.1	1.9	2.4	#	5.0	21.7
C26	GI cancer	12	5.1	2.4	1.2	4.1	#	0.2	50.0
C33–C34	Lung	639	265.8	2.4	2.2	2.6	#	11.0	9.9
C43	Malign. melanoma	297	137.7	2.2	1.9	2.4	#	4.7	3.0
C46,C49	Soft tissue	62	19.4	3.2	2.5	4.1	#	1.3	3.2
C48	Peritoneal	39	14.5	2.7	1.9	3.7	#	0.7	7.7
C50	Breast	3933	1106.0	3.6	3.4	3.7	#	83.4	
C51	Vulva	73	35.1	2.1	1.6	2.6	#	1.1	1.4
C53	Cervix uteri	82	48.4	1.7	1.3	2.1	#	1.0	9.8
C54	Corpus uteri	437	193.2	2.3	2.1	2.5	#	7.2	1.6
C55,C57	Fem. genitals un	13	6.5	2.0	1.1	3.4	#	0.2	46.2
C56	Ovary	317	137.0	2.3	2.1	2.6	#	5.3	8.5
C64	Kidney	171	77.3	2.2	1.9	2.6	#	2.8	5.8
C65	Renal pelvis	20	10.3	1.9	1.2	3.0	#	0.3	
C66	Ureter	14	5.4	2.6	1.4	4.3	#	0.3	
C67	Bladder	104	63.1	1.6	1.3	2.0	#	1.2	5.8
C69	Eye melanoma	13	4.2	3.1	1.6	5.3	#	0.3	
C70–C72	CNS cancer	66	44.1	1.5	1.2	1.9	#	0.6	13.6
C73	Thyroid	110	62.0	1.8	1.5	2.1	#	1.4	2.7
C76–C79	CUP	69	58.3	1.2	0.9	1.5		0.3	2.9
C81	Hodgkin lymphoma	14	6.2	2.2	1.2	3.8	#	0.2	7.1
C82–C85	NHL	271	130.2	2.1	1.8	2.3	#	4.2	3.3
C90	Mult. myeloma	67	40.1	1.7	1.3	2.1	#	0.8	17.9
C91–C96	Leukaemia	140	48.1	2.9	2.4	3.4	#	2.7	11.4
Others, specified		90	51.2	1.8	1.4	2.2	#	1.1	10.0
Not observed		0	1.5	0.0	0.0	2.4		-0.0	
All further malignancies		8784	3463.9	2.5	2.5	2.6	#	157.0	4.4

Patients	70126
Median age at next malignancy (years)	70.7
Person-years	338880
Mean observation time (years)	4.8
Median observation time (years)	3.2

The occurrence of further specified malignancy is statistically significant.

Further observed malignancies with count 1 to 11 are pooled in category “Others, specified”.

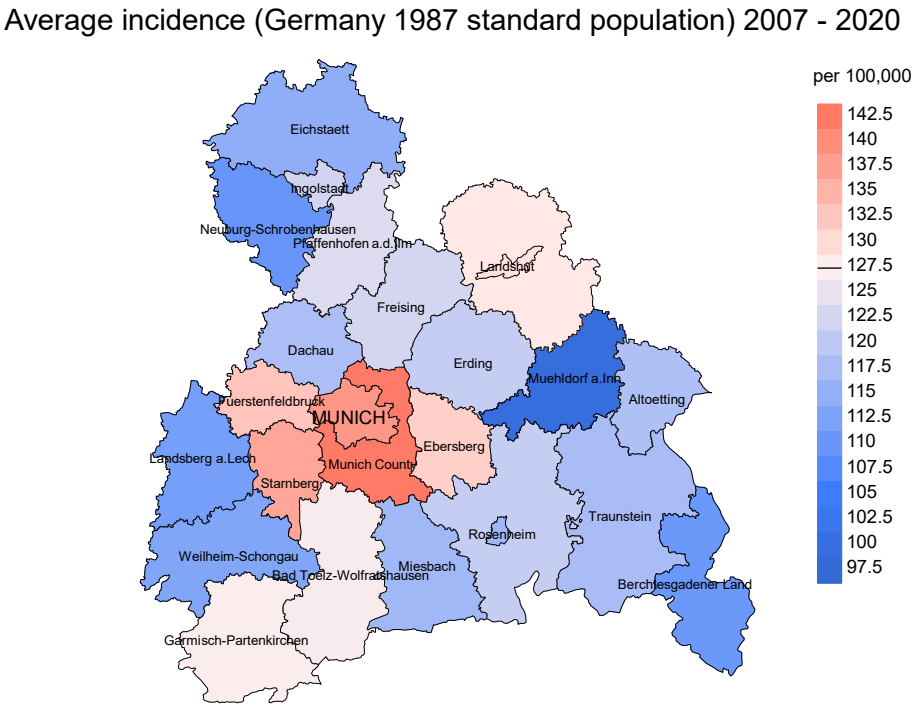

Figure 8a. Map of cancer incidence (german standard population, incl. DCO cases) by county averaged for period 2007 to 2020. According to their individual incidence rates, the counties are displayed in different red and blue hues, being the fine white color attributed to the population mean (127.5/100,000 WS N=51,515).

