Munich Cancer Registry

- Survival
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Munich Cancer Registry at Munich Cancer Center
Marchioninistr. 15
Munich, 81377
Germany

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

Cancer statistics: Baseline statistics

C40, C41: Bone cancer

Year of diagnosis	1998-2012
Patients	449
Diseases	451
Creation date	03/20/2014
Export date	02/12/2014
Population	4.5 m

http://www.tumorregister-muenchen.de/en/facts/base/base_C4041E.pdf

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 4.5 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. The time-delayed acquisition of data and the occasionally high DCO-rates indicate optimizing reserves, among others, because of current financial and legal conditions that hinder the analyses.

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, March 2014

[#] 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 2.51 million to 3.96 in 2002, and to 4.52 million in 2007). Death certificates from 2013 are incorporated into these analyses.

[##] 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. A high proportion of DCO cases (≥5%) in particular cancer types indicate insufficient participation of specific cancer specializations.

INCIDENCE

Table 1

Patient cohorts by year of diagnosis including DCO cases and multiple primaries, and with proportion of deaths and active follow-up

Year of diagnosis	Cases n	DCO cases n	Prop. DCO %	Prop. mult. primaries %	Prop. deaths %	Prop. actively followed %	
1998	20			30.0	35.0	85.0	
1999	17	1	5.9	29.4	47.1	100.0	
2000	15	1	6.7	20.0	33.3	93.3	
2001	14	1	7.1	7.1	35.7	92.9	
2002	30	2	6.7	26.7	50.0	96.7	#
2003	27	3	11.1	7.4	48.1	92.6	#
2004	37	8	21.6	16.2	59.5	97.3	#
2005	26	1	3.8	19.2	50.0	80.8	#
2006	24	1	4.2	16.7	29.2	75.0	#
2007	52	1	1.9	17.3	28.8	67.3	# ##
2008	36	3	8.3	11.1	50.0	63.9	
2009	39	2	5.1	12.8	28.2	61.5	
2010	44	2	4.5	20.5	36.4	54.5	
2011	37	3	8.1	32.4	45.9	75.7	
2012	33	2	6.1	24.2	21.2	100.0	###
1998-2012	451	31	6.9	19.3	39.7	79.2	

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

Since 2007 the percentage of actively followed patients sharply declined compared to the previous years. This is a consequence of ambiguous data protection rules that currently forbid cancer registries in Bavaria to obtain the essential life status informations from competent registration offices.

Please be aware that data of recent annual patient cohorts may not yet be fully processed. Therefore, the presented figures and tables are potentially related to different time periods as pointed out in the respective headlines or legends.

Table 1a

Patient cohorts by year of diagnosis and gender
including DCO cases

Year of diagnosis	All n	Males n	Females n	Prop. males %
1998	20	9	11	45.0
1999	17	7	10	41.2
2000	15	4	11	26.7
2001	14	8	6	57.1
2002	30	17	13	56.7
2003	27	14	13	51.9
2004	37	21	16	56.8
2005	26	16	10	61.5
2006	24	12	12	50.0
2007	52	33	19	63.5
2008	36	20	16	55.6
2009	39	26	13	66.7
2010	44	21	23	47.7
2011	37	28	9	75.7
2012	33	21	12	63.6
1998-2012	451	257	194	57.0

Table 2

Incidence measures by year of diagnosis and gender including DCO cases
(with respect to registry area expansion from 2.51 to 3.96 m as of 2002,
and from 3.96 to 4.52 m as of 2007, respectively)

Year of diagnosis	Males n	Females n	Males Inc. raw	Fem. Inc. raw	Males Inc. WS	Fem. Inc. WS	Males Inc. ES	Fem. Inc. ES	Males Inc. BRD-S	Fem. Inc. BRD-S
1998	9	11	0.8	0.9	0.8	0.7	0.8	0.8	0.9	0.9
1999	7	10	0.6	0.8	0.6	0.8	0.6	0.8	0.6	0.8
2000	4	11	0.4	0.9	0.2	0.9	0.3	0.9	0.3	0.9
2001	8	6	0.7	0.5	0.9	0.6	0.8	0.5	0.8	0.6
2002	17	13	0.9	0.7	0.7	0.7	0.8	0.7	1.0	0.7
2003	14	13	0.7	0.7	0.7	0.5	0.7	0.5	0.8	0.6
2004	21	16	1.1	0.8	0.9	0.7	1.0	0.7	1.2	0.9
2005	16	10	0.8	0.5	1.0	0.4	0.9	0.4	0.9	0.5
2006	12	12	0.6	0.6	0.6	0.5	0.6	0.5	0.6	0.5
2007	33	19	1.5	0.8	1.5	0.9	1.5	0.9	1.6	0.8
2008	20	16	0.9	0.7	1.0	0.6	0.9	0.6	1.0	0.6
2009	26	13	1.2	0.6	1.1	0.6	1.1	0.6	1.2	0.6
2010	21	23	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2011	28	9	1.2	0.4	1.0	0.2	1.2	0.3	1.2	0.3
2012	21	12	0.9	0.5	0.8	0.4	0.8	0.5	0.9	0.6
1998-2012	257	194	0.9	0.7	0.9	0.6	0.9	0.6	1.0	0.7

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

Table 3

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

Year of diagnosis	Cases n	Mean	Std. dev.	Min.	Max.	10%	25%	Median 50%	75%	90%
1998	20	48.5	19.8	14.1	77.1	17.8	30.9	54.0	63.8	72.8
1999	17	46.4	26.3	5.5	87.5	8.2	29.1	47.5	58.7	87.1
2000	15	44.6	20.6	7.9	87.0	14.8	31.8	45.2	55.4	75.2
2001	14	37.2	27.3	6.5	78.6	11.4	17.9	24.1	73.0	75.4
2002	30	46.6	23.9	12.6	87.2	16.3	23.3	42.7	65.6	78.2
2003	27	49.7	24.9	10.0	89.2	13.0	27.7	50.9	69.4	86.0
2004	37	52.1	24.2	12.5	92.9	17.8	28.3	56.9	73.7	82.4
2005	26	43.0	26.5	8.7	91.8	12.2	16.6	42.2	63.6	76.3
2006	24	43.9	22.4	9.5	80.5	13.2	30.0	38.9	64.0	74.7
2007	52	40.3	24.2	6.7	85.6	12.3	16.7	37.6	63.2	70.6
2008	36	44.8	28.0	8.3	88.9	12.2	17.7	41.8	71.2	84.2
2009	39	41.6	21.4	11.4	81.0	15.2	21.2	42.4	57.1	76.5
2010	44	43.8	25.4	5.6	78.4	11.6	17.7	49.5	67.3	75.2
2011	37	53.8	22.5	5.2	91.8	15.3	44.5	55.5	69.3	79.7
2012	33	51.4	25.1	7.4	86.5	15.4	24.6	57.2	74.4	80.0
1998-2012	451	46.0	24.4	5.2	92.9	13.3	22.0	47.5	67.3	77.4

Table 3a

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

Year of diagnosis	Cases n	Mean	Std. dev.	Min.	Max.	10%	25%	Median 50%	75%	90%
1998	9	45.0	20.9	17.0	73.9	17.0	29.6	47.1	59.1	73.9
1999	7	40.0	18.5	5.5	58.7	5.5	29.1	47.5	52.8	58.7
2000	4	48.4	11.4	31.8	56.1	31.8	40.9	52.8	55.8	56.1
2001	8	37.6	25.5	11.4	74.0	11.4	18.7	26.2	62.6	74.0
2002	17	49.7	21.0	18.9	87.2	21.4	32.5	45.9	64.2	75.3
2003	14	42.7	21.9	10.0	76.4	11.2	25.2	44.4	58.4	70.2
2004	21	52.4	24.4	12.5	91.9	15.7	33.3	60.9	67.5	79.5
2005	16	37.1	25.7	8.7	91.8	9.9	13.4	28.6	56.8	68.7
2006	12	40.1	20.6	13.2	73.3	14.0	26.7	35.2	58.0	70.7
2007	33	40.4	23.0	9.8	81.9	13.4	20.4	36.2	63.4	69.7
2008	20	39.0	24.5	11.9	88.9	14.9	18.4	28.7	60.5	73.1
2009	26	43.2	19.9	13.3	78.2	16.2	26.2	44.1	56.4	72.6
2010	21	41.1	26.3	7.5	78.4	10.7	14.7	33.1	67.2	75.2
2011	28	50.6	22.2	5.2	91.8	14.3	41.6	53.3	68.0	72.6
2012	21	54.3	27.5	7.4	86.5	13.3	22.2	63.2	75.9	83.8
1998-2012	257	44.6	23.3	5.2	91.9	13.3	21.7	47.1	64.1	74.0

