Munich Cancer Registry

GIST: Gastroint. stromal tumor

Incidence and Mortality

Year of diagnosis	1998-2014
Patients	829
Diseases	830
Creation date	04/13/2016
Export date	12/23/2015
Population	4.64 m

BERLIN

GERMANY

BAVARIA

MUNICH

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

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

http://www.tumorregister-muenchen.de/en/facts/base/bhGISTE-GIST-Gastroint.-stromal-tumor-incidence-and-mortality.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 4.64 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, April 2016

[#]   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).

[##] 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.

Morphology codes (ICD-O-3 2011) used for specifying cancer site

Code	Description
8936/1	Gastrointestinal stromal tumor, NOS
8936/3	Gastrointestinal stromal sarcoma

INCIDENCE

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                              Table 1

        All patients with invasive cancer by year of diagnosis,
       proportions of multiple primaries, deaths, and active follow-up
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Year of diagnosis	Cases n	Prop. mult. primaries %	Prop. deaths %	Prop. actively followed %
1998	2	50.0	100.0	100.0
1999	6		83.3	100.0
2000	15	26.7	66.7	93.3
2001	23	30.4	65.2	100.0
2002	31	22.6	74.2	96.8 #
2003	30	23.3	33.3	90.0
2004	42	26.2	54.8	97.6
2005	34	32.4	41.2	94.1
2006	24	29.2	54.2	91.7
2007	30	23.3	36.7	70.0 #
2008	47	29.8	27.7	68.1
2009	52	30.8	30.8	57.7
2010	82	37.8	22.0	62.2
2011	96	35.4	14.6	55.2
2012	131	37.4	14.5	44.3
2013	96	40.6	11.5	99.0
2014	89	33.7	3.4	96.6 ##
1998-2014	830	33.1	26.5	75.1

\#   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 found in the respective headings.

Table 1a

All patients with invasive cancer
by year of diagnosis and gender

Year of diagnosis	All n	Males n	Females n	Prop. males %
1998	2	1	1	50.0
1999	6	4	2	66.7
2000	15	9	6	60.0
2001	23	12	11	52.2
2002	31	17	14	54.8
2003	30	16	14	53.3
2004	42	19	23	45.2
2005	34	16	18	47.1
2006	24	8	16	33.3
2007	30	15	15	50.0
2008	47	23	24	48.9
2009	52	28	24	53.8
2010	82	46	36	56.1
2011	96	57	39	59.4
2012	131	69	62	52.7
2013	96	60	36	62.5
2014	89	46	43	51.7
1998-2014	830	446	384	53.7

Table 2

Incidence measures by year of diagnosis
(with respect to registry area expansion from 2.51 to 3.96 m as of 2002,
and from 3.96 to 4.64 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	1	1	0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.0
1999	4	2	0.4	0.2	0.3	0.1	0.4	0.1	0.4	0.1
2000	9	6	0.8	0.5	0.4	0.3	0.7	0.4	0.8	0.4
2001	12	11	1.0	0.9	0.6	0.5	0.9	0.7	1.2	0.8
2002	17	14	0.9	0.7	0.5	0.5	0.7	0.6	1.1	0.7
2003	16	14	0.9	0.7	0.6	0.4	0.8	0.5	0.8	0.6
2004	19	23	1.0	1.2	0.6	0.7	0.9	0.9	1.1	1.1
2005	16	18	0.8	0.9	0.5	0.4	0.7	0.6	0.9	0.8
2006	8	16	0.4	0.8	0.2	0.4	0.4	0.5	0.4	0.6
2007	15	15	0.7	0.6	0.4	0.3	0.6	0.4	0.6	0.6
2008	23	24	1.0	1.0	0.6	0.6	0.8	0.8	1.0	0.9
2009	28	24	1.3	1.0	0.7	0.5	1.0	0.7	1.2	0.9
2010	46	36	2.0	1.5	1.1	0.8	1.6	1.1	2.0	1.3
2011	57	39	2.5	1.7	1.2	0.8	1.8	1.1	2.3	1.3
2012	69	62	3.0	2.6	1.6	1.1	2.3	1.7	2.7	2.2
2013	60	36	2.6	1.5	1.4	0.8	2.0	1.1	2.4	1.3
2014	46	43	2.0	1.8	1.1	0.9	1.5	1.2	1.9	1.5
1998-2014	446	384	1.4	1.1	0.8	0.6	1.1	0.8	1.4	1.0

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 patients)

Year of diagnosis	Cases n	Mean	Std. dev.	Min.	Max.	10%	25%	Median 50%	75%	90%
1998	2	88.8	1.7	87.5	90.0	87.5	87.5	88.8	90.0	90.0
1999	6	63.3	14.4	46.4	88.3	46.4	53.0	62.5	67.1	88.3
2000	15	60.6	14.1	36.6	79.1	37.6	55.1	60.0	72.5	77.9
2001	23	64.1	12.5	31.9	80.5	52.7	57.0	63.9	73.7	79.2
2002	31	66.5	14.6	19.3	89.0	46.8	60.3	68.9	75.8	81.6
2003	30	64.6	13.0	17.9	92.1	52.6	59.4	64.5	72.7	78.4
2004	42	62.4	13.8	16.7	83.2	47.1	55.0	61.6	73.7	79.7
2005	34	67.7	15.2	34.3	89.4	48.8	55.2	70.1	80.8	84.6
2006	24	67.8	11.7	39.5	89.2	54.6	61.0	67.6	75.1	84.8
2007	30	67.9	10.9	46.5	88.3	53.8	59.8	67.0	76.7	82.6
2008	47	66.1	13.7	26.5	97.0	45.9	58.9	67.2	73.8	81.7
2009	52	65.7	13.8	32.6	93.5	49.2	53.7	67.3	77.0	80.2
2010	82	66.6	11.0	30.6	87.5	53.4	60.3	67.4	73.8	80.5
2011	96	66.8	14.1	30.0	88.3	44.6	55.3	71.6	77.3	83.1
2012	131	69.0	11.0	34.9	91.8	54.2	62.0	69.8	76.9	82.2
2013	96	66.1	14.7	16.2	90.6	45.7	58.7	69.5	75.9	79.4
2014	89	65.7	14.7	25.9	93.1	42.0	57.1	67.8	76.4	82.6
1998−2014	830	66.5	13.3	16.2	97.0	48.3	58.3	68.0	75.9	82.0