The results should be interpreted with caution! E.g., in county Ebersberg with a population of 67,727 female residents (averaged) in the period from 2007 to 2020 a total of 1,482 women were identified with newly diagnosed breast cancer (women). Therefore, the mean incidence rate for this cancer type in this area can be calculated at 131.4/100,000 (german standard population). Though, the value of this parameter may vary with an underlying probability of 99% between 122.7 and 140.6/100,000.

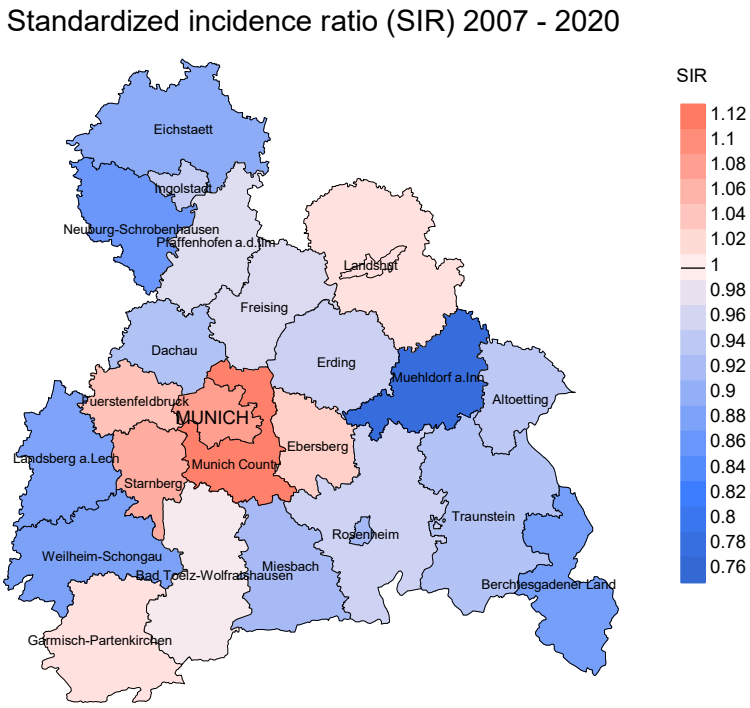

Figure 8b. Map of standardized incidence ratio (SIR, incl. DCO cases) by county averaged for period 2007 to 2020. According to their individual SIR values, the counties are displayed in different red and blue hues, being the fine white color attributed to the population overall of 1.0 (N=51,515).

The results should be interpreted with caution! E.g., in county Ebersberg with a population of 67,153 female residents (averaged) in the period from 2007 to 2020 a total of 1,482 women were identified with newly diagnosed breast cancer (women). Therefore, the mean standardized incidence ratio (SIR) for this cancer type in this area can be calculated at 1.03. Though, the value of this parameter may vary with an underlying probability of 99% between 0.96 and 1.10, and is therefore not statistically striking.

MORTALITY

Table 9a

Annual cohorts: Incident cancers, follow-up status, proportion of DCO, deaths among the annual cohorts and proportion of available death certificates (with respect to registry area expansion from 2.65 to 4.10 m as of 2002, and from 4.10 to 4.94 m as of 2007, respectively)

Year of diagnosis	Incident cases n	Prop. actively followed %	Prop. DCO %	Deaths n	Prop. deaths %	Prop. deaths with death certific. %
1998	1922	95.6	5.9	1198	62.3	93.4
1999	1958	94.9	4.8	1142	58.3	93.2
2000	1972	96.5	4.2	1131	57.4	95.0
2001	2004	94.7	4.8	1072	53.5	95.1
2002	3386	95.9	7.9	1956	57.8	95.0
2003	3163	95.3	7.7	1791	56.6	95.1
2004	3267	94.8	6.0	1698	52.0	95.3
2005	3376	95.4	5.8	1717	50.9	94.4
2006	3332	93.8	4.1	1549	46.5	94.6
2007	3673	94.0	5.1	1706	46.4	94.0
2008	4062	96.9	4.2	1704	41.9	93.5
2009	4124	97.5	4.6	1707	41.4	93.1
2010	4028	97.2	4.3	1557	38.7	93.6
2011	3939	96.9	4.3	1396	35.4	93.8
2012	3975	96.6	3.4	1345	33.8	91.4
2013	3909	97.1	4.0	1253	32.1	91.8
2014	3799	96.3	3.9	1114	29.3	89.9
2015	3827	95.6	4.0	1014	26.5	85.7
2016	3689	99.5	4.5	914	24.8	85.4
2017	3682	99.3	3.9	723	19.6	82.4
2018	3598	99.4	2.3	549	15.3	74.7
2019	3543	99.4	0.3	349	9.9	85.4
2020	3130	99.7	0.0	171	5.5	89.5
1998-2020	77358	96.7	4.3	28756	37.2	92.4

