Munich Cancer Registry

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ICD-10 D46: Myelodysplastic syndrome

Incidence and Mortality

Year of diagnosis	1998-2014
Patients	2,342
Diseases	2,346
Creation date	04/13/2016
Export date	12/23/2015
Population	4.64 m

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/bD46__E-ICD-10-D46-Myelodysplastic-syndrome-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.

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

Code	Description
D46.-	Myelodysplastic syndromes
D46.0	Refractory anaemia without ring sideroblasts, so stated
D46.1	Refractory anaemia with ring sideroblasts
D46.2	Refractory anaemia with excess of blasts [RAEB]
D46.4	Refractory anaemia, unspecified
D46.5	Refractory anaemia with multi-lineage dysplasia
D46.6	Myelodysplastic syndrome with isolated del(5q) chromosomal abnormality
D46.7	Other myelodysplastic syndromes
D46.9	Myelodysplastic syndrome, unspecified

INCIDENCE

Table 1

All patients by year of diagnosis,
proportions of DCO, multiple primaries, deaths, and active follow-up
(incl. DCO)

Year of diagnosis	Cases n	DCO cases n	Prop. DCO %	Prop. mult. primaries %	Prop. deaths %	Prop. actively followed %	
1998	49	24	49.0	20.4	95.9	100.0	
1999	53	23	43.4	18.9	94.3	100.0	
2000	66	37	56.1	24.2	93.9	100.0	
2001	59	34	57.6	33.9	94.9	96.6	
2002	110	57	51.8	36.4	97.3	98.2	#
2003	99	55	55.6	37.4	92.9	97.0	
2004	110	68	61.8	40.0	90.9	99.1	
2005	145	92	63.4	33.8	94.5	97.9	
2006	151	83	55.0	42.4	86.1	94.7	
2007	192	94	49.0	35.4	85.9	91.1	#
2008	201	95	47.3	38.8	87.1	91.5	
2009	195	79	40.5	46.7	79.0	90.8	
2010	197	88	44.7	42.6	81.2	87.8	
2011	235	103	43.8	45.1	79.6	87.2	
2012	194	105	54.1	49.0	83.5	93.3	
2013	183	85	46.4	38.8	71.6	98.4	
2014	107	87	81.3	49.5	86.0	98.1	##
1998-2014	2346	1209	51.5	39.9	85.5	93.9	

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
by year of diagnosis and gender
(incl. DCO)

Year of diagnosis	All n	Males n	Females n	Prop. males %
1998	49	16	33	32.7
1999	53	27	26	50.9
2000	66	37	29	56.1
2001	59	20	39	33.9
2002	110	61	49	55.5
2003	99	51	48	51.5
2004	110	66	44	60.0
2005	145	70	75	48.3
2006	151	87	64	57.6
2007	192	106	86	55.2
2008	201	92	109	45.8
2009	195	98	97	50.3
2010	197	110	87	55.8
2011	235	112	123	47.7
2012	194	102	92	52.6
2013	183	103	80	56.3
2014	107	60	47	56.1
1998-2014	2346	1218	1128	51.9

Table 2

Incidence measures by year of diagnosis including DCO cases
(with respect to registry area expansion from 2.51 to 3.96 m as of 2002,
and from 3.96 to 4.64 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	16	33	1.4	2.8	1.0	1.0	1.4	1.6	1.8	2.3
1999	27	26	2.4	2.2	1.6	0.6	2.4	1.1	3.5	1.6
2000	37	29	3.2	2.4	1.9	0.7	2.9	1.2	4.1	1.7
2001	20	39	1.7	3.2	0.9	1.1	1.5	1.7	2.3	2.3
2002	61	49	3.3	2.5	1.6	0.7	2.7	1.3	4.0	1.9
2003	51	48	2.7	2.4	1.4	0.7	2.2	1.2	3.3	1.7
2004	66	44	3.5	2.2	1.7	0.7	2.9	1.1	4.1	1.6
2005	70	75	3.7	3.8	1.6	1.2	2.8	1.9	4.3	2.6
2006	87	64	4.5	3.2	2.3	1.0	3.6	1.6	4.9	2.2
2007	106	86	4.8	3.7	2.6	1.2	3.8	1.9	5.1	2.7
2008	92	109	4.1	4.7	1.9	1.7	3.0	2.5	4.2	3.3
2009	98	97	4.4	4.2	2.1	1.5	3.2	2.3	4.4	3.2
2010	110	87	4.9	3.7	2.1	1.1	3.4	1.7	5.0	2.6
2011	112	123	4.9	5.2	2.0	1.6	3.2	2.5	4.7	3.5
2012	102	92	4.5	3.9	2.0	1.2	3.2	1.8	4.4	2.5
2013	103	80	4.5	3.4	2.0	1.1	3.0	1.7	4.4	2.3
2014	60	47	2.6	2.0	0.9	0.4	1.7	0.8	2.6	1.2
1998-2014	1218	1128	3.8	3.4	1.8	1.1	2.9	1.7	4.1	2.4