Table 3a

Age distribution parameters by year of diagnosis (MALES)

Year of diagnosis	Cases n	Mean	Std. dev.	Min.	Max.	10%	25%	Median 50%	75%	90%
1998	1	87.5		87.5	87.5	87.5	87.5	87.5	87.5	87.5
1999	4	63.7	18.5	46.4	88.3	46.4	49.7	60.1	77.7	88.3
2000	9	60.7	15.8	36.6	79.1	36.6	55.1	64.0	72.5	79.1
2001	12	64.1	14.4	31.9	80.5	53.6	55.9	62.9	77.6	80.4
2002	17	71.4	10.9	44.8	89.0	58.1	67.2	71.9	79.2	81.9
2003	16	62.7	15.4	17.9	92.1	52.6	57.6	64.4	68.1	77.9
2004	19	61.2	16.1	16.7	83.2	41.0	54.9	61.4	76.2	80.9
2005	16	63.6	16.3	34.3	89.4	35.6	53.0	65.9	76.0	82.2
2006	8	66.9	12.1	51.7	89.2	51.7	59.9	63.8	73.4	89.2
2007	15	64.1	7.6	47.4	75.2	55.6	58.5	64.0	71.6	73.9
2008	23	66.3	14.0	26.5	88.0	45.4	60.6	69.6	76.2	78.4
2009	28	62.6	13.6	40.8	93.5	44.6	52.7	59.1	74.1	79.8
2010	46	66.9	12.5	30.6	87.5	50.8	59.0	68.4	75.4	82.5
2011	57	68.0	14.3	30.0	88.3	44.7	55.9	72.4	78.9	84.2
2012	69	67.0	10.8	34.9	91.0	51.6	62.0	68.5	73.4	80.2
2013	60	66.7	12.7	34.6	89.4	48.0	58.8	70.0	74.8	79.1
2014	46	64.5	14.0	30.9	83.8	41.7	55.7	66.9	76.4	80.6
1998−2014	446	65.9	13.2	16.7	93.5	48.0	57.6	67.9	75.2	80.9

Table 3b

Age distribution parameters by year of diagnosis (FEMALES)
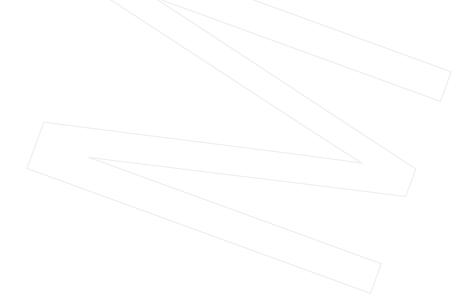
Year of diagnosis	Cases n	Mean	Std. dev.	Min.	Max.	10%	25%	Median 50%	75%	90%
1998	1	90.0		90.0	90.0	90.0	90.0	90.0	90.0	90.0
1999	2	62.5	1.1	61.7	63.2	61.7	61.7	62.5	63.2	63.2
2000	6	60.5	12.5	41.1	77.9	41.1	55.2	59.8	68.9	77.9
2001	11	64.1	10.7	40.4	79.2	52.7	57.0	66.9	69.9	73.7
2002	14	60.5	16.6	19.3	81.8	42.1	52.1	63.9	72.5	75.8
2003	14	66.8	9.7	46.8	83.9	58.0	59.6	66.3	72.9	79.0
2004	23	63.4	11.9	37.1	81.0	51.8	55.0	63.0	73.7	79.5
2005	18	71.3	13.5	48.8	85.7	49.8	64.3	75.7	82.9	85.4
2006	16	68.2	11.9	39.5	88.2	54.6	61.9	68.7	75.1	84.8
2007	15	71.6	12.5	46.5	88.3	52.0	62.8	76.7	81.5	84.4
2008	24	66.0	13.7	38.1	97.0	48.4	56.3	65.1	73.1	84.8
2009	24	69.3	13.5	32.6	89.4	49.2	62.4	71.7	79.4	83.0
2010	36	66.4	9.0	47.1	85.0	58.2	60.4	66.4	70.7	79.8
2011	39	64.9	13.9	34.3	86.6	44.2	51.9	68.9	74.8	81.9
2012	62	71.2	10.9	47.2	91.8	55.8	62.4	72.4	79.3	86.0
2013	36	65.1	17.7	16.2	90.6	43.1	58.0	67.9	77.6	85.6
2014	43	67.0	15.5	25.9	93.1	46.1	58.8	68.3	77.2	85.9
1998-2014	384	67.1	13.3	16.2	97.0	48.4	59.6	68.2	77.1	83.1

Table 4

Age distribution by 5-year age group and gender for period 2007-2014

Age at diagnosis Years	Cases n	%	Cum.%	Males n	%	Cum.%	Females n	%	Cum.%
15-19	1	0.2	0.2			0.0	1	0.4	0.4
20-24	1	0.2	0.3			0.0	1	0.4	0.7
25-29	2	0.3	0.6	1	0.3	0.3	1	0.4	1.1
30-34	10	1.6	2.2	7	2.0	2.3	3	1.1	2.2
35-39	8	1.3	3.5	5	1.5	3.8	3	1.1	3.2
40-44	19	3.0	6.6	12	3.5	7.3	7	2.5	5.7
45-49	34	5.5	12.0	16	4.7	11.9	18	6.5	12.2
50-54	37	5.9	18.0	29	8.4	20.3	8	2.9	15.1
55-59	55	8.8	26.8	29	8.4	28.8	26	9.3	24.4
60-64	72	11.6	38.4	32	9.3	38.1	40	14.3	38.7
65-69	102	16.4	54.7	61	17.7	55.8	41	14.7	53.4
70-74	105	16.9	71.6	65	18.9	74.7	40	14.3	67.7
75-79	94	15.1	86.7	48	14.0	88.7	46	16.5	84.2
80-84	45	7.2	93.9	25	7.3	95.9	20	7.2	91.4
85+	38	6.1	100.0	14	4.1	100.0	24	8.6	100.0
All ages	623	100.0		344	100.0		279	100.0	

Included in the statistics are 51.5% multiple primaries in males and 42.1% in females.