Table 9b

Annual cohorts of incident cancers and deaths, proportion of death certificates and cases deceased within the same year of being diagnosed with cancer (incl. DCO)
(with respect to registry area expansion from 2.65 to 4.10 m as of 2002, and from 4.10 to 4.94 m as of 2007, respectively)

Year of diagnosis/ death	Incident cases n	Deaths n	Prop. deaths with death certific. %	Deaths in same year n	Prop. deaths in same year %
1998	1922	818	87.2	156	8.1
1999	1958	813	87.8	120	6.1
2000	1972	838	90.5	123	6.2
2001	2004	828	90.8	122	6.1
2002	3386	1246	96.9	334	9.9
2003	3163	1376	97.4	304	9.6
2004	3267	1412	97.7	265	8.1
2005	3376	1450	97.0	274	8.1
2006	3332	1412	97.3	227	6.8
2007	3673	1578	98.0	266	7.2
2008	4062	1660	98.4	301	7.4
2009	4124	1653	98.4	250	6.1
2010	4028	1736	98.4	265	6.6
2011	3939	1830	99.0	273	6.9
2012	3975	1824	98.2	239	6.0
2013	3909	1921	98.6	266	6.8
2014	3799	1858	98.3	252	6.6
2015	3827	1996	98.5	252	6.6
2016	3689	2006	98.6	280	7.6
2017	3682	2120	96.9	243	6.6
2018	3598	1821	69.0	153	4.3
2019	3543	1630	46.5	93	2.6
2020	3130	2073	89.0	83	2.7
1998–2020	77358	35899	92.9	5141	6.6

Table 9c

Annual cohorts of deaths, proportion of cancer-related and non-cancer-related deaths, and cancer recorded on death certificates (incl. DCO)
(with respect to registry area expansion from 2.65 to 4.10 m as of 2002, and from 4.10 to 4.94 m as of 2007, respectively)

Year of death	Deaths n	Prop. cancer-related %	Prop. non-cancer-related %	Prop. cancer recorded on death certificate %
1998	818	69.4	30.6	84.4
1999	813	71.3	28.7	86.7
2000	838	70.9	29.1	83.1
2001	828	67.3	32.7	83.2
2002	1246	72.1	27.9	86.4
2003	1376	70.1	29.9	84.6
2004	1412	75.8	24.2	85.9
2005	1450	69.7	30.3	81.5
2006	1412	72.2	27.8	83.7
2007	1578	69.6	30.4	81.4
2008	1660	69.2	30.8	80.4
2009	1653	68.1	31.9	79.2
2010	1736	68.7	31.3	80.1
2011	1830	67.8	32.2	80.3
2012	1824	66.9	33.1	78.8
2013	1921	63.7	36.3	76.1
2014	1858	64.7	35.3	77.1
2015	1996	63.3	36.7	75.6
2016	2006	64.7	35.3	77.1
2017	2120	60.2	39.8	72.8
2018	1821	57.9	42.1	65.0
2019	1630	49.8	50.2	69.4
2020	2073	49.8	50.2	63.7
1998-2020	35899	65.3	34.7	78.3

Table 10

Medians of age at death according to the grouping in Table 9

Year of death	Deaths n	Age at death (all causes) Years	Age at death (cancer-related) Years	Age at death (non-cancer-related) Years	Age at death (according to death certificate) Years
1998	818	76.4	72.9	83.5	76.0
1999	813	75.5	71.1	84.3	75.1
2000	838	76.3	71.1	85.2	74.9
2001	828	75.9	69.6	83.6	73.6
2002	1246	76.9	71.0	85.6	75.5
2003	1376	75.7	69.7	84.6	72.8
2004	1412	76.7	71.7	84.7	74.2
2005	1450	76.9	70.6	85.0	74.0
2006	1412	77.2	71.5	85.5	74.2
2007	1578	77.6	71.0	85.7	73.1
2008	1660	78.7	72.6	86.1	75.2
2009	1653	78.8	72.6	85.9	74.8
2010	1736	78.6	73.4	86.0	75.5
2011	1830	79.0	73.9	86.4	75.6
2012	1824	78.2	73.3	87.0	75.0
2013	1921	79.1	74.4	86.2	76.4
2014	1858	80.0	75.0	87.3	77.2
2015	1996	79.7	76.1	86.2	77.3
2016	2006	79.4	75.7	86.8	77.3
2017	2120	80.7	77.0	86.4	78.2
2018	1821	79.6	75.5	84.7	77.0
2019	1630	79.6	74.3	83.7	77.0
2020	2073	81.0	76.2	84.8	77.4
1998–2020	35899	78.7	73.7	85.6	75.9