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)
(incl. DCO)

Year of diagnosis	Cases n	Mean	Std. dev.	Min.	Max.	10%	25%	Median 50%	75%	90%
1998	49	74.3	14.8	4.5	93.4	59.6	67.8	74.2	84.7	89.6
1999	53	76.0	16.5	1.7	94.6	64.6	72.7	80.9	85.0	88.1
2000	66	74.9	14.4	10.2	101	58.3	66.8	76.0	86.7	90.6
2001	59	76.3	13.2	31.7	96.0	61.1	70.7	78.3	85.2	90.6
2002	110	77.2	10.3	41.0	97.4	65.0	72.9	77.6	83.2	90.1
2003	99	76.1	13.6	12.2	93.9	63.1	69.0	78.4	84.5	89.4
2004	110	76.9	12.3	12.0	103	63.0	69.5	78.6	85.4	90.2
2005	145	77.1	12.0	6.0	97.1	64.6	70.4	80.3	84.5	90.0
2006	151	74.4	15.2	4.5	96.5	58.8	68.7	78.4	84.7	88.8
2007	192	75.0	17.8	3.0	100	59.0	69.7	78.4	85.7	89.9
2008	201	75.1	15.5	3.9	99.5	60.3	69.7	78.0	85.0	88.9
2009	195	73.9	14.9	2.6	100	57.7	67.4	77.8	83.6	88.2
2010	197	77.3	13.4	3.7	98.9	65.5	72.3	79.9	85.6	89.0
2011	235	77.2	12.0	3.7	95.8	64.8	72.3	78.9	85.5	88.6
2012	194	76.9	16.0	4.6	99.0	62.7	72.0	80.6	86.9	90.3
2013	183	75.6	15.3	7.6	97.5	63.7	71.5	78.4	84.2	89.1
2014	107	82.1	7.8	61.5	99.3	72.1	77.0	81.8	88.6	92.1
1998-2014	2346	76.2	14.2	1.7	103	62.5	70.8	78.9	85.1	89.5

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	16	69.7	19.2	4.5	90.1	62.4	66.1	72.2	80.2	86.2
1999	27	70.2	20.3	1.7	90.6	47.2	67.5	74.2	83.8	85.0
2000	37	71.0	15.4	10.2	93.8	55.2	62.5	74.0	80.5	88.5
2001	20	74.0	9.7	49.9	89.1	61.6	67.4	76.2	80.6	83.9
2002	61	75.3	11.0	41.0	92.1	62.8	69.9	76.4	82.6	86.8
2003	51	73.4	15.0	12.2	93.9	61.8	65.7	76.2	82.5	87.1
2004	66	76.4	10.1	54.9	93.7	62.5	68.6	77.4	85.4	89.2
2005	70	76.0	10.1	27.1	95.6	66.0	71.0	77.7	81.4	86.0
2006	87	72.2	14.3	4.5	96.5	56.4	63.1	72.8	82.4	88.8
2007	106	72.1	19.7	3.0	100	50.3	68.5	76.6	84.1	87.8
2008	92	72.8	14.2	14.0	94.6	55.7	67.9	75.1	82.2	87.2
2009	98	72.8	14.5	2.6	92.5	59.9	67.0	75.0	82.4	86.6
2010	110	76.5	14.3	3.7	98.9	63.2	71.9	79.4	84.9	88.9
2011	112	75.6	11.0	3.7	89.0	66.1	71.4	77.0	82.5	85.6
2012	102	75.3	16.1	10.0	96.8	60.2	68.4	79.6	85.2	89.7
2013	103	73.9	16.0	7.6	93.0	64.6	71.0	76.4	83.7	85.8
2014	60	80.8	8.0	61.5	99.3	69.9	75.9	81.1	86.8	91.0
1998-2014	1218	74.4	14.5	1.7	100	61.3	69.1	77.0	83.1	88.0