Table 3b

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

Year of diagnosis	Cases n	Mean	Std. dev.	Min.	Max.	10%	25%	Median 50%	75%	90%
1998	11	51.3	19.5	14.1	77.1	26.8	32.3	56.3	65.1	71.8
1999	10	50.9	30.8	8.2	87.5	11.9	19.4	51.0	83.2	87.3
2000	11	43.2	23.4	7.9	87.0	14.8	27.5	44.9	52.9	75.2
2001	6	36.8	32.0	6.5	78.6	6.5	11.7	24.1	75.4	78.6
2002	13	42.6	27.6	12.6	85.8	14.4	16.5	33.8	67.3	81.1
2003	13	57.1	26.6	13.0	89.2	21.8	39.4	67.1	83.0	86.9
2004	16	51.7	24.7	17.8	92.9	19.9	26.9	55.9	73.9	84.0
2005	10	52.2	26.4	12.2	88.2	14.4	35.3	54.3	74.1	82.3
2006	12	47.7	24.3	9.5	80.5	12.6	33.4	42.0	69.4	78.6
2007	19	40.2	26.9	6.7	85.6	10.7	14.6	39.1	62.9	83.1
2008	16	51.9	31.1	8.3	88.2	9.1	15.4	66.4	77.6	84.3
2009	13	38.3	24.6	11.4	81.0	12.7	15.3	29.4	57.1	77.0
2010	23	46.3	24.9	5.6	78.2	13.0	20.4	59.2	67.5	73.7
2011	9	63.9	21.2	17.5	84.4	17.5	55.2	70.6	79.5	84.4
2012	12	46.3	20.6	16.3	77.6	22.0	25.8	46.8	58.9	75.9
1998-2012	194	47.8	25.7	5.6	92.9	13.0	22.2	49.3	71.3	82.0

Table 4

Age distribution by 5-year age group and gender for period 1998-2012 (incl. DCO)

Age at diagnosis Years	Cases n	%	Cum.%	Males n	%	Cum.%	Females n	%	Cum.%
5-9	17	3.8	3.8	9	3.5	3.5	8	4.1	4.1
10-14	42	9.3	13.1	24	9.3	12.8	18	9.3	13.4
15-19	42	9.3	22.4	25	9.7	22.6	17	8.8	22.2
20-24	25	5.5	27.9	15	5.8	28.4	10	5.2	27.3
25-29	26	5.8	33.7	14	5.4	33.9	12	6.2	33.5
30-34	19	4.2	37.9	14	5.4	39.3	5	2.6	36.1
35-39	25	5.5	43.5	14	5.4	44.7	11	5.7	41.8
40-44	15	3.3	46.8	9	3.5	48.2	6	3.1	44.8
45-49	24	5.3	52.1	13	5.1	53.3	11	5.7	50.5
50-54	25	5.5	57.6	20	7.8	61.1	5	2.6	53.1
55-59	34	7.5	65.2	17	6.6	67.7	17	8.8	61.9
60-64	34	7.5	72.7	24	9.3	77.0	10	5.2	67.0
65-69	29	6.4	79.2	16	6.2	83.3	13	6.7	73.7
70-74	34	7.5	86.7	19	7.4	90.7	15	7.7	81.4
75-79	27	6.0	92.7	14	5.4	96.1	13	6.7	88.1
80-84	15	3.3	96.0	3	1.2	97.3	12	6.2	94.3
85+	18	4.0	100.0	7	2.7	100.0	11	5.7	100.0
All ages	451	100.0		257	100.0		194	100.0	

Included in the statistics are 25.4% multiple primaries in males and 27.5% in females.

Table 5

Age-specific incidence, DCO rate and proportion of all cancers
for period 1998-2012

Age at diagnosis Years	Males n	Females n	Males Age-spec. incid.	Females Age-spec. incid.	Males DCO rate n=13 %	Females DCO rate n=18 %	Males Prop.all cancers n=146755 %	Females Prop.all cancers n=142297 %
0- 4			0.0	0.0				
5- 9	9	8	0.6	0.6			5.5	7.1
10-14	24	18	1.7	1.3			16.3	11.1
15-19	25	17	1.8	1.2		5.9	7.8	6.4
20-24	15	10	0.9	0.6			2.7	2.1
25-29	14	12	0.8	0.6			1.6	1.2
30-34	14	5	0.7	0.2			1.0	0.3
35-39	14	11	0.6	0.5			0.7	0.3
40-44	9	6	0.4	0.3			0.3	0.1
45-49	13	11	0.6	0.5			0.3	0.1
50-54	20	5	1.1	0.3	10.0		0.2	0.0
55-59	17	17	1.0	1.0			0.1	0.1
60-64	24	10	1.5	0.6	12.5		0.1	0.1
65-69	16	13	1.1	0.8		15.4	0.1	0.1
70-74	19	15	1.6	1.1	5.3	20.0	0.1	0.1
75-79	14	13	1.9	1.2	21.4	15.4	0.1	0.1
80-84	3	12	0.7	1.4		41.7	0.0	0.1
85+	7	11	2.3	1.3	57.1	45.5	0.1	0.1
All ages	257	194			5.1	9.3	0.2	0.1
Incidence								
Raw			0.9	0.7				
WS			0.9	0.6				
ES			0.9	0.6				
BRD-S			1.0	0.7				

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).

Table 6a

Standardized incidence ratio (SIR, with 95% confidence limits),
excess absolute risk (EAR) and DCO rate of second primaries
for period 1998-2012
MALES

Diagnosis	Observed n	Expected n	SIR	LCL 95%	UCL 95%	EAR	DCO %
C33-C34 Lung	2	0.5	3.9	0.5	14.2	26.8	50.0
Other primaries	9	1.9	4.8	2.2	9.0 #	127.7	
Not observed	0	2.0	0.0	0.0	1.9	-35.5	
All mult. primaries	11	4.4	2.5	1.3	4.5 #	119.0	9.1

Patients	168
Mean age at second malignancy (years)	59.4
Person-years	557
Mean observation time (years)	3.3
Median observation time (years)	2.2

The occurrence of second malignancy is statistically significant.

Observed second primaries with count 1 are pooled in category "Other primaries".

Table 6b

Standardized incidence ratio (SIR, with 95% confidence limits), excess absolute risk (EAR) and DCO rate of second primaries for period 1998-2012
FEMALES

Diagnosis	Observed n	Expected n	SIR	LCL 95%	UCL 95%		EAR	DCO %
C33-C34 Lung	2	0.2	9.6	1.2	34.6	#	29.4	
C43 Malign. melanoma	3	0.1	21.7	4.5	63.4	#	47.0	
C50 Breast	3	1.0	3.0	0.6	8.8		32.8	
Other primaries	5	0.3	17.2	5.6	40.0	#	77.3	
Not observed	0	1.6	0.0	0.0	2.3		-26.6	
All mult. primaries	13	3.3	4.0	2.1	6.8	#	159.9	

Patients	132
Mean age at second malignancy (years)	56.8
Person-years	609
Mean observation time (years)	4.6
Median observation time (years)	3.7

The occurrence of second malignancy is statistically significant.

Observed second malignancies with count 1 are pooled in category "Other primaries".