Table 5

Age-specific incidence and proportion of all cancers
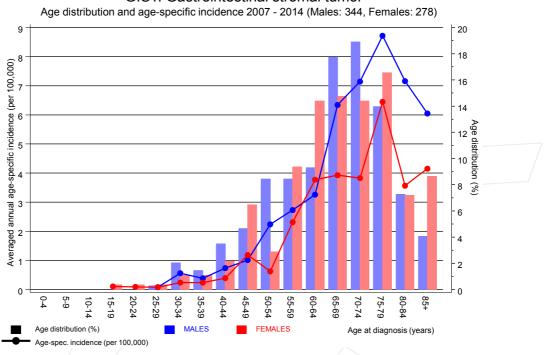for period 2007-2014

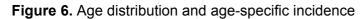| Age at diagnosis Years	Males n	Females n	Males Age-spec. incid.	Females Age-spec. incid.	Males Prop.all cancers n=91183 %	Females Prop.all cancers n=89596 %
0- 4			0.0	0.0		
5- 9			0.0	0.0		
10-14			0.0	0.0		
15-19		1	0.0	0.1		0.6
20-24		1	0.0	0.1		0.3
25-29	1	1	0.1	0.1	0.2	0.2
30-34	7	3	0.6	0.2	0.9	0.3
35-39	5	3	0.4	0.2	0.4	0.2
40-44	12	6	0.7	0.4	0.7	0.2
45-49	16	18	1.0	1.2	0.5	0.3
50-54	29	8	2.2	0.6	0.6	0.1
55-59	29	26	2.7	2.3	0.4	0.3
60-64	32	40	3.3	3.8	0.3	0.4
65-69	61	41	6.3	3.9	0.4	0.4
70-74	65	40	7.1	3.8	0.4	0.3
75-79	48	46	8.7	6.4	0.4	0.5
80-84	25	20	7.2	3.6	0.3	0.2
85+	14	24	6.0	4.2	0.2	0.2
All ages	344	278			0.4	0.3
Incidence						
Raw			1.9	1.5		
WS			1.0	0.7		
ES			1.5	1.0		
BRD-S			1.8	1.2		

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).
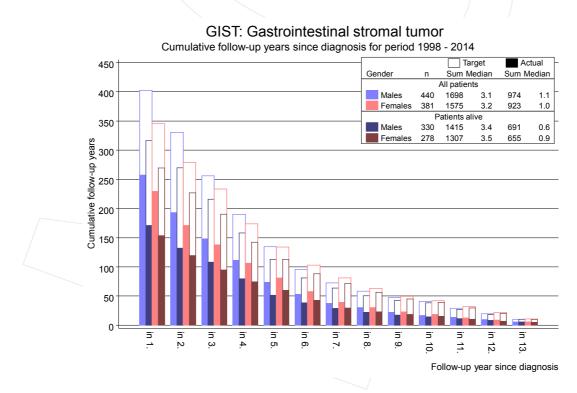
GIST: Gastrointestinal stromal tumor
Age distribution and age-specific incidence 2007 - 2014 (Males: 344, Females: 278)

Figure 6. Age distribution and age-specific incidence

GIST: Gastrointestinal stromal tumor
Cumulative follow-up years since diagnosis for period 1998 - 2014

Gender	n	Target Sum	Target Median	Actual Sum	Actual Median
All patients					
Males	440	1698	3.1	974	1.1
Females	381	1575	3.2	923	1.0
Patients alive					
Males	330	1415	3.4	691	0.6
Females	278	1307	3.5	655	0.9

Figure 7. 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.

Table 8a

Standardized incidence ratio (SIR, with 95% confidence limits),
excess absolute risk (EAR) and DCO rate of second primaries
for period 1998-2014
MALES

Diagnosis		Observed n	Expected n	SIR	LCL 95%	UCL 95%		EAR	DCO %
C15	Oesophagus	5	0.3	18.4	6.0	43.0	#	48.9	
C17	Small intestine	6	0.1	76.1	27.9	165.6	#	61.2	
C18	Colon	9	1.4	6.5	3.0	12.4	#	78.8	
C19-C20	Rectum	3	0.8	3.9	0.8	11.4		23.1	
C33-C34	Lung	2	1.7	1.2	0.1	4.3		3.2	
C43	Malign. melanoma	4	0.6	6.2	1.7	15.8	#	34.7	
C61	Prostate	6	4.1	1.5	0.5	3.2		19.6	
C64	Kidney	7	0.5	13.9	5.6	28.7	#	67.2	
C76-C79	CUP	2	0.2	8.1	1.0	29.4		18.1	
C82-C85	NHL	2	0.6	3.5	0.4	12.8		14.8	
C90	Mult. myeloma	3	0.2	16.9	3.5	49.3	#	29.2	
Other primaries		7	1.9	3.7	1.5	7.5	#	52.6	
Not observed		0	2.1	0.0	0.0	1.7		-21.9	
All mult. primaries		56	14.5	3.9	2.9	5.0	#	429.5	

Patients	438
Median age at second malignancy (years)	70.7
Person-years	967
Mean observation time (years)	2.2
Median observation time (years)	1.0

The occurrence of second malignancy is statistically significant.