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	33	76.5	11.8	41.4	93.4	59.6	67.8	79.1	84.9	89.6
1999	26	81.9	7.8	64.6	94.6	66.4	77.7	83.7	86.6	90.1
2000	29	80.0	11.4	53.3	101	62.3	74.7	80.7	88.7	91.3
2001	39	77.6	14.6	31.7	96.0	61.0	72.9	81.0	88.4	90.8
2002	49	79.5	8.8	62.8	97.4	66.2	74.2	78.2	85.0	92.4
2003	48	78.9	11.4	39.6	92.7	66.4	76.3	82.0	86.5	89.7
2004	44	77.7	15.1	12.0	103	64.1	74.0	80.6	86.5	90.6
2005	75	78.2	13.5	6.0	97.1	63.2	69.5	82.8	85.5	92.5
2006	64	77.4	16.0	6.4	92.4	66.3	71.6	82.1	86.1	90.2
2007	86	78.5	14.6	7.4	98.1	63.2	73.9	81.3	87.6	92.4
2008	109	77.0	16.4	3.9	99.5	62.1	72.5	81.0	86.3	90.8
2009	97	75.1	15.3	12.9	100	57.4	69.1	78.5	85.0	88.9
2010	87	78.4	12.1	13.3	93.4	69.7	73.2	80.9	86.4	89.5
2011	123	78.7	12.7	10.1	95.8	63.0	73.0	82.5	87.4	90.3
2012	92	78.8	15.6	4.6	99.0	66.5	73.0	82.6	88.5	90.3
2013	80	77.7	14.1	11.3	97.5	60.1	73.7	80.1	86.8	91.9
2014	47	83.8	7.3	68.6	97.2	74.2	78.4	84.0	89.7	93.2
1998-2014	1128	78.2	13.7	3.9	103	64.0	73.0	81.2	86.9	90.7

Table 4

Age distribution by 5-year age group and gender for period 2007-2014
(incl. DCO)

Age at diagnosis Years	Cases n	%	Cum.%	Males n	%	Cum.%	Females n	%	Cum.%
0-4	6	0.4	0.4	4	0.5	0.5	2	0.3	0.3
5-9	5	0.3	0.7	3	0.4	0.9	2	0.3	0.6
10-14	17	1.1	1.9	10	1.3	2.2	7	1.0	1.5
15-19	7	0.5	2.3	5	0.6	2.8	2	0.3	1.8
20-24	0	0.0	2.3			2.8			1.8
25-29	4	0.3	2.6	2	0.3	3.1	2	0.3	2.1
30-34	1	0.1	2.7	1	0.1	3.2			2.1
35-39	7	0.5	3.1	1	0.1	3.3	6	0.8	2.9
40-44	8	0.5	3.7	6	0.8	4.1	2	0.3	3.2
45-49	12	0.8	4.5	9	1.1	5.2	3	0.4	3.6
50-54	18	1.2	5.7	10	1.3	6.5	8	1.1	4.7
55-59	37	2.5	8.1	14	1.8	8.3	23	3.2	7.9
60-64	64	4.3	12.4	39	5.0	13.3	25	3.5	11.4
65-69	138	9.2	21.5	93	11.9	25.2	45	6.2	17.6
70-74	214	14.2	35.8	124	15.8	41.0	90	12.5	30.1
75-79	272	18.1	53.9	152	19.4	60.4	120	16.6	46.7
80-84	292	19.4	73.3	157	20.1	80.5	135	18.7	65.5
85+	402	26.7	100.0	153	19.5	100.0	249	34.5	100.0
All ages	1504	100.0		783	100.0		721	100.0	

Included in the statistics are 63.9% multiple primaries in males and 45.8% in females.