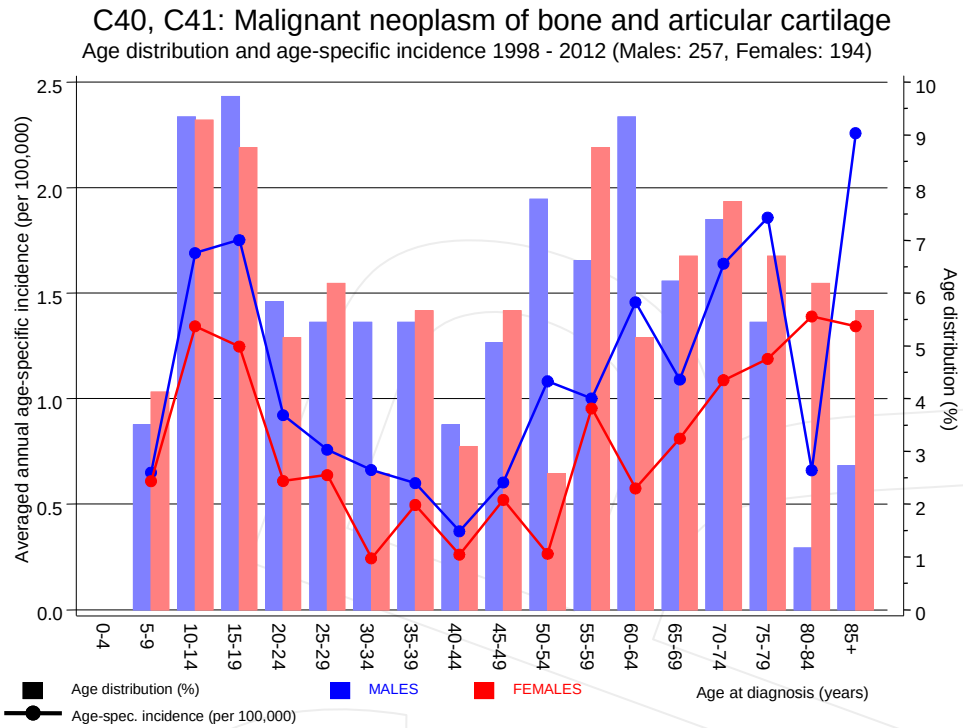


Figure 7. Age distribution and age-specific incidence

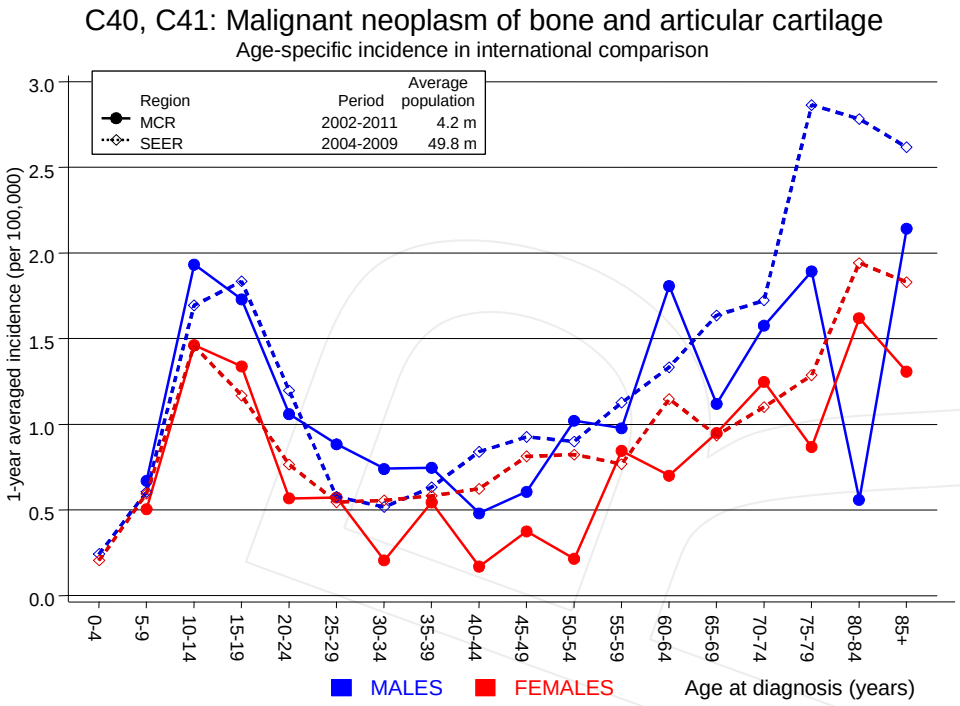


Figure 7a. Age-specific incidence in MCR registry areas compared to SEER (Surveillance, Epidemiology, and End Results, USA).

Reference:

Surveillance, Epidemiology, and End Results (SEER) Program SEER*Stat Database: Incidence - SEER 18 Regs Research Data, released April 2012, based on the November 2011 submission. http://www.seer.cancer.gov.

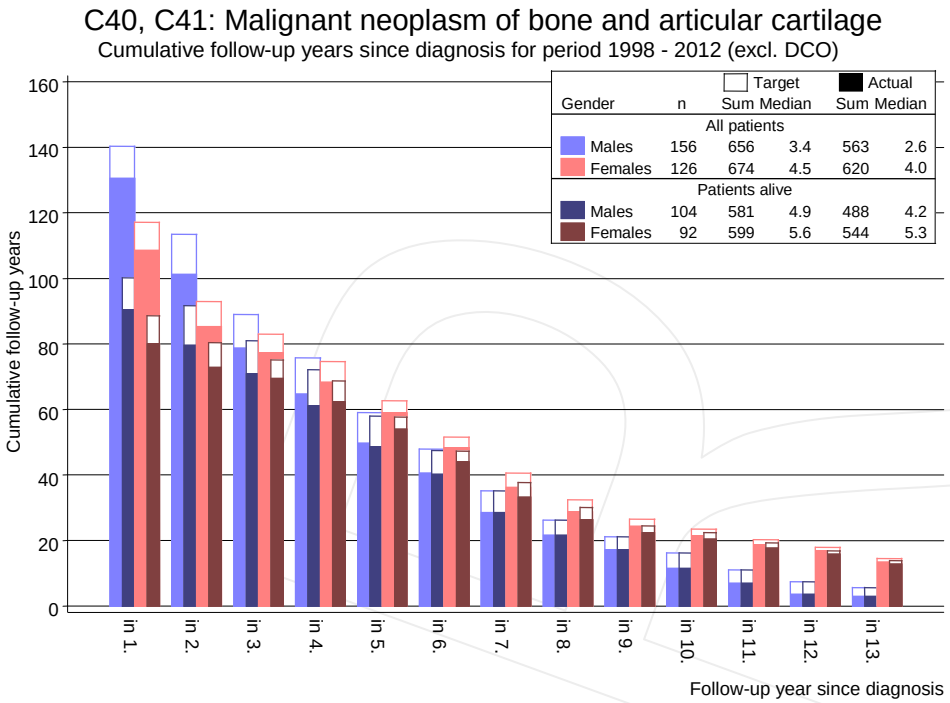
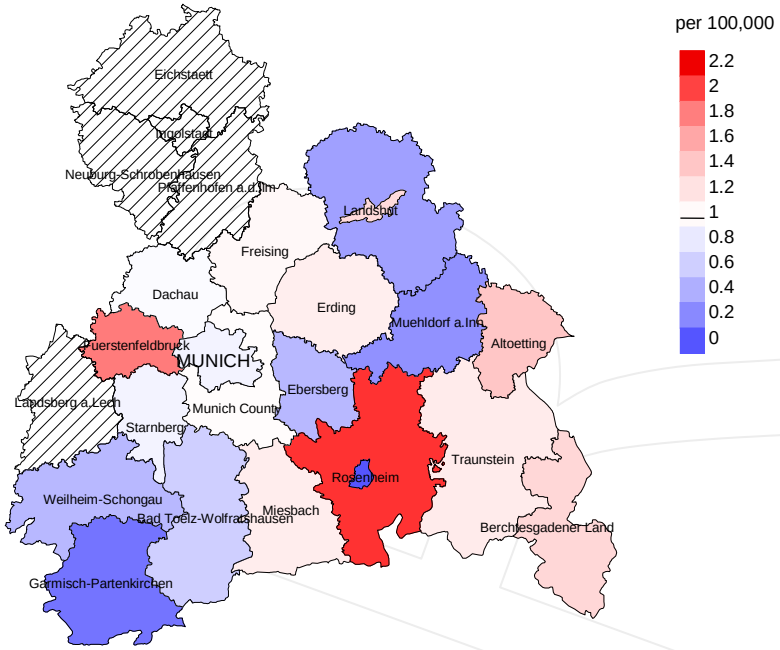


Figure 8. Cumulative follow-up years depending on time since diagnosis

The increase of the lost to follow-up rate can be interpreted as a consequence of a declining number of survivors over time.