Observed second primaries with count 1 are pooled in category "Other primaries"
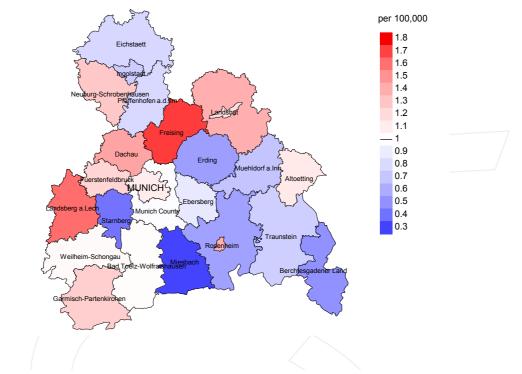
Table 8b

Standardized incidence ratio (SIR, with 95% confidence limits),
excess absolute risk (EAR) and DCO rate of second primaries
for period 1998-2014
FEMALES

Diagnosis		Observed n	Expected n	SIR	LCL 95%	UCL 95%		EAR	DCO %
C16	Stomach	2	0.3	5.8	0.7	21.1		18.3	
C17	Small intestine	3	0.1	56.4	11.6	164.8	#	32.5	
C18	Colon	6	1.0	6.1	2.2	13.3	#	55.4	
C25	Pancreas	2	0.5	4.2	0.5	15.3		16.9	
C33-C34	Lung	3	0.8	3.8	0.8	11.2		24.5	
C50	Breast	10	3.2	3.2	1.5	5.8	#	75.6	
C54	Corpus uteri	2	0.6	3.4	0.4	12.2		15.5	
C56	Ovary	6	0.4	14.2	5.2	30.9	#	61.6	16.7
C64	Kidney	3	0.3	11.5	2.4	33.5	#	30.2	
C82-C85	NHL	2	0.4	5.1	0.6	18.3		17.7	
Other primaries		7	1.4	5.1	2.1	10.6	#	62.2	
Not observed		0	1.5	0.0	0.0	2.4		−17.0	
All mult. primaries		46	10.4	4.4	3.2	5.9	#	393.6	2.2

Patients	373
Median age at second malignancy (years)	73.7
Person-years	905
Mean observation time (years)	2.4
Median observation time (years)	1.0

The occurrence of second malignancy is statistically significant.

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

Average incidence (world standard population) 2007 - 2014: Males

Average incidence (world standard population) 2007 - 2014: Females
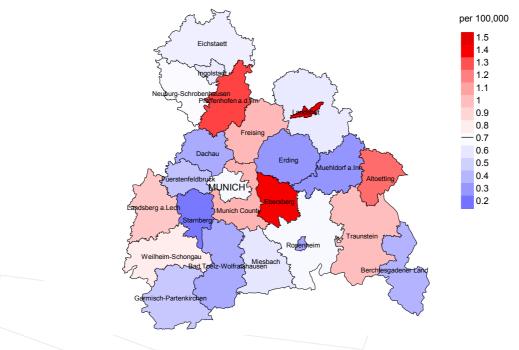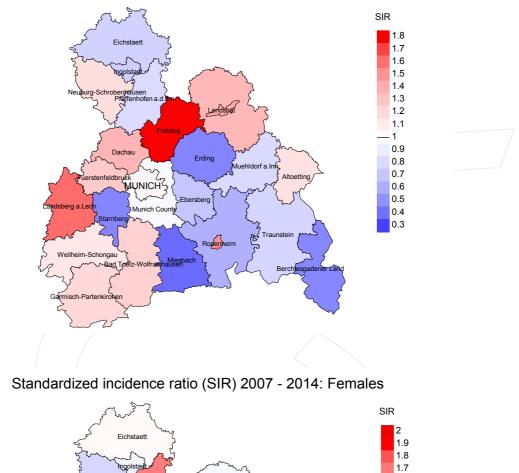

Figure 9a. Map of cancer incidence (world standard population) by county averaged for period 2007 to 2014. According to their individual incidence rates, the counties are displayed in different red and blue color temperatures where the fine white color indicates the population mean (males 1.0/100,000 WS N=344, females 0.7/100,000 WS N=278).

The results should be interpreted with caution! E.g., in county Ebersberg with a population of 65,347 female residents (averaged) in the period from 2007 to 2014 a total of 14 women were identified with newly diagnosed gastroint. stromal tumor. Therefore, the mean incidence rate for this cancer type in this area can be calculated at 1.4/100,000 (world standard population). Though, the value of this parameter may vary with an underlying probability of 99% between 0.6 and 2.9/100,000.

Standardized incidence ratio (SIR) 2007 - 2014: Males

Standardized incidence ratio (SIR) 2007 - 2014: Females
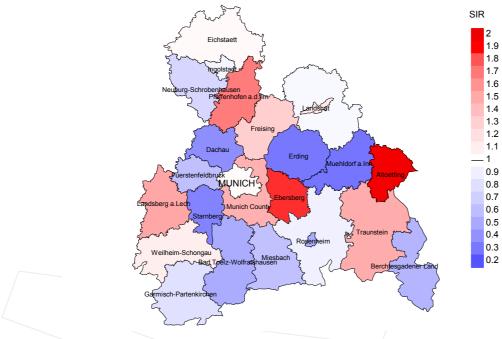
Figure 9b. Map of standardized incidence ratio (SIR) by county averaged for period 2007 to 2014. According to their individual SIR values, the counties are displayed in different red and blue color temperatures where the fine white color indicates the population overall of 1.0 (males N=344, females N=278).

The results should be interpreted with caution! E.g., in county Ebersberg with a population of 64,924 female residents (averaged) in the period from 2007 to 2014 a total of 14 women were identified with newly diagnosed gastroint. stromal tumor. Therefore, the mean standardized incidence ratio (SIR) for this cancer type in this area can be calculated at 1.87. Though, the value of this parameter may vary with an underlying probability of 99% between 0.83 and 3.58, and is therefore not statistically striking.