Table 5

Age-specific incidence and DCO rate
for period 2007-2014

Age at diagnosis Years	Males n	Females n	Males Age-spec. incid.	Females Age-spec. incid.	Males DCO rate n=345 %	Females DCO rate n=390 %
0- 4	4	2	0.5	0.2		
5- 9	3	2	0.3	0.2		
10-14	10	7	1.1	0.8		
15-19	5	2	0.5	0.2		
20-24			0.0	0.0		
25-29	2	2	0.2	0.2		
30-34	1		0.1	0.0		
35-39	1	6	0.1	0.5		16.7
40-44	6	2	0.4	0.1		
45-49	9	3	0.6	0.2		
50-54	10	8	0.8	0.6	10.0	12.5
55-59	14	23	1.3	2.0	21.4	8.7
60-64	39	25	4.0	2.4	28.2	24.0
65-69	93	45	9.7	4.3	34.4	22.2
70-74	124	90	13.6	8.6	29.0	28.9
75-79	152	120	27.6	16.8	35.5	47.5
80-84	156	134	44.7	23.9	58.3	61.2
85+	153	249	66.1	43.1	76.5	82.3
All ages	782	720			44.1	54.2
Incidence						
Raw			4.3	3.8		
WS			2.0	1.2		
ES			3.0	1.9		
BRD-S			4.4	2.7		

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).