Average incidence (world standard population) 2003 - 2008: Males



Average incidence (world standard population) 2003 - 2008: Females

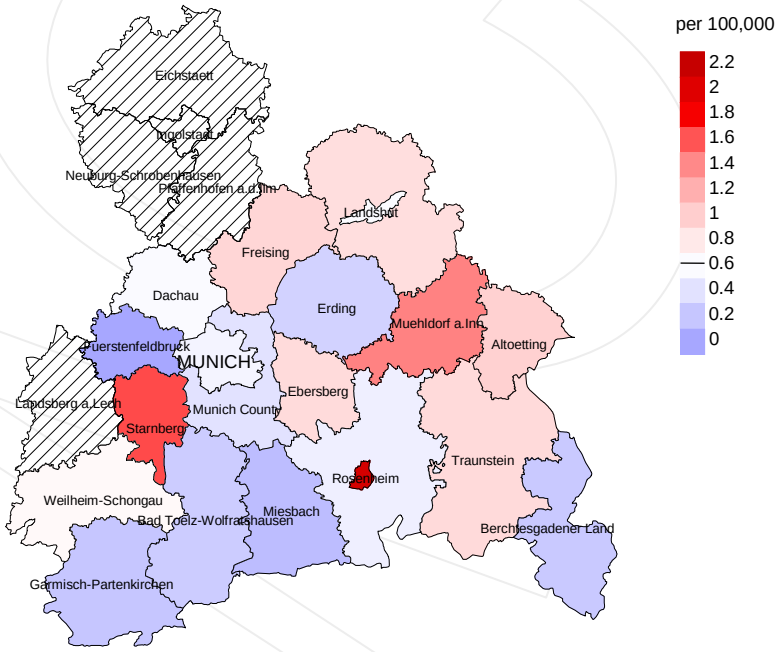
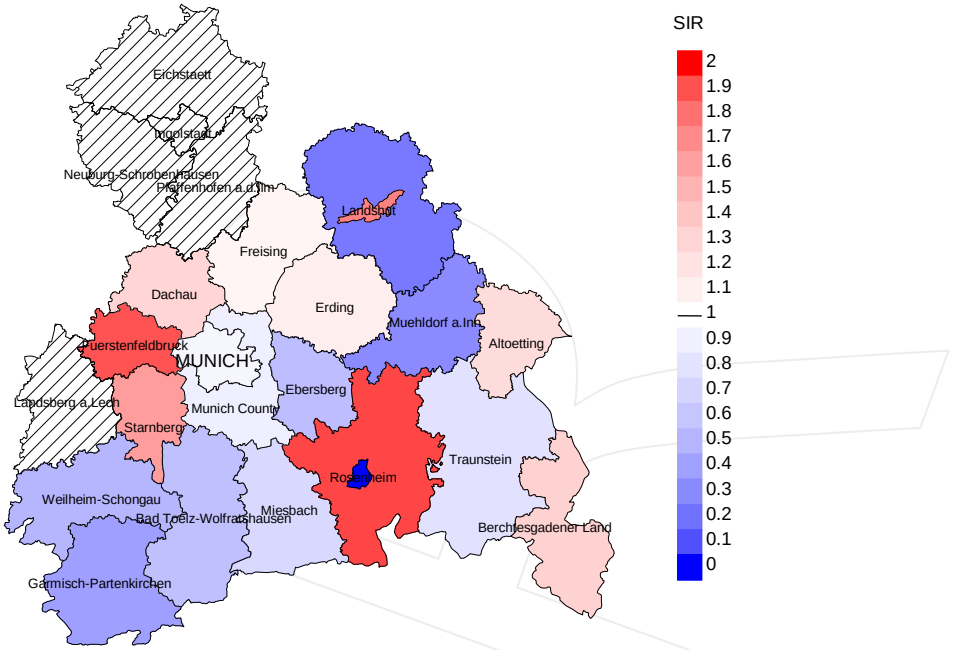


Figure 9a. Map of cancer incidence (world standard population, incl. DCO cases) by county averaged for period 2003 to 2008. According to their individual incidence rates, the counties are displayed in different red and blue color temperatures where the fine white color indicates the population mean (males 1.0/100,000 WS N=112, females 0.6/100,000 WS N=84). Since cancer data are not available in some counties until 2007, the local incidence rates were not calculated, and the map tiles show as shaded.

The results should be interpreted with caution! E.g., in county Ebersberg with a population of 63,131 female residents (averaged) in the period from 2003 to 2008 a total of 3 women were identified with newly diagnosed bone cancer. Therefore, the mean incidence rate for this cancer type in this area can be calculated at 0.9/100,000 (world standard population). Though, the value of this parameter may vary with an underlying probability of 99% between 0.1 and 4.1/100,000.

Standardized incidence ratio (SIR) 2003 - 2008: Males



Standardized incidence ratio (SIR) 2003 - 2008: Females

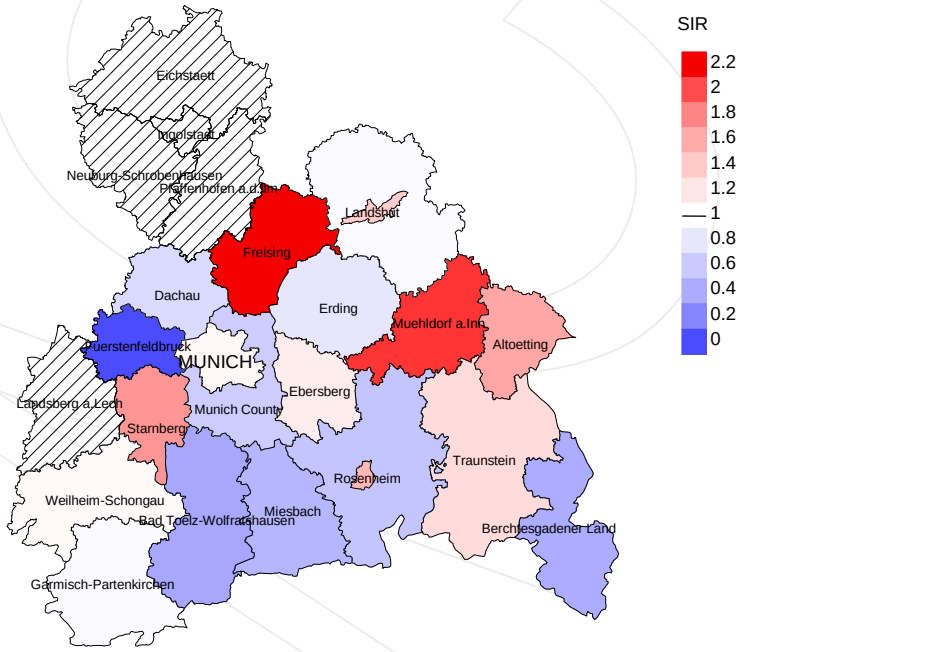


Figure 9b. Map of standardized incidence ratio (SIR, incl. DCO cases) by county averaged for period 2003 to 2008. According to their individual SIR values, the counties are displayed in different red and blue color temperatures where the fine white color indicates the population overall of 1.0 (males N=112, females N=84). Since cancer data are not available in some counties until 2007, the local SIR values were not calculated, and the map tiles show as shaded.