MORTALITY

Table 10a

Patient cohorts of incident cancers by year of diagnosis, follow-up status,
and deaths among the annual cohorts

(with respect to registry area expansion from 2.51 to 3.96 m as of 2002,
and from 3.96 to 4.64 m as of 2007, respectively)

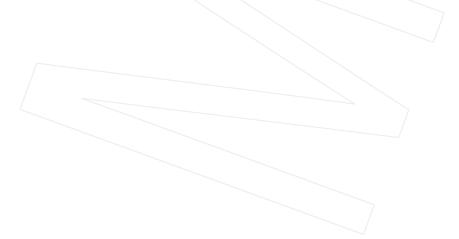| Year of diagnosis	Incident cases n	Prop. actively followed %	Deaths n	Prop. deaths %	Prop. deaths with death certific. %
1998	2	100.0	2	100.0	100.0
1999	6	100.0	5	83.3	60.0
2000	15	93.3	10	66.7	100.0
2001	23	100.0	15	65.2	80.0
2002	31	96.8	23	74.2	100.0
2003	30	90.0	10	33.3	100.0
2004	42	97.6	23	54.8	95.7
2005	34	94.1	14	41.2	100.0
2006	24	91.7	13	54.2	100.0
2007	30	70.0	11	36.7	100.0
2008	47	68.1	13	27.7	92.3
2009	52	57.7	16	30.8	100.0
2010	82	62.2	18	22.0	100.0
2011	96	55.2	14	14.6	92.9
2012	131	44.3	19	14.5	94.7
2013	96	99.0	11	11.5	100.0
2014	89	96.6	3	3.4	33.3
1998-2014	830	75.1	220	26.5	95.0

Table 10b

Annual cohorts of incident cancers and deaths,
and cases deceased the same year of cancer diagnosis

(with respect to registry area expansion from 2.51 to 3.96 m as of 2002,
and from 3.96 to 4.64 m as of 2007, respectively)

Year of diagnosis/ death	Incident cases n	Deaths n	Deaths in same year n	Prop. deaths in same year %
1998	2	1	1	50.0
1999	6			
2000	15	3	2	13.3
2001	23	4	1	4.3
2002	31	11	5	16.1
2003	30	12	2	6.7
2004	42	18	7	16.7
2005	34	14	3	8.8
2006	24	12	2	8.3
2007	30	11	1	3.3
2008	47	16	4	8.5
2009	52	12	3	5.8
2010	82	17	5	6.1
2011	96	18	4	4.2
2012	131	25	10	7.6
2013	96	28	6	6.3
2014	89	24		
1998–2014	830	226	56	6.7
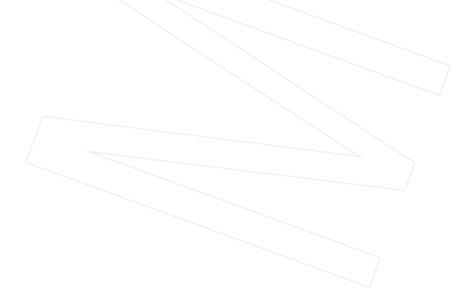
Table 10c

Annual cohorts of deaths, and proportion of cancer-related and non-cancer-
related deaths

(with respect to registry area expansion from 2.51 to 3.96 m as of 2002,
and from 3.96 to 4.64 m as of 2007, respectively)

Year of death	Deaths n	Prop. cancer-related %	Prop. non-cancer-related %	Prop. cancer recorded on death certificate %
1998	1		100.0	100.0
1999				
2000	3	33.3	66.7	100.0
2001	4	100.0		100.0
2002	11	54.5	45.5	63.6
2003	12	75.0	25.0	90.9
2004	18	72.2	27.8	93.3
2005	14	85.7	14.3	85.7
2006	12	75.0	25.0	81.8
2007	11	90.9	9.1	72.7
2008	16	93.8	6.3	93.8
2009	12	83.3	16.7	83.3
2010	17	64.7	35.3	80.0
2011	18	72.2	27.8	83.3
2012	25	72.0	28.0	80.0
2013	28	67.9	32.1	81.5
2014	24	70.8	29.2	82.6
1998-2014	226	73.9	26.1	83.3

Table 11a

Medians 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 (non-cancer-related) Years	Age at death (according to death certificate) Years
1998	1	87.6		87.6	87.6
1999					
2000	2	84.4	79.2	89.5	79.2
2001	2	71.5	71.5		71.5
2002	5	78.9	80.1	77.6	80.1
2003	8	68.3	70.2	60.0	70.0
2004	10	68.6	67.4	80.5	68.6
2005	5	77.9	77.7	78.4	77.7
2006	7	70.4	70.4	76.2	70.4
2007	7	66.3	66.3		66.3
2008	4	70.4	70.4		70.4
2009	5	68.6	68.6	88.7	68.6
2010	13	72.2	70.3	78.0	71.4
2011	8	73.3	74.3	68.1	72.3
2012	11	77.9	71.6	81.6	71.6
2013	14	74.0	73.0	87.6	71.9
2014	10	73.5	69.1	81.2	73.5
1998–2014	112	72.4	70.3	78.4	70.3

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

Medians 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 (non-cancer-related) Years	Age at death (according to death certificate) Years
1998					
1999					
2000	1	78.5		78.5	78.5
2001	2	60.2	60.2		60.2
2002	6	74.7	71.9	76.3	78.5
2003	4	59.6	59.6		59.6
2004	8	76.5	75.3	79.7	76.5
2005	9	72.8	71.7	74.4	71.7
2006	5	84.2	84.7	74.2	84.7
2007	4	82.7	83.6	81.7	60.9
2008	12	72.8	72.6	82.0	72.6
2009	7	78.5	77.8	97.8	77.8
2010	4	67.7	58.4	75.8	67.7
2011	10	74.7	74.4	75.4	74.7
2012	14	75.2	73.6	87.2	73.6
2013	14	87.5	78.9	88.0	87.5
2014	14	78.3	77.7	78.4	77.7
1998–2014	114	77.1	74.6	81.9	75.4