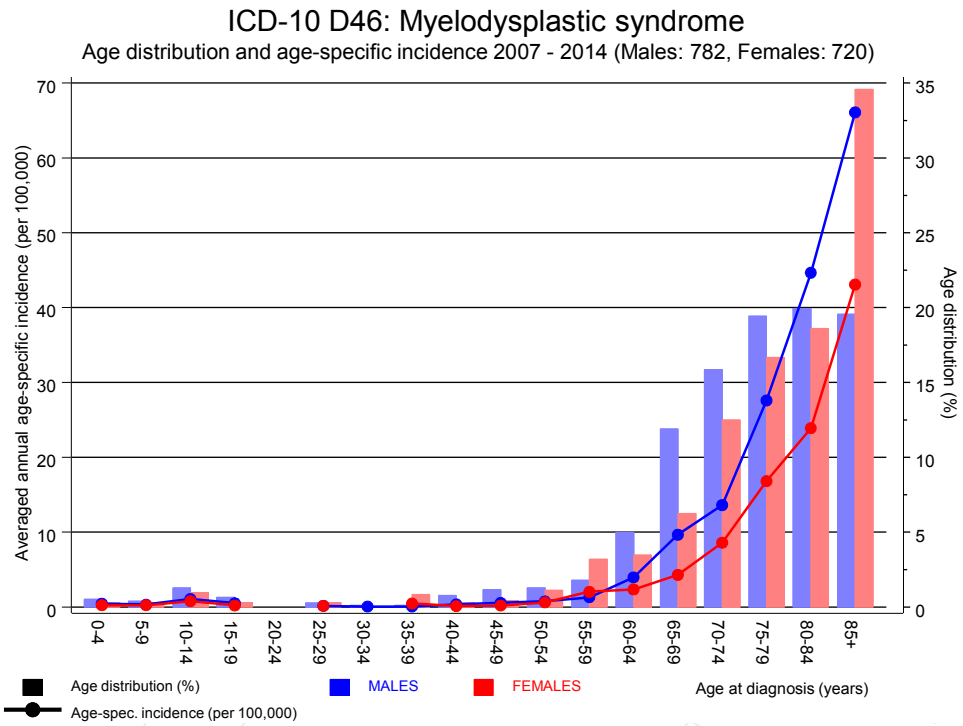


Figure 6. Age distribution and age-specific incidence

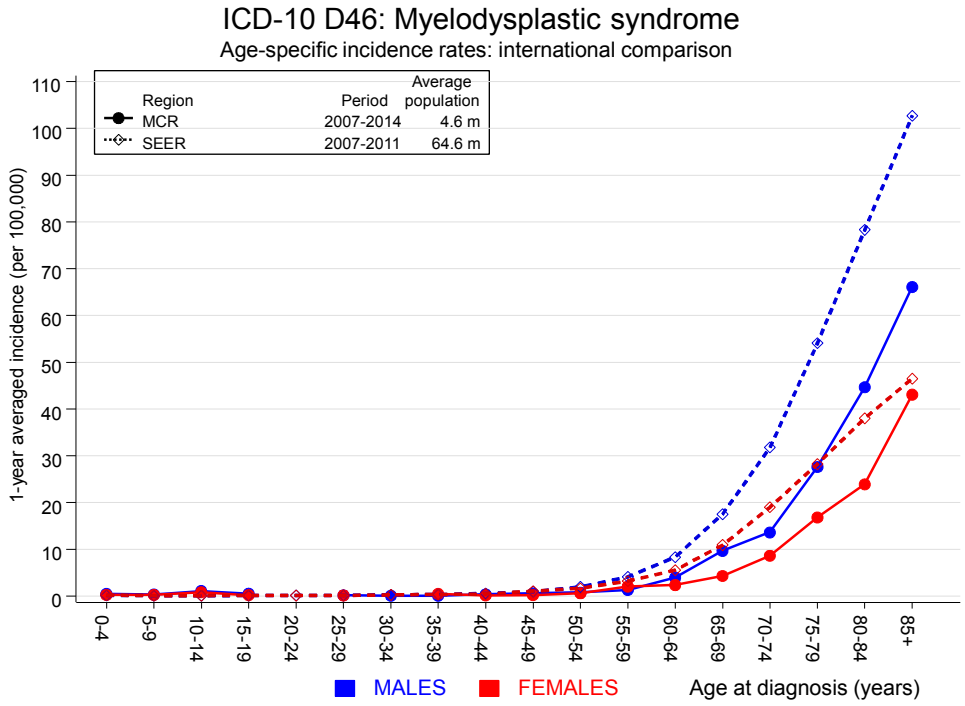


Figure 6a. Age-specific incidence in MCR registry areas compared to SEER (Surveillance, Epidemiology, and End Results, USA).

Reference:

Surveillance, Epidemiology, and End Results (SEER) Program SEER*Stat Database: Incidence - SEER 18 Regs Research Data, released April 2014, based on the November 2013 submission. http://www.seer.cancer.gov.