The results should be interpreted with caution! E.g., in county Ebersberg with a population of 63,131 female residents (averaged) in the period from 2003 to 2008 a total of 3 women were identified with newly diagnosed bone cancer. Therefore, the mean standardized incidence ratio (SIR) for this cancer type in this area can be calculated at 1.15. Though, the value of this parameter may vary with an underlying probability of 99% between 0.13 and 4.20, and is therefore not statistically striking.

MORTALITY

Table 10a

Patient cohorts of incident cancers by year of diagnosis, follow-up status, proportion of DCO, deaths among the annual cohorts, and proportion of available death certificates (with respect to registry area expansion from 2.51 to 3.96 m as of 2002, and from 3.96 to 4.52 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	20	85.0		7	35.0	71.4
1999	17	100.0	5.9	8	47.1	75.0
2000	15	93.3	6.7	5	33.3	100.0
2001	14	92.9	7.1	5	35.7	100.0
2002	30	96.7	6.7	15	50.0	86.7
2003	27	92.6	11.1	13	48.1	100.0
2004	37	97.3	21.6	22	59.5	95.5
2005	26	80.8	3.8	13	50.0	100.0
2006	24	75.0	4.2	7	29.2	100.0
2007	52	67.3	1.9	15	28.8	100.0
2008	36	63.9	8.3	18	50.0	94.4
2009	39	61.5	5.1	11	28.2	100.0
2010	44	54.5	4.5	16	36.4	100.0
2011	37	75.7	8.1	17	45.9	94.1
2012	33	100.0	6.1	7	21.2	100.0
1998-2012	451	79.2	6.9	179	39.7	95.0

Table 10b

Annual cohorts of incident cancers and deaths, proportion of death certificates and cases deceased the same year of cancer diagnosis
(incl. DCO)
(with respect to registry area expansion from 2.51 to 3.96 m as of 2002, and from 3.96 to 4.52 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	20	11	90.9	4	20.0
1999	17	6	66.7	2	11.8
2000	15	7	85.7	1	6.7
2001	14	10	100.0	2	14.3
2002	30	13	92.3	2	6.7
2003	27	18	100.0	4	14.8
2004	37	15	86.7	10	27.0
2005	26	14	92.9	2	7.7
2006	24	14	92.9	1	4.2
2007	52	16	100.0	5	9.6
2008	36	29	96.6	11	30.6
2009	39	13	100.0	3	7.7
2010	44	22	100.0	7	15.9
2011	37	18	100.0	6	16.2
2012	33	22	100.0	6	18.2
1998-2012	451	228	95.6	66	14.6

Table 10c

Annual cohorts of deaths, proportion of cancer-related and not cancer-related deaths, and cancer recorded on death certificates (incl. DCO)
(with respect to registry area expansion from 2.51 to 3.96 m as of 2002, and from 3.96 to 4.52 m as of 2007, respectively)

Year of death	Deaths n	Prop. cancer-related %	Prop. not cancer-related %	Prop. cancer recorded on death certificate %
1998	11	81.8	18.2	80.0
1999	6	83.3	16.7	100.0
2000	7	85.7	14.3	100.0
2001	10	70.0	30.0	80.0
2002	13	84.6	15.4	91.7
2003	18	77.8	22.2	88.9
2004	15	80.0	20.0	92.3
2005	14	85.7	14.3	92.3
2006	14	92.9	7.1	100.0
2007	16	81.3	18.8	81.3
2008	29	93.1	6.9	92.9
2009	13	92.3	7.7	92.3
2010	22	95.5	4.5	95.5
2011	18	77.8	22.2	77.8
2012	22	100.0		100.0
1998-2012	228	86.8	13.2	90.8

Table 11a

Means of age at death according to the grouping in Table 10
MALES

Year of death	Deaths n	Age at death (all causes) Years	Age at death (cancer-related) Years	Age at death (not cancer-related) Years	Age at death (according to death certificate) Years
1998	7	51.3	50.0	59.3	50.0
1999	2	44.4	44.4		44.4
2000	4	49.9	43.8	68.4	43.8
2001	7	57.9	59.4	49.1	59.4
2002	7	52.0	50.6	60.1	55.1
2003	9	49.2	46.4	59.1	46.4
2004	8	53.2	53.2		59.0
2005	9	48.0	46.5	60.7	46.5
2006	7	56.6	56.6		60.8
2007	11	48.3	47.9	49.9	47.9
2008	15	50.0	47.4	86.5	47.7
2009	9	60.1	60.1		60.1
2010	10	54.8	54.8		54.8
2011	9	62.6	63.3	56.9	63.3
2012	17	57.4	57.4		57.4
1998-2012	131	53.6	53.0	59.9	53.9

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 11b

Means of age at death according to the grouping in Table 10
FEMALES

Year of death	Deaths n	Age at death (all causes) Years	Age at death (cancer-related) Years	Age at death (not cancer-related) Years	Age at death (according to death certificate) Years
1998	4	59.6	57.6	65.7	57.8
1999	4	71.4	65.8	88.2	65.7
2000	3	74.6	74.6		74.6
2001	3	72.4	89.9	63.7	84.2
2002	6	65.0	61.4	82.9	65.0
2003	9	72.0	68.3	85.0	72.0
2004	7	79.9	74.1	87.6	76.1
2005	5	49.7	40.1	88.3	40.1
2006	7	60.9	57.0	84.1	60.9
2007	5	64.3	56.8	94.3	56.8
2008	14	65.3	63.4	89.0	63.4
2009	4	66.7	56.7	96.6	62.3
2010	12	61.7	58.9	93.3	58.9
2011	9	68.1	56.4	91.5	56.4
2012	5	58.4	58.4		58.4
1998-2012	97	65.8	61.1	85.1	62.9

By 2010, life expectancy for a newborn male in Germany is 77.5 years compared with 82.6 years for his female counterpart.

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 12a

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

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	6	0.5	0.67	0.4	0.49	0.5	0.58	0.5	0.60
1999	2	0.2	0.29	0.1	0.21	0.2	0.26	0.2	0.26
2000	3	0.3	0.75	0.2	0.94	0.2	0.75	0.3	0.88
2001	6	0.5	0.75	0.4	0.48	0.5	0.65	0.6	0.72
2002	6	0.3	0.35	0.3	0.34	0.3	0.36	0.3	0.33
2003	7	0.4	0.50	0.3	0.46	0.4	0.48	0.4	0.59
2004	8	0.4	0.38	0.4	0.43	0.4	0.42	0.5	0.42
2005	8	0.4	0.50	0.4	0.38	0.4	0.44	0.5	0.53
2006	7	0.4	0.58	0.2	0.37	0.3	0.49	0.4	0.61
2007	9	0.4	0.27	0.4	0.24	0.4	0.27	0.4	0.28
2008	14	0.6	0.70	0.5	0.55	0.6	0.60	0.6	0.64
2009	9	0.4	0.35	0.3	0.26	0.3	0.30	0.4	0.32
2010	10	0.4	0.48	0.3	0.31	0.4	0.39	0.4	0.46
2011	8	0.4	0.29	0.2	0.21	0.3	0.24	0.4	0.31
2012	17	0.7	0.81	0.5	0.71	0.6	0.77	0.8	0.81
1998-2012	120	0.4	0.47	0.3	0.38	0.4	0.42	0.5	0.47