By 2018, Bavarians' life expectancy at birth is estimated at 79.3 years for boys and 83.8 years for girls.

Deaths of patients are considered to be cancer-related, in case that fact was recorded on the death certificate, or patients had suffered from metastasis or recurrence.

Table 11

Mortality measures (cancer-related death) and mortality-incidence-index
by year of death

Year of death	Deaths n	Mort. raw	MI-Index raw	Mort. WS	MI-Index WS	Mort. ES	MI-Index ES	Mort. BRD-S	MI-Index BRD-S
1998	569	48.4	0.30	21.9	0.24	32.3	0.26	40.7	0.29
1999	581	49.0	0.30	22.9	0.25	33.4	0.26	41.4	0.29
2000	595	49.5	0.31	22.9	0.25	33.5	0.27	41.6	0.29
2001	558	45.9	0.28	21.7	0.23	31.5	0.25	38.8	0.27
2002	898	45.9	0.27	20.7	0.22	30.3	0.24	37.6	0.25
2003	967	49.1	0.31	23.0	0.27	33.4	0.28	40.9	0.30
2004	1070	54.1	0.34	23.9	0.27	35.2	0.29	44.0	0.32
2005	1011	50.8	0.31	22.9	0.26	33.4	0.27	41.3	0.29
2006	1020	50.8	0.31	22.2	0.25	32.6	0.27	41.0	0.30
2007	1103	47.8	0.31	20.9	0.25	30.6	0.26	38.1	0.29
2008	1151	49.6	0.29	20.5	0.22	30.4	0.24	38.5	0.26
2009	1128	48.5	0.28	20.5	0.22	30.2	0.24	37.8	0.26
2010	1193	51.0	0.31	20.6	0.23	30.6	0.25	39.1	0.28
2011	1241	53.1	0.32	21.1	0.24	31.4	0.26	39.7	0.29
2012	1221	51.7	0.31	20.7	0.24	30.8	0.26	38.9	0.28
2013	1223	51.3	0.32	19.8	0.24	29.7	0.26	38.2	0.29
2014	1202	49.9	0.33	18.6	0.23	28.1	0.26	36.4	0.29
2015	1266	52.0	0.34	18.5	0.24	28.4	0.26	37.7	0.30
2016	1299	52.9	0.36	20.0	0.27	29.9	0.29	38.7	0.33
2017	1277	51.8	0.36	18.5	0.25	28.0	0.28	36.9	0.31
2018	1059	42.7	0.30	16.3	0.23	24.2	0.25	30.9	0.27
2019	815	32.8	0.24	12.8	0.18	19.1	0.19	24.1	0.21
2020	1037	41.8	0.34	15.5	0.24	23.2	0.27	29.9	0.30
1998-2020	23484	48.7	0.31	19.9	0.24	29.6	0.26	37.4	0.28

Table 12

Age distribution of age at death (cancer-related) for period 2007-2020
(**incl. multiple malignancies**)

Age at death Years	Cases n	%	Cum.%
0-4			
5-9			
10-14			
15-19			
20-24			
25-29	18	0.1	0.1
30-34	54	0.3	0.4
35-39	142	0.9	1.3
40-44	298	1.8	3.2
45-49	563	3.5	6.6
50-54	841	5.2	11.8
55-59	1119	6.9	18.7
60-64	1321	8.1	26.9
65-69	1781	11.0	37.8
70-74	2194	13.5	51.4
75-79	2426	15.0	66.3
80-84	2357	14.5	80.9
85+	3101	19.1	100.0
All ages	16215	100.0	

Table 13

Age-specific mortality (cancer-related) and proportion of all cancers
for period 2007-2020
(**incl. multiple malignancies**)