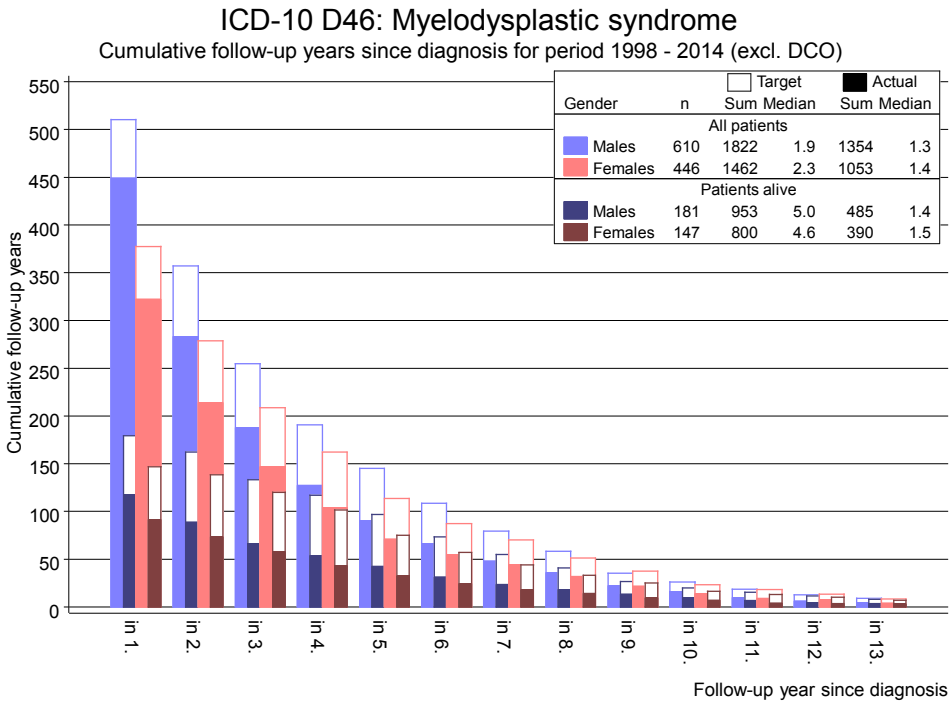


Figure 7. Cumulative follow-up years depending on time since diagnosis

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	2	0.5	4.3	0.5	15.7		10.7	
C16	Stomach	3	1.2	2.4	0.5	7.0		12.3	
C18	Colon	4	2.9	1.4	0.4	3.5		7.5	
C19-C20	Rectum	5	1.5	3.4	1.1	7.9	#	24.6	
C32	Larynx	2	0.2	8.2	1.0	29.5		12.3	
C33-C34	Lung	17	3.3	5.2	3.0	8.4	#	95.9	17.6
C43	Malign. melanoma	2	1.1	1.8	0.2	6.4		6.1	
C61	Prostate	8	8.1	1.0	0.4	1.9		-1.0	12.5
C64	Kidney	3	0.9	3.2	0.7	9.5		14.5	
C67	Bladder	2	1.4	1.4	0.2	5.1		4.0	
C70-C72	CNS cancer	2	0.4	5.7	0.7	20.6		11.5	50.0
C82-C85	NHL	16	1.2	13.7	7.8	22.3	#	103.5	6.3
C90	Mult. myeloma	10	0.4	26.4	12.7	48.6	#	67.2	
C91-C96	Leukaemia	96	0.5	187.2	151.6	228.6	#	666.5	22.9
Other primaries		6	2.8	2.2	0.8	4.7		22.4	50.0
Not observed		0	1.9	0.0	0.0	1.9		-13.6	
All mult. primaries		178	28.4	6.3	5.4	7.3	#	1044	17.4

Patients	770
Median age at second malignancy (years)	75.3
Person-years	1433
Mean observation time (years)	1.9
Median observation time (years)	0.9

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

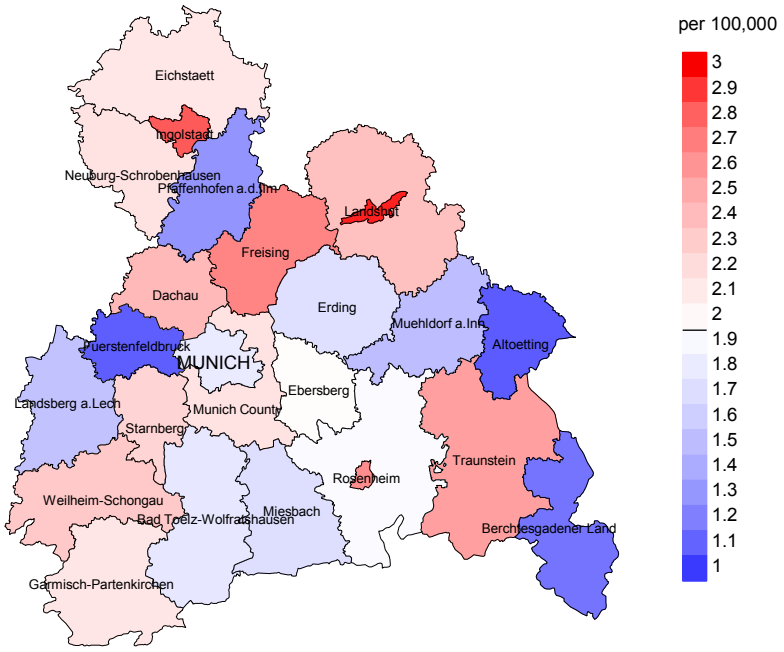
Diagnosis		Observed n	Expected n	SIR	LCL 95%	UCL 95%		EAR	DCO %
C18	Colon	4	1.7	2.4	0.6	6.0		19.1	25.0
C50	Breast	10	4.2	2.4	1.1	4.3	#	47.9	30.0
C67	Bladder	2	0.3	6.0	0.7	21.7		13.8	50.0
C82–C85	NHL	7	0.6	11.2	4.5	23.1	#	53.0	
C90	Mult. myeloma	4	0.2	19.8	5.4	50.6	#	31.5	
C91–C96	Leukaemia	67	0.3	248.7	192.8	315.9	#	554.2	19.4
Other primaries		10	4.2	2.4	1.1	4.3	#	47.9	20.0
Not observed		0	3.8	0.0	0.0	1.0	#	-31.5	
All mult. primaries		104	15.4	6.8	5.5	8.2	#	736.0	19.2