Table 12b

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

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	3	0.3	0.27	0.1	0.17	0.2	0.21	0.2	0.24
1999	3	0.3	0.30	0.1	0.18	0.2	0.26	0.2	0.27
2000	3	0.2	0.27	0.1	0.11	0.2	0.17	0.2	0.26
2001	1	0.1	0.17	0.0	0.03	0.0	0.06	0.0	0.07
2002	5	0.3	0.38	0.2	0.22	0.2	0.29	0.3	0.36
2003	7	0.4	0.54	0.2	0.38	0.2	0.47	0.3	0.53
2004	4	0.2	0.25	0.1	0.14	0.1	0.19	0.2	0.19
2005	4	0.2	0.40	0.2	0.44	0.2	0.44	0.2	0.43
2006	6	0.3	0.50	0.2	0.36	0.2	0.45	0.3	0.48
2007	4	0.2	0.21	0.1	0.13	0.1	0.15	0.2	0.22
2008	13	0.6	0.81	0.3	0.52	0.4	0.67	0.5	0.80
2009	3	0.1	0.23	0.1	0.13	0.1	0.19	0.1	0.21
2010	11	0.5	0.48	0.3	0.32	0.4	0.37	0.4	0.41
2011	6	0.3	0.67	0.2	0.80	0.2	0.74	0.3	0.73
2012	5	0.2	0.42	0.1	0.31	0.2	0.35	0.2	0.34
1998-2012	78	0.3	0.40	0.2	0.26	0.2	0.32	0.2	0.36

Table 13

Age distribution of age at death (cancer-related) for period 1998-2012
(**incl. multiple primaries**)

Age at death Years	Cases n	%	Cum.%	Males n	%	Cum.%	Females n	%	Cum.%
5-9	2	1.0	1.0	1	0.8	0.8	1	1.3	1.3
10-14	6	3.0	4.0	5	4.2	5.0	1	1.3	2.5
15-19	5	2.5	6.5	5	4.2	9.2			2.5
20-24	13	6.5	13.1	10	8.3	17.5	3	3.8	6.3
25-29	9	4.5	17.6	6	5.0	22.5	3	3.8	10.1
30-34	9	4.5	22.1	7	5.8	28.3	2	2.5	12.7
35-39	9	4.5	26.6	3	2.5	30.8	6	7.6	20.3
40-44	7	3.5	30.2	6	5.0	35.8	1	1.3	21.5
45-49	8	4.0	34.2	6	5.0	40.8	2	2.5	24.1
50-54	9	4.5	38.7	4	3.3	44.2	5	6.3	30.4
55-59	15	7.5	46.2	10	8.3	52.5	5	6.3	36.7
60-64	14	7.0	53.3	8	6.7	59.2	6	7.6	44.3
65-69	27	13.6	66.8	14	11.7	70.8	13	16.5	60.8
70-74	24	12.1	78.9	14	11.7	82.5	10	12.7	73.4
75-79	23	11.6	90.5	12	10.0	92.5	11	13.9	87.3
80-84	12	6.0	96.5	5	4.2	96.7	7	8.9	96.2
85+	7	3.5	100.0	4	3.3	100.0	3	3.8	100.0
All ages	199	100.0		120	100.0		79	100.0	

Included in the statistics are 25.4% multiple primaries in males and 27.5% in females.

Table 14

Age-specific mortality (cancer-related) and proportion of all cancers
for period 1998-2012
(**incl. multiple primaries**)

Age at death Years	Males n	Females n	Males Age-spec. mortal.	MI-index	Females Age-spec. mortal.	MI-index	Males Prop.all cancers %	Females Prop.all cancers %
0- 4			0.0		0.0			
5- 9	1	1	0.1	0.11	0.1	0.13	2.9	2.6
10-14	5	1	0.4	0.21	0.1	0.06	15.2	3.6
15-19	5		0.4	0.20	0.0		11.9	
20-24	10	3	0.6	0.67	0.2	0.30	12.0	6.4
25-29	6	3	0.3	0.43	0.2	0.25	6.3	2.8
30-34	7	2	0.3	0.50	0.1	0.40	4.0	0.9
35-39	3	6	0.1	0.21	0.3	0.55	0.8	1.2
40-44	6	1	0.2	0.67	0.0	0.17	0.7	0.1
45-49	6	2	0.3	0.46	0.1	0.18	0.4	0.1
50-54	4	5	0.2	0.20	0.3	1.00	0.1	0.2
55-59	10	5	0.6	0.59	0.3	0.29	0.2	0.1
60-64	8	6	0.5	0.33	0.3	0.60	0.1	0.1
65-69	14	13	1.0	0.88	0.8	1.00	0.1	0.2
70-74	14	10	1.2	0.74	0.7	0.67	0.1	0.1
75-79	12	11	1.6	0.86	1.0	0.85	0.1	0.1
80-84	5	7	1.1	1.67	0.8	0.58	0.1	0.1
85+	4	3	1.3	0.57	0.4	0.27	0.0	0.0
All ages	120	79					0.2	0.1
Mortality								
Raw			0.4	0.47	0.3	0.41		
WS			0.3	0.38	0.2	0.26		
ES			0.4	0.42	0.2	0.33		
BRD-S			0.5	0.47	0.2	0.37		
PYLL-70								
per 100,000			9.3		3.9			
ES			9.8		3.8			
AYLL-70			27.0		20.0			

The rates underestimate the prognosis if other synchronous cancers are prognostic unfavorable.

Table 15a

Multiple primaries in deaths in period 1998-2012
MALES

Diagnosis	Total n	Total %↓	Pre n	Pre ←%	Syn-chron ±30d n	Syn-chron ±30d ←%	Post n	Post ←%
C09-C10 Oropharynx	1	2.3					1	100.0
C16 Stomach	1	2.3					1	100.0
C18 Colon	2	4.5	2	100.0				
C19-C20 Rectum	4	9.1	3	75.0			1	25.0
C22 Liver	1	2.3					1	100.0
C33-C34 Lung	9	20.5	4	44.4	1	11.1	4	44.4
C44 Skin others	1	2.3	1	100.0				
C46,C49 Soft tissue	4	9.1	2	50.0			2	50.0
C61 Prostate	7	15.9	5	71.4	1	14.3	1	14.3
C62 Testis	1	2.3			1	100.0		
C64 Kidney	2	4.5	1	50.0			1	50.0
C70-C72 CNS cancer	3	6.8	2	66.7	1	33.3		
C81 Hodgkin lymphoma	1	2.3	1	100.0				
C82-C85 NHL	1	2.3					1	100.0
C90 Mult. myeloma	5	11.4	4	80.0	1	20.0		
C91-C96 Leukaemia	1	2.3					1	100.0
All mult. primaries	44	100.0	25	56.8	5	11.4	14	31.8

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 multiple malignancy.

Table 15b

Multiple primaries in deaths in period 1998-2012
FEMALES

Diagnosis		Total n	Total %↓	Pre n	Pre ←%	Syn-chron ±30d n	Syn-chron ±30d ←%	Post n	Post ←%
C16	Stomach	2	5.6					2	100.0
C18	Colon	1	2.8	1	100.0				
C19-C20	Rectum	3	8.3	2	66.7			1	33.3
C22	Liver	1	2.8	1	100.0				
C25	Pancreas	2	5.6					2	100.0
C33-C34	Lung	2	5.6	1	50.0			1	50.0
C40-C41	Bone	1	2.8					1	100.0
C43	Malign. melanoma	3	8.3	2	66.7			1	33.3
C46,C49	Soft tissue	2	5.6	1	50.0			1	50.0
C50	Breast	7	19.4	2	28.6	1	14.3	4	57.1
C53	Cervix uteri	4	11.1	3	75.0			1	25.0
C54	Corpus uteri	1	2.8					1	100.0
C56	Ovary	3	8.3	3	100.0				
C64	Kidney	1	2.8					1	100.0
C70-C72	CNS cancer	1	2.8	1	100.0				
C81	Hodgkin lymphoma	1	2.8	1	100.0				
C96	Systemic	1	2.8					1	100.0
All mult. primaries		36	100.0	18	50.0	1	2.8	17	47.2

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 multiple malignancy.