By 2010, life expectancy at birth was 77.5 years for boys and 82.6 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 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
2000	1	0.1	0.11	0.0	0.09	0.1	0.12	0.1	0.18
2001	2	0.2	0.17	0.1	0.19	0.2	0.17	0.2	0.15
2002	2	0.1	0.12	0.0	0.09	0.1	0.11	0.2	0.15
2003	5	0.3	0.31	0.1	0.23	0.2	0.28	0.3	0.37
2004	8	0.4	0.42	0.2	0.34	0.3	0.36	0.4	0.39
2005	4	0.2	0.25	0.1	0.21	0.2	0.25	0.3	0.31
2006	5	0.3	0.63	0.1	0.52	0.2	0.58	0.3	0.66
2007	7	0.3	0.47	0.2	0.46	0.3	0.47	0.3	0.45
2008	4	0.2	0.17	0.1	0.16	0.1	0.16	0.2	0.17
2009	4	0.2	0.14	0.1	0.12	0.1	0.12	0.1	0.12
2010	9	0.4	0.20	0.2	0.18	0.3	0.18	0.4	0.18
2011	5	0.2	0.09	0.1	0.07	0.1	0.07	0.2	0.09
2012	8	0.4	0.12	0.2	0.11	0.3	0.12	0.3	0.13
2013	11	0.5	0.18	0.2	0.15	0.3	0.16	0.4	0.17
2014	8	0.4	0.17	0.2	0.16	0.3	0.17	0.3	0.17
2000-2014	83	0.3	0.20	0.1	0.18	0.2	0.19	0.3	0.20

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
2000									
2001	2	0.2	0.18	0.1	0.18	0.1	0.18	0.1	0.17
2002	4	0.2	0.29	0.1	0.19	0.1	0.23	0.2	0.26
2003	4	0.2	0.29	0.1	0.32	0.2	0.29	0.2	0.27
2004	5	0.3	0.22	0.1	0.13	0.1	0.15	0.2	0.19
2005	8	0.4	0.44	0.2	0.48	0.3	0.50	0.4	0.47
2006	4	0.2	0.25	0.0	0.10	0.1	0.14	0.1	0.20
2007	3	0.1	0.20	0.0	0.17	0.1	0.16	0.1	0.16
2008	11	0.5	0.46	0.2	0.36	0.3	0.40	0.4	0.41
2009	6	0.3	0.25	0.1	0.19	0.1	0.21	0.2	0.24
2010	2	0.1	0.06	0.1	0.07	0.1	0.06	0.1	0.06
2011	8	0.3	0.21	0.1	0.18	0.2	0.18	0.2	0.19
2012	10	0.4	0.16	0.2	0.14	0.2	0.14	0.3	0.16
2013	8	0.3	0.22	0.1	0.12	0.2	0.15	0.2	0.16
2014	9	0.4	0.21	0.1	0.12	0.2	0.15	0.3	0.21
2000-2014	84	0.3	0.24	0.1	0.18	0.2	0.20	0.2	0.22

Table 13

Age distribution of age at death (cancer-related) for period 2007-2014
(**incl. multiple primaries**)

Age at death Years	Cases n	%	Cum.%	Males n	%	Cum.%	Females n	%	Cum.%
35-39	1	0.9	0.9	1	1.8	1.8			0.0
40-44	1	0.9	1.8			1.8	1	1.8	1.8
45-49	4	3.5	5.3	2	3.6	5.4	2	3.5	5.3
50-54	3	2.7	8.0	3	5.4	10.7			5.3
55-59	7	6.2	14.2	4	7.1	17.9	3	5.3	10.5
60-64	11	9.7	23.9	6	10.7	28.6	5	8.8	19.3
65-69	16	14.2	38.1	10	17.9	46.4	6	10.5	29.8
70-74	25	22.1	60.2	14	25.0	71.4	11	19.3	49.1
75-79	12	10.6	70.8	3	5.4	76.8	9	15.8	64.9
80-84	17	15.0	85.8	8	14.3	91.1	9	15.8	80.7
85+	16	14.2	100.0	5	8.9	100.0	11	19.3	100.0
All ages	113	100.0		56	100.0		57	100.0	

Included in the statistics are 51.5% multiple primaries in males and 42.1% in females.

Table 14

Age-specific mortality (cancer-related) and proportion of all cancers
for period 2007-2014
(**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			0.0		0.0			
10-14			0.0		0.0			
15-19			0.0		0.0			
20-24			0.0		0.0			
25-29			0.0		0.0			
30-34			0.0		0.0			
35-39	1		0.1	0.20	0.0		0.6	
40-44		1	0.0		0.1	0.14		0.2
45-49	2	2	0.1	0.13	0.1	0.11	0.2	0.2
50-54	3		0.2	0.10	0.0		0.2	
55-59	4	3	0.4	0.14	0.3	0.12	0.1	0.1
60-64	6	5	0.6	0.19	0.5	0.13	0.1	0.1
65-69	10	6	1.0	0.16	0.6	0.15	0.1	0.1
70-74	14	11	1.5	0.22	1.1	0.28	0.2	0.2
75-79	3	9	0.5	0.06	1.3	0.20	0.0	0.1
80-84	8	9	2.3	0.32	1.6	0.45	0.1	0.1
85+	5	11	2.2	0.36	1.9	0.46	0.1	0.1
All ages	56	57					0.1	0.1
Mortality								
Raw			0.3	0.16	0.3	0.20		
WS			0.2	0.15	0.1	0.15		
ES			0.2	0.16	0.2	0.17		
BRD-S			0.3	0.16	0.2	0.18		
PYLL-70								
per 100,000			1.6		1.0			
ES			1.4		0.8			
AYLL-70			9.6		9.6			