Age at death Years	Cases n	Age-spec. mortality	MI-index	Prop. all cancers %
0- 4		0.0		
5- 9		0.0		
10-14		0.0		
15-19		0.0		
20-24		0.0		
25-29	18	0.8	0.10	18.2
30-34	54	2.4	0.10	29.8
35-39	142	6.2	0.11	34.8
40-44	298	12.3	0.11	34.9
45-49	563	21.6	0.13	33.7
50-54	841	33.5	0.15	31.8
55-59	1119	51.4	0.22	29.3
60-64	1321	69.6	0.23	26.5
65-69	1781	98.2	0.26	25.6
70-74	2194	127.6	0.37	25.1
75-79	2426	161.6	0.44	24.7
80-84	2357	221.4	0.61	25.1
85+	3101	297.4	0.80	25.9
All ages	16215			26.3
Mortality				
Raw		48.3	0.31	
WS		18.8	0.23	
ES		28.1	0.25	
BRD-S		36.0	0.28	
PYLL-70				
per 100,000		252.4		
ES		210.8		
AYLL-70		11.6		

Table 14

Further malignancies in deaths in period 1998–2020

Diagnosis		Total n	Total %↓	Pre n	Pre ←%	Syn-chron ±30d n	Syn-chron ±30d ←%	Post n	Post ←%
C03–C06	Oral cavity	47	0.5	18	38.3	4	8.5	25	53.2
C09–C10	Oropharynx	38	0.4	10	26.3	2	5.3	26	68.4
C15	Oesophagus	89	0.9	6	6.7	5	5.6	78	87.6
C16	Stomach	358	3.7	70	19.6	22	6.1	266	74.3
C17	Small intestine	33	0.3	7	21.2	2	6.1	24	72.7
C18	Colon	716	7.4	201	28.1	46	6.4	469	65.5
C19–C20	Rectum	304	3.2	90	29.6	26	8.6	188	61.8
C21	Anus/canal	32	0.3	7	21.9	4	12.5	21	65.6
C22	Liver	89	0.9	5	5.6	6	6.7	78	87.6
C23–C24	Bile	100	1.0	3	3.0	3	3.0	94	94.0
C25	Pancreas	457	4.8	22	4.8	25	5.5	410	89.7
C32	Larynx	23	0.2	8	34.8	1	4.3	14	60.9
C33–C34	Lung	834	8.7	71	8.5	63	7.6	700	83.9
C43	Malign. melanoma	291	3.0	135	46.4	14	4.8	142	48.8
C44	Skin others	447	4.6	142	31.8	41	9.2	264	59.1
C46,C49	Soft tissue	87	0.9	20	23.0			67	77.0
C48	Peritoneal	41	0.4	4	9.8	5	12.2	32	78.0
C50	Breast	2733	28.4	1	0.0	881	32.2	1851	67.7
C51	Vulva	60	0.6	17	28.3	2	3.3	41	68.3
C53	Cervix uteri	176	1.8	110	62.5	12	6.8	54	30.7
C54	Corpus uteri	535	5.6	206	38.5	48	9.0	281	52.5
C55,C57	Fem. genitals un	32	0.3	10	31.3	4	12.5	18	56.3
C56	Ovary	511	5.3	113	22.1	44	8.6	354	69.3
C64	Kidney	202	2.1	82	40.6	19	9.4	101	50.0
C65	Renal pelvis	32	0.3	8	25.0			24	75.0
C67	Bladder	166	1.7	40	24.1	8	4.8	118	71.1
C69	Eye melanoma	25	0.3	8	32.0	3	12.0	14	56.0
C70–C72	CNS cancer	115	1.2	13	11.3	9	7.8	93	80.9
C73	Thyroid	137	1.4	72	52.6	2	1.5	63	46.0
C76–C79	CUP	150	1.6	45	30.0	10	6.7	95	63.3
C81	Hodgkin lymphoma	42	0.4	30	71.4	1	2.4	11	26.2
C82–C85	NHL	293	3.0	91	31.1	28	9.6	174	59.4
C90	Mult. myeloma	99	1.0	11	11.1	6	6.1	82	82.8
C91–C96	Leukaemia	167	1.7	16	9.6	7	4.2	144	86.2
Others, specified		159	1.7	29	18.2	9	5.7	121	76.1
All further malignancies		9620	100.0	1721	17.9	1362	14.2	6537	68.0

Further malignancies with number of cases 1 to 19 are pooled in category “Others, specified”.

ICD-10 C44 (Other malignant neoplasms of skin) is not systematically recorded by MCR and therefore not considered for evaluation as a particular primary but at least as a further malignancy.