Table 16

Age-specific mortality (cancer-related) and proportion of all cancers
for period 1998-2012
(**Singular primaries only** *)

Age at death Years	Males n	Females n	Males Age-spec. mortal.	MI-index	Females Age-spec. mortal.	MI-index	Males Prop.all cancers %	Females Prop.all cancers %
0- 4			0.0		0.0			
5- 9	1	1	0.1	0.11	0.1	0.13	3.0	2.8
10-14	5	1	0.4	0.22	0.1	0.06	15.2	3.8
15-19	4		0.3	0.17	0.0		10.3	
20-24	10	3	0.6	0.71	0.2	0.38	12.8	7.0
25-29	5	2	0.3	0.36	0.1	0.18	5.6	1.9
30-34	7	2	0.3	0.54	0.1	0.40	4.1	1.1
35-39	2	5	0.1	0.14	0.2	0.50	0.6	1.1
40-44	6		0.2	0.75	0.0		0.8	
45-49	6	2	0.3	0.50	0.1	0.18	0.4	0.1
50-54	4	5	0.2	0.22	0.3	1.00	0.1	0.2
55-59	9	5	0.5	0.56	0.3	0.38	0.2	0.1
60-64	7	4	0.4	0.39	0.2	0.50	0.1	0.1
65-69	7	7	0.5	0.78	0.4	0.88	0.1	0.1
70-74	8	7	0.7	0.62	0.5	0.70	0.1	0.1
75-79	9	10	1.2	0.90	0.9	0.91	0.1	0.1
80-84	3	6	0.7	3.00	0.7	0.60	0.0	0.1
85+	4	2	1.3	0.67	0.2	0.22	0.1	0.0
All ages	97	62					0.2	0.1
Mortality								
Raw			0.4	0.44	0.2	0.37		
WS			0.3	0.36	0.1	0.23		
ES			0.3	0.40	0.2	0.30		
BRD-S			0.4	0.45	0.2	0.34		
PYLL-70								
per 100,000			8.6		3.4			
ES			9.1		3.4			
AYLL-70			29.1		22.4			

* See corresponding tables with multiple primaries.

Table 17

Age-specific mortality (cancer-related) and proportion of all cancers
for period 1998-2012
(**Single primaries only** *)

Age at death Years	Males n	Females n	Males Age-spec. mortal.	MI-index	Females Age-spec. mortal.	MI-index	Males Prop.all cancers %	Females Prop.all cancers %
0- 4			0.0		0.0			
5- 9	1	1	0.1	0.11	0.1	0.13	3.1	2.9
10-14	5	1	0.4	0.22	0.1	0.06	15.2	4.2
15-19	4		0.3	0.17	0.0		10.3	
20-24	10	3	0.6	0.71	0.2	0.38	13.7	7.5
25-29	4	2	0.2	0.29	0.1	0.22	4.8	2.1
30-34	7	1	0.3	0.54	0.0	0.20	4.2	0.6
35-39	2	4	0.1	0.17	0.2	0.44	0.6	1.0
40-44	6		0.2	0.75	0.0		0.8	
45-49	5	2	0.2	0.45	0.1	0.20	0.3	0.1
50-54	3	4	0.2	0.18	0.2	1.00	0.1	0.2
55-59	7	5	0.4	0.54	0.3	0.42	0.2	0.1
60-64	5	3	0.3	0.31	0.2	0.50	0.1	0.1
65-69	3	5	0.2	0.50	0.3	0.63	0.0	0.1
70-74	8	4	0.7	0.62	0.3	0.44	0.1	0.1
75-79	8	9	1.1	0.80	0.8	0.90	0.1	0.1
80-84	2	5	0.4	2.00	0.6	0.50	0.0	0.1
85+	4	2	1.3	0.67	0.2	0.22	0.1	0.0
All ages	84	51					0.2	0.1
Mortality								
Raw			0.3	0.40	0.2	0.33		
WS			0.3	0.33	0.1	0.21		
ES			0.3	0.37	0.1	0.26		
BRD-S			0.3	0.41	0.2	0.30		
PYLL-70								
per 100,000			8.1		3.0			
ES			8.6		3.0			
AYLL-70			32.2		23.5			

* See corresponding tables with multiple primaries.

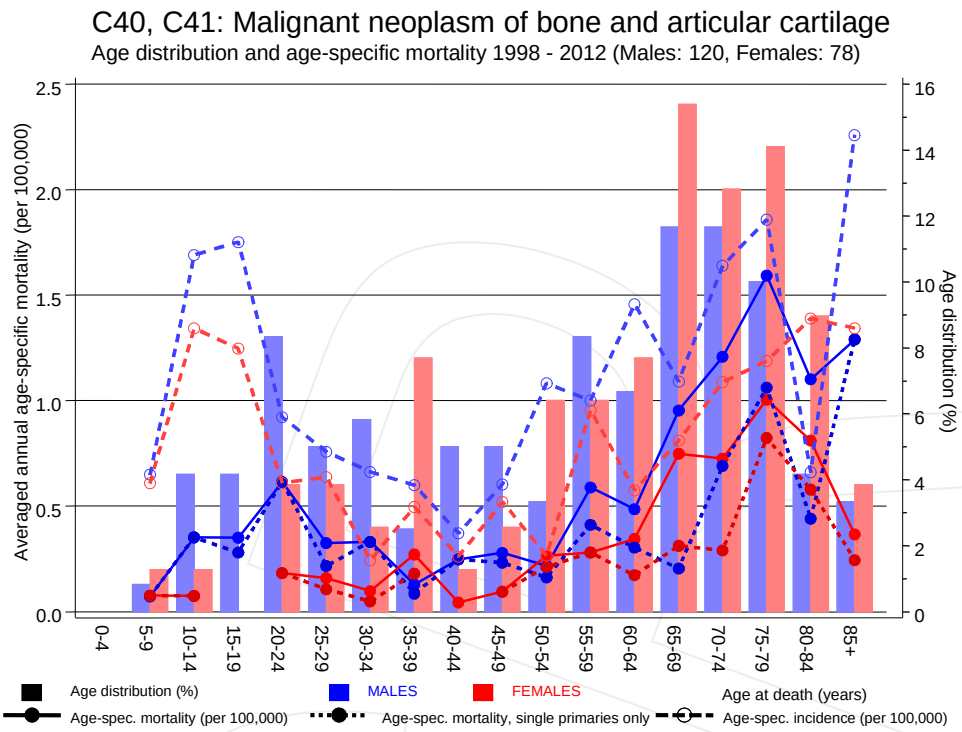
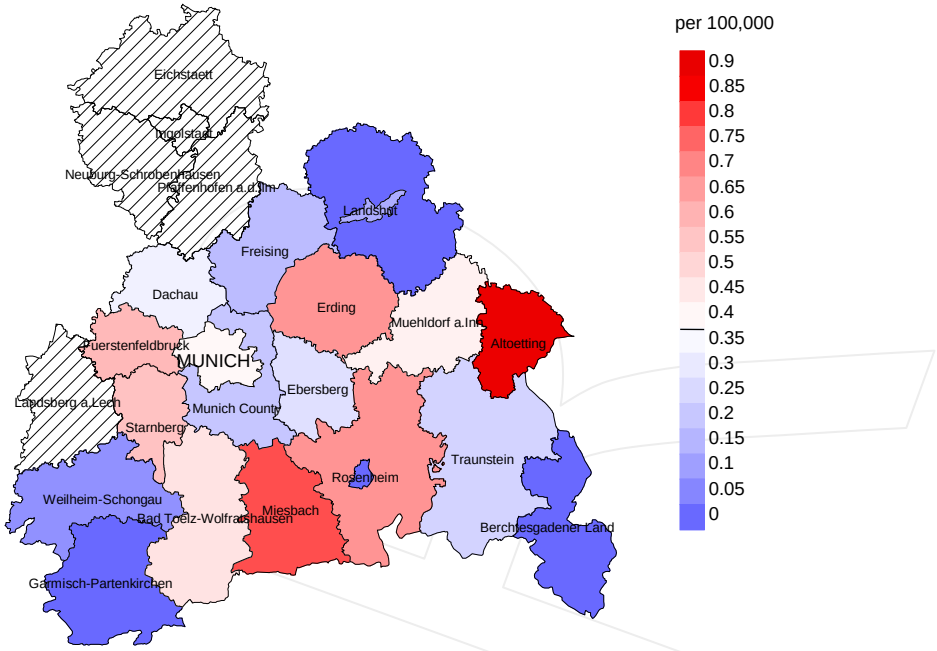


Figure 18. Distribution of age at death (bars) and age-specific mortality (all patients: solid line, patients with single primaries: dotted line). The age-specific incidence is additionally plotted for comparison (dashed line).