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

Table 15a

Multiple primaries in deaths in period 2000-2014
MALES

Diagnosis		Total n	Total %↓	Pre n	Pre ←%	Syn-chron ±30d n	Syn-chron ±30d ←%	Post n	Post ←%
C15	Oesophagus	2	4.1			1	50.0	1	50.0
C16	Stomach	6	12.2			4	66.7	2	33.3
C17	Small intestine	1	2.0			1	100.0		
C18	Colon	3	6.1			2	66.7	1	33.3
C19-C20	Rectum	3	6.1					3	100.0
C22	Liver	1	2.0			1	100.0		
C23-C24	Bile	1	2.0	1	100.0				
C25	Pancreas	3	6.1	2	66.7	1	33.3		
C32	Larynx	2	4.1	2	100.0				
C33-C34	Lung	1	2.0			1	100.0		
C43	Malign. melanoma	2	4.1	2	100.0				
C61	Prostate	10	20.4	7	70.0			3	30.0
C64	Kidney	2	4.1			2	100.0		
C67	Bladder	2	4.1	2	100.0				
C73	Thyroid	1	2.0	1	100.0				
C76-C79	CUP	2	4.1	1	50.0	1	50.0		
C82-C85	NHL	3	6.1	2	66.7			1	33.3
C90	Mult. myeloma	1	2.0					1	100.0
C91-C96	Leukaemia	3	6.1	2	66.7			1	33.3
All mult. primaries		49	100.0	22	44.9	14	28.6	13	26.5

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 2000−2014
FEMALES

Diagnosis		Total n	Total %↓	Pre n	Pre ←%	Syn- chron ±30d n	Syn- chron ±30d ←%	Post n	Post ←%
C16	Stomach	3	7.3			1	33.3	2	66.7
C17	Small intestine	1	2.4					1	100.0
C18	Colon	3	7.3			1	33.3	2	66.7
C22	Liver	1	2.4			1	100.0		
C25	Pancreas	4	9.8			1	25.0	3	75.0
C26	GI cancer	1	2.4					1	100.0
C33−C34	Lung	4	9.8	2	50.0	1	25.0	1	25.0
C43	Malign. melanoma	1	2.4					1	100.0
C44	Skin others	1	2.4	1	100.0				
C46,C49	Soft tissue	1	2.4			1	100.0		
C50	Breast	9	22.0	6	66.7			3	33.3
C53	Cervix uteri	2	4.9	2	100.0				
C56	Ovary	4	9.8	2	50.0	1	25.0	1	25.0
C64	Kidney	1	2.4					1	100.0
C67	Bladder	1	2.4	1	100.0				
C69	Eye melanoma	1	2.4	1	100.0				
C70−C72	CNS cancer	1	2.4	1	100.0				
C74−C80	Cancer others	1	2.4					1	100.0
C90	Mult. myeloma	1	2.4					1	100.0
All mult. primaries		41	100.0	16	39.0	7	17.1	18	43.9

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 2007-2014
(**First 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			0.0		0.0			
10-14			0.0		0.0			
15-19			0.0		0.0			
20-24			0.0		0.0			
25-29			0.0		0.0			
30-34			0.0		0.0			
35-39	1		0.1	0.25	0.0		0.6	
40-44		1	0.0		0.1	0.33		0.2
45-49	1	2	0.1	0.07	0.1	0.12	0.1	0.2
50-54	2		0.2	0.08	0.0		0.1	
55-59	3	2	0.3	0.14	0.2	0.10	0.1	0.1
60-64	4	5	0.4	0.20	0.5	0.17	0.1	0.2
65-69	6	3	0.6	0.14	0.3	0.10	0.1	0.1
70-74	9	7	1.0	0.24	0.7	0.33	0.1	0.1
75-79	1	5	0.2	0.04	0.7	0.15	0.0	0.1
80-84	6	8	1.7	0.35	1.4	0.62	0.1	0.2
85+	2	8	0.9	0.33	1.4	0.47	0.0	0.1
All ages	35	41					0.1	0.1
Mortality								
Raw			0.2	0.15	0.2	0.20		
WS			0.1	0.14	0.1	0.15		
ES			0.1	0.14	0.1	0.16		
BRD-S			0.2	0.15	0.2	0.18		
PYLL-70								
per 100,000			1.1		0.9			
ES			1.0		0.7			
AYLL-70			10.1		11.0			

* See corresponding tables with multiple primaries.

Table 17

Age-specific mortality (cancer-related) and proportion of all cancers
for period 2007-2014
(**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			0.0		0.0			
10-14			0.0		0.0			
15-19			0.0		0.0			
20-24			0.0		0.0			
25-29			0.0		0.0			
30-34			0.0		0.0			
35-39	1		0.1	0.25	0.0		0.6	
40-44			0.0		0.0			
45-49	1	1	0.1	0.07	0.1	0.06	0.1	0.1
50-54	2		0.2	0.08	0.0		0.1	
55-59	3	2	0.3	0.15	0.2	0.10	0.1	0.1
60-64	4	3	0.4	0.22	0.3	0.10	0.1	0.1
65-69	6	3	0.6	0.16	0.3	0.11	0.1	0.1
70-74	8	7	0.9	0.24	0.7	0.35	0.1	0.2
75-79	1	4	0.2	0.04	0.6	0.14	0.0	0.1
80-84	4	7	1.1	0.29	1.2	0.58	0.1	0.2
85+	2	7	0.9	0.40	1.2	0.41	0.1	0.1
All ages	32	34					0.1	0.1
Mortality								
Raw			0.2	0.15	0.2	0.18		
WS			0.1	0.14	0.1	0.12		
ES			0.1	0.14	0.1	0.14		
BRD-S			0.2	0.15	0.1	0.16		
PYLL-70								
per 100,000			1.1		0.5			
ES			1.0		0.4			
AYLL-70			10.1		8.6			