Table 15

Age-specific mortality (cancer-related) and proportion of all cancers
for period 2007-2020
(**First primaries only** *)

Age at death Years	Cases n	Age-spec. mortality	MI-index	Prop. all cancers %
0- 4		0.0		
5- 9		0.0		
10-14		0.0		
15-19		0.0		
20-24		0.0		
25-29	17	0.8	0.10	18.7
30-34	43	1.9	0.09	27.0
35-39	129	5.7	0.11	35.0
40-44	248	10.2	0.10	32.9
45-49	475	18.2	0.12	33.1
50-54	687	27.4	0.14	30.6
55-59	892	41.0	0.21	28.0
60-64	1061	55.9	0.22	26.0
65-69	1429	78.8	0.27	25.8
70-74	1688	98.2	0.38	24.9
75-79	1884	125.5	0.47	25.1
80-84	1791	168.2	0.63	24.8
85+	2375	227.8	0.80	25.2
All ages	12719			26.0
Mortality				
Raw		37.9	0.30	
WS		15.0	0.22	
ES		22.3	0.24	
BRD-S		28.4	0.27	
PYLL-70				
per 100,000		207.9		
ES		173.8		
AYLL-70		11.8		

* See corresponding tables with multiple malignancies.

Table 16

Age-specific mortality (cancer-related) and proportion of all cancers
for period 2007-2020
(**Single primaries only** *)

Age at death Years	Cases n	Age-spec. mortality	MI-index	Prop. all cancers %
0- 4		0.0		
5- 9		0.0		
10-14		0.0		
15-19		0.0		
20-24		0.0		
25-29	16	0.7	0.10	18.2
30-34	40	1.8	0.09	25.5
35-39	124	5.5	0.11	34.1
40-44	244	10.1	0.11	32.7
45-49	452	17.4	0.12	31.9
50-54	623	24.8	0.14	28.2
55-59	793	36.4	0.20	25.3
60-64	869	45.8	0.20	21.8
65-69	1100	60.7	0.22	20.4
70-74	1239	72.1	0.31	18.9
75-79	1364	90.8	0.37	18.8
80-84	1327	124.7	0.50	19.1
85+	1861	178.5	0.65	20.7
All ages	10052			21.2
Mortality				
Raw		29.9	0.26	
WS		12.3	0.20	
ES		18.1	0.21	
BRD-S		22.6	0.23	
PYLL-70				
per 100,000		188.2		
ES		157.9		
AYLL-70		12.5		

* See corresponding tables with multiple malignancies.

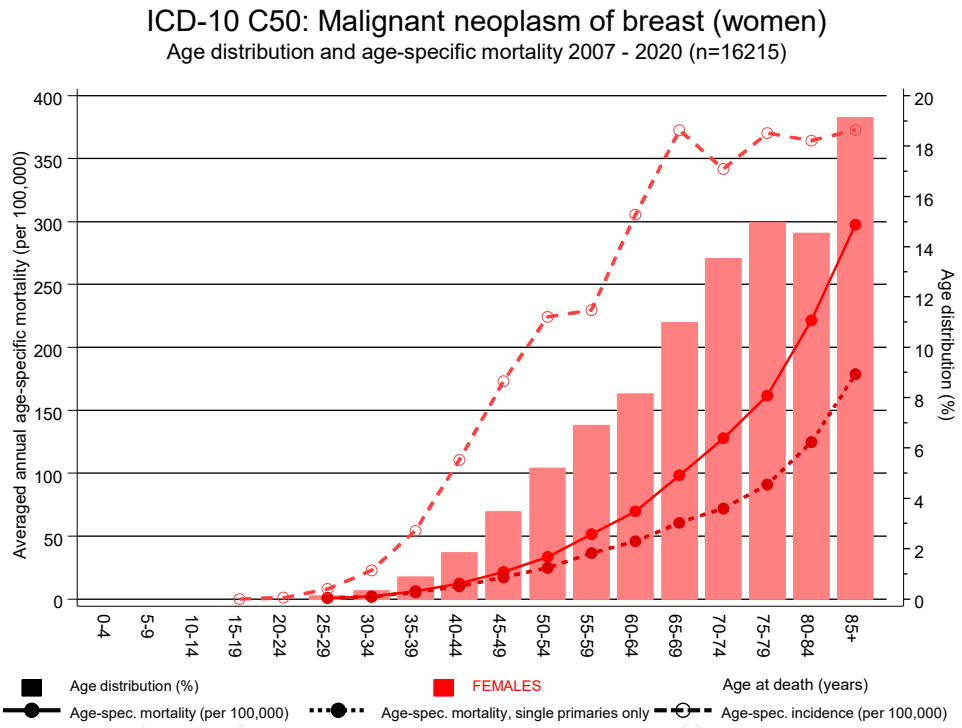

Figure 17. Distribution of age at death (bars; n=mean=65.2 yrs, median=65.7 yrs) and age-specific mortality (all patients: solid line, patients with single primaries: dotted line). The age-specific incidence is additionally plotted for comparison (dashed line).