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

Average mortality (world standard population) 2003 - 2008: Males



Average mortality (world standard population) 2003 - 2008: Females

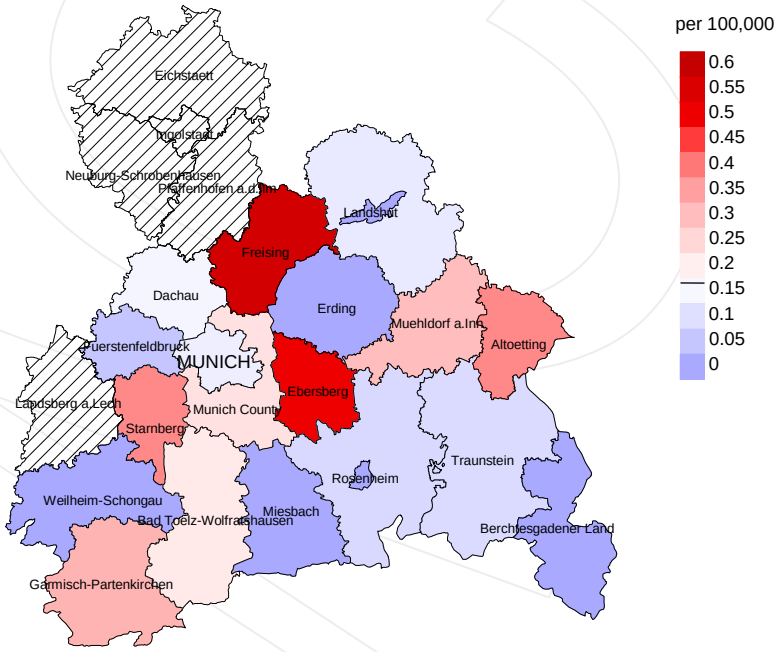
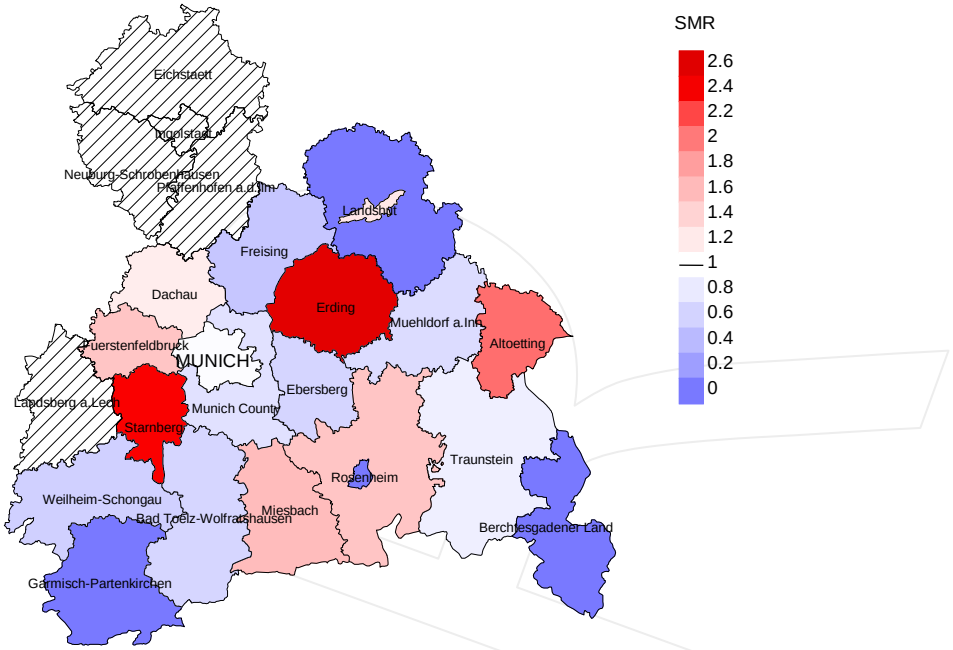


Figure 19a. Map of cancer mortality (world standard population) by county averaged for period 2003 to 2008. According to their individual mortality rates, the counties are displayed in different red and blue color temperatures where the fine white color indicates the population mean (males 0.4/100,000 WS N=51, females 0.2/100,000 WS N=35). Since cancer data are not available in some counties until 2007, the local mortality rates were not calculated, and the map tiles show as shaded.

The results should be interpreted with caution! E.g., in county Ebersberg with a population of 63,131 female residents (averaged) in the period from 2003 to 2008 a total of 1 women died from bone cancer. Therefore, the mean mortality rate for this cancer type in this area can be calculated at 0.5/100,000 (world standard population). Though, the value of this parameter may vary with an underlying probability of 99% between 0.0 and 3.7/100,000.

Standardized mortality ratio (SMR) 2003 - 2008: Males



Standardized mortality ratio (SMR) 2003 - 2008: Females

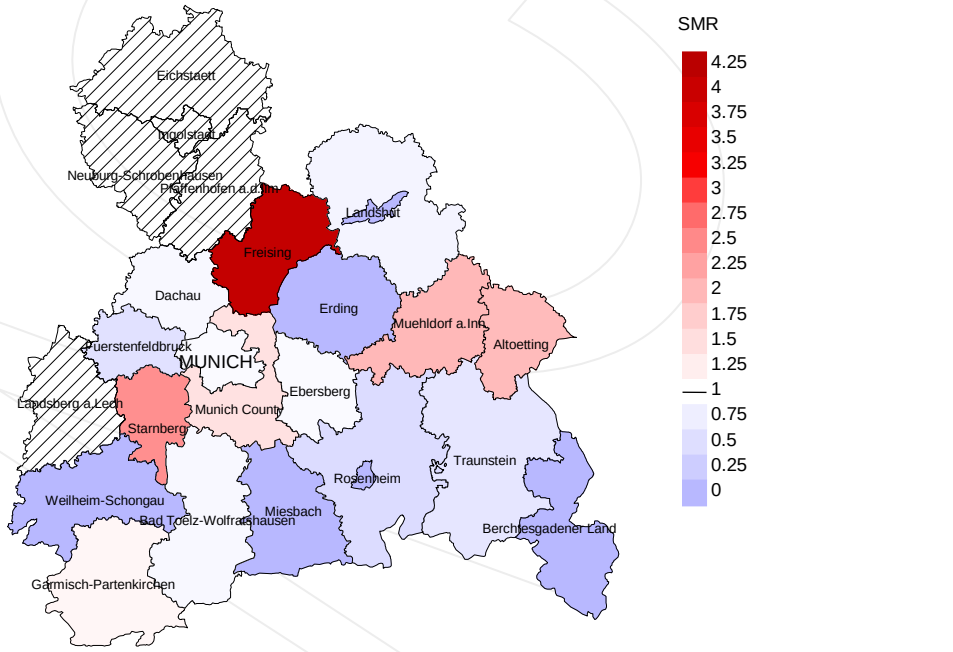


Figure 19b. Map of standardized mortality ratio (SMR, incl. DCO cases) by county averaged for period 2003 to 2008. According to their individual SMR values, the counties are displayed in different red and blue color temperatures where the fine white color indicates the population overall of 1.0 (males N=51, females N=35). Since cancer data are not available in some counties until 2007, the local SMR values were not calculated, and the map tiles show as shaded.

The results should be interpreted with caution! E.g., in county Ebersberg with a population of 63,131 female residents (averaged) in the period from 2003 to 2008 a total of 1 women died from bone cancer. Therefore, the mean standardized mortality ratio (SMR) for this cancer type in this area can be calculated at 0.95. Though, the value of this parameter may vary with an underlying probability of 99% between 0.00 and 7.05, 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. 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 tumor-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 index from mortality and incidence (Mortality-Incidence ratio, **MI-index**) is a statistic 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 MI- index. 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

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

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