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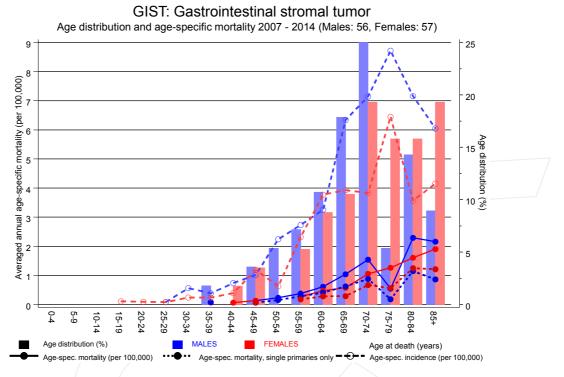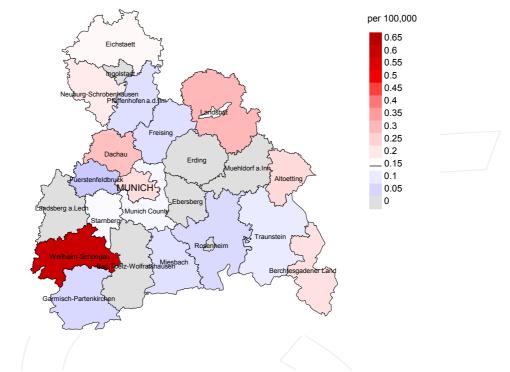
Figure 18. Distribution of age at death (bars) and age-specific mortality (all patients: solid line, patients with single primaries: dotted line). The age-specific incidence is additionally plotted for comparison (dashed line).

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

Average mortality (world standard population) 2007 - 2014: Males

Average mortality (world standard population) 2007 - 2014: Females
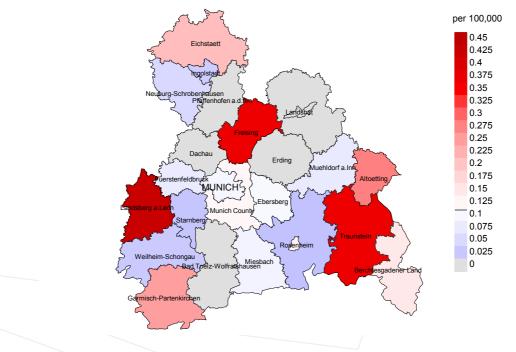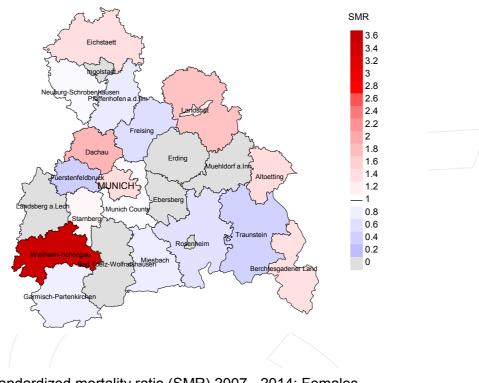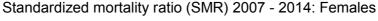
Figure 19a. Map of cancer mortality (world standard population) by county averaged for period 2007 to 2014. According to their individual mortality rates, the counties are displayed in different red and blue color temperatures where the fine white color indicates the population mean (males 0.1/100,000 WS N=55, females 0.1/100,000 WS N=56).

The results should be interpreted with caution! E.g., in county Ebersberg with a population of 65,347 female residents (averaged) in the period from 2007 to 2014 a total of 2 women died from gastroint. stromal tumor. Therefore, the mean mortality rate for this cancer type in this area can be calculated at 0.1/100,000 (world standard population). Though, the value of this parameter may vary with an underlying probability of 99% between 0.0 and 0.5/100,000.

Standardized mortality ratio (SMR) 2007 - 2014: Males

Standardized mortality ratio (SMR) 2007 - 2014: Females
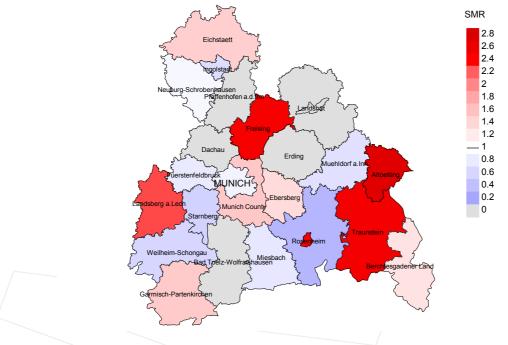
Figure 19b. Map of standardized mortality ratio (SMR) by county averaged for period 2007 to 2014. According to their individual SMR values, the counties are displayed in different red and blue color temperatures where the fine white color indicates the population overall of 1.0 (males N=55, females N=56).

The results should be interpreted with caution! E.g., in county Ebersberg with a population of 64,924 female residents (averaged) in the period from 2007 to 2014 a total of 2 women died from gastroint. stromal tumor. Therefore, the mean standardized mortality ratio (SMR) for this cancer type in this area can be calculated at 1.36. Though, the value of this parameter may vary with an underlying probability of 99% between 0.07 and 6.31, 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 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

FRG	Federal Republic of Germany
GEKID	Association of Population-based Cancer Registries in Germany (Gesellschaft der epidemiologischen Krebsregister in Deutschland e.V.)
MCR	Munich Cancer Registry (Tumorregister München)
SEER	Surveillance, Epidemiology, and End Results (USA)

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)
LCL	Lower confidence limit
MI-index	Ratio between mortality and incidence
PYLL-70	Potential years of life lost prior to age 70 given a person dies before that age
SIR	Standardized incidence ratio
SMR	Standardized mortality ratio
UCL	Upper confidence limit
WS	World standard population

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