The difference between age at diagnosis (Table 3) and age at breast cancer (women)-related death (see Table 10) should be considered.

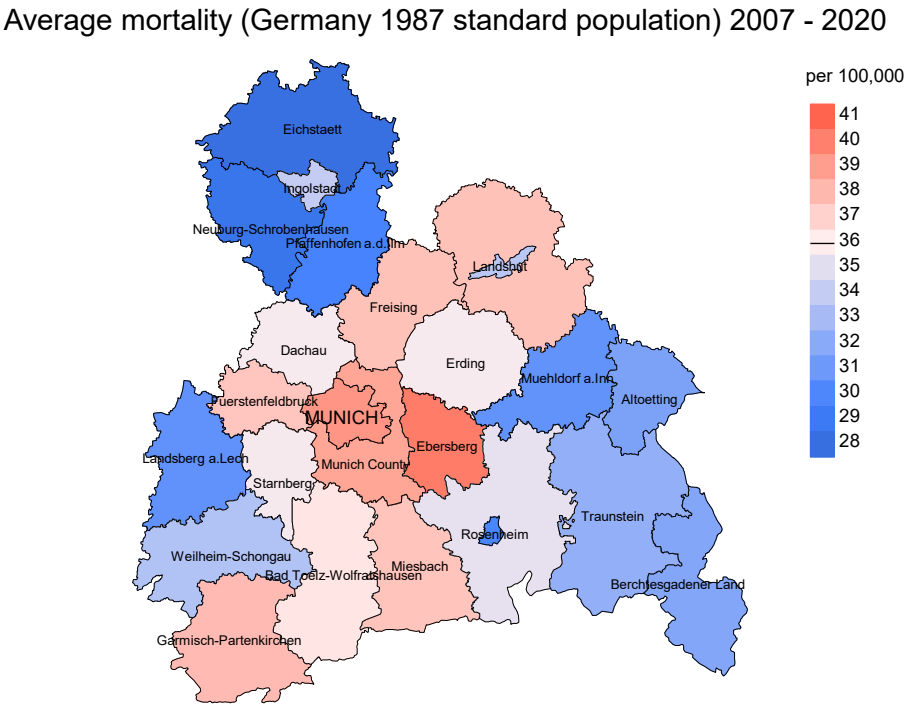

Figure 18a. Map of cancer mortality (german standard population) by county averaged for period 2007 to 2020. According to their individual mortality rates, the counties are displayed in different red and blue hues, being the fine white color attributed to the population mean (36.0/100,000 WS N=16,215).

The results should be interpreted with caution! E.g., in county Ebersberg with a population of 67,727 female residents (averaged) in the period from 2007 to 2020 a total of 490 women died from breast cancer (women). Therefore, the mean mortality rate for this cancer type in this area can be calculated at 40.2/100,000 (german standard population). Though, the value of this parameter may vary with an underlying probability of 99% between 35.6 and 45.2/100,000.

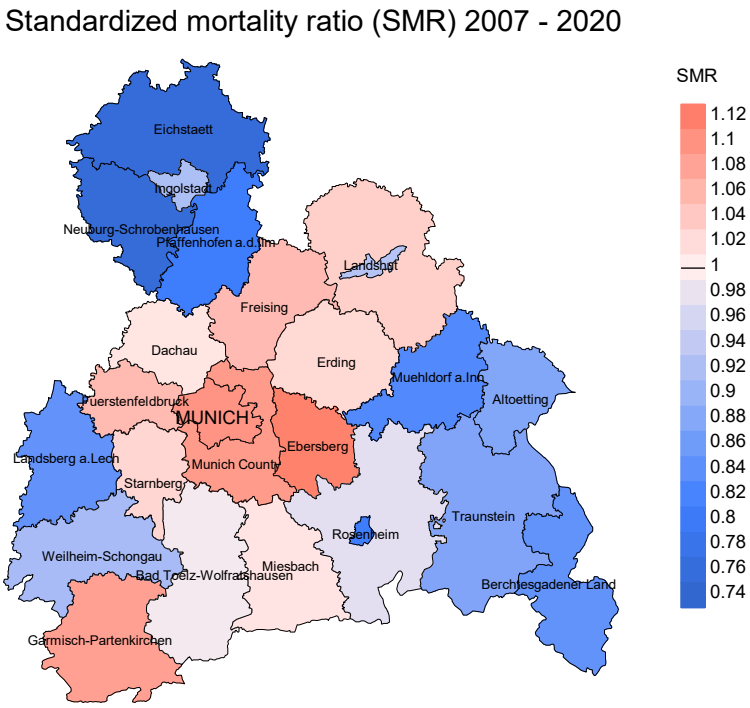

Figure 18b. Map of standardized mortality ratio (SMR, incl. DCO cases) by county averaged for period 2007 to 2020. According to their individual SMR values, the counties are displayed in different red and blue hues, being the fine white color attributed to the population overall of 1.0 (N=16,215).

The results should be interpreted with caution! E.g., in county Ebersberg with a population of 67,153 female residents (averaged) in the period from 2007 to 2020 a total of 490 women died from breast cancer (women). Therefore, the mean standardized mortality ratio (SMR) for this cancer type in this area can be calculated at 1.12. Though, the value of this parameter may vary with an underlying probability of 99% between 0.99 and 1.25, and is therefore not statistically striking.

Statistical Notes

In all tables and figures the respective reference values should be carefully considered. The incidence rates include diagnoses (with multiple primary), and death certificate only (DCO) cases, where applicable. For mortality statistics patients, diagnoses and progressive course of disease are presented. In the calculations, all courses of disease are considered whereby progressions occurred and/or death certificate identified progressive cancers were ascertained. Additionally there are three groups of disease course to consider:

1. **All multiple primaries included**

   The mortality statistic describes the tumor-specific death, independent of any malignancy. The patient perspective, induced secondary malignancies, and the problem of multiple malignancies from the same primary tumor all have reasons for their inclusion.

2. **First singular primary** (no information about other prior or synchronous malignancy)

   The mortality statistic describes the cancer-related death for patients who have no therapeutic restrictions due to a previous or synchronous cancer. These statistics are comparable to studies that have exclusion criteria based on a second malignancy.

3. **Single primary** (no information about other prior, syn- or metachronous malignancy)

   The mortality statistic describes the tumor-specific death that occurs without any impact through secondary primaries, earlier, synchronous, later or induced. Precisely the difference between disease group 1 and 2 highlight the magnitude of the problem of secondary malignancies.

For this reason differences appear concerning official mono-causal mortality statistics. To judge the maximum deviation, 2 further tables are presented. In the first table the distribution of secondary malignancies before, at or after the described cancer are shown, that could be an alternative cause of death. In the second table, the age-specific mortality rates for all courses of disease, without designation of secondary malignancies are shown.

A previously minimally acknowledged statistic is the **age at death**, which allows for a good assessment of the quality of classification of the apparent tumor-specific death. For assumed tumor-independent deaths, the age of death should be estimated from the age of diagnosis and the normal life expectancy, whereas tumor-dependent deaths can be estimated from the age of diagnosis plus the average tumor-specific life expectancy. The comparison of different tumors demonstrates this association, if the causes of cancer and the competing cause of death are independent of each other (e.g. breast and colon versus head&neck and lung).

The ratio of mortality and incidence (mortality-to-incidence ratio, **MIR**, **MI-Index**) is a statistical index that allows for the evaluation of the quality of data. For diseases with poor prognoses, comparable values are obtained from all age groups, because to a large extent, the numerator and denominator contain the same cases. For tumors with a good prognosis, increasing and decreasing incidence and age-specific differences in prognosis can more strongly alter the MIR. Additionally, attention should be paid to the confidence intervals where fewer cases are reported.

The complexity of problems identified here emphasizes the importance of relative survival data for the appropriate analysis of long term results.

As a measurement of the burden of disease, the number of potential life years loss due to premature deaths in a cohort can be calculated (**PYLL**, potential years of life lost, standardized per 100,000 persons or per European standard) as well as the average loss of life years per individual (**AYLL**, average years of life lost). Depending upon the analytic aim (health economy, prevention, health care research) different methods exist for the generation of these measurements. In the results presented here, the age for a premature death is considered to be before 70 years, according to the guidelines of the OECD and the WHO (as seen in the abbreviation PYLL-70 or AYLL-70).

Shortcuts

MCR	Munich Cancer Registry (Tumorregister München)
GEKID	Association of Population-based Cancer Registries in Germany (Gesellschaft der epidemiologischen Krebsregister in Deutschland e.V.)
SEER	Surveillance, Epidemiology, and End Results (USA)
DCO	Death certificate only
BRD-S	German (FRG) standard population
ES	European standard population (old)
WS	World standard population
SIR	Standardized incidence ratio
CI	Confidence interval
EAR	Excess absolute risk = excess cancer cases (O - E) per 10,000 person-years
PYLL-70	Potential years of life lost prior to age 70 given a person dies before that age
AYLL-70	Average years of life lost prior to age 70 given a person dies before that age
SMR	Standardized mortality ratio
MI-index	Ratio of mortality to incidence, MIR
FRG	Federal Republic of Germany

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