Patients	626
Median age at second malignancy (years)	77.0
Person-years	1204
Mean observation time (years)	1.9
Median observation time (years)	0.9

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

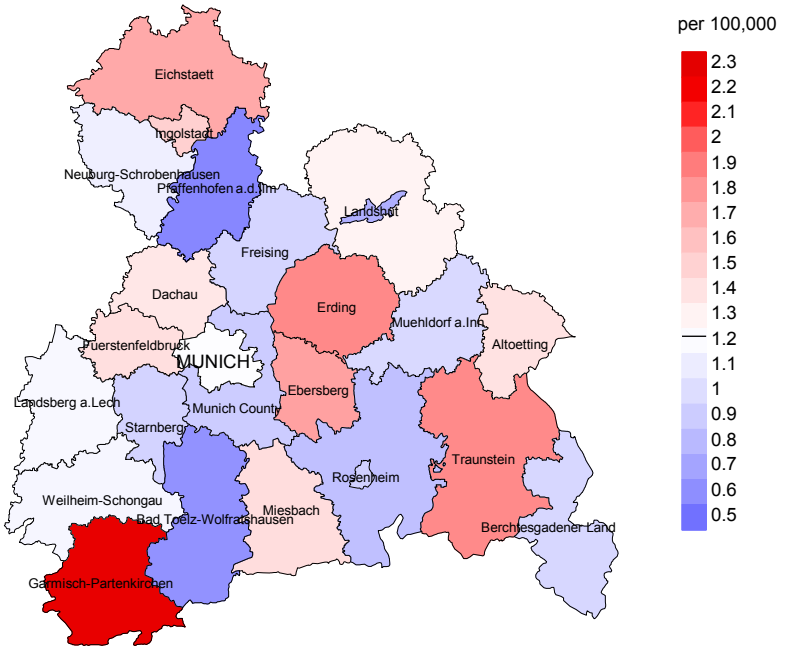
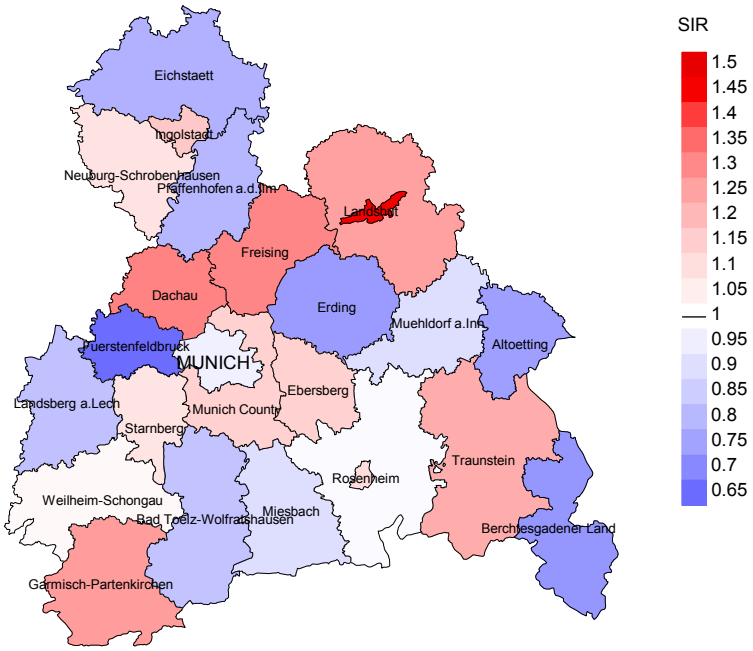


Figure 9a. Map of cancer incidence (world standard population, incl. DCO cases) by county averaged for period 2007 to 2014. According to their individual incidence rates, the counties are displayed in different red and blue color temperatures where the fine white color indicates the population mean (males 1.9/100,000 WS N=782, females 1.2/100,000 WS N=720).

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 17 women were identified with newly diagnosed myelodysplastic syndrome. Therefore, the mean incidence rate for this cancer type in this area can be calculated at 1.8/100,000 (world standard population). Though, the value of this parameter may vary with an underlying probability of 99% between 0.5 and 4.9/100,000.

Standardized incidence ratio (SIR) 2007 - 2014: Males



Standardized incidence ratio (SIR) 2007 - 2014: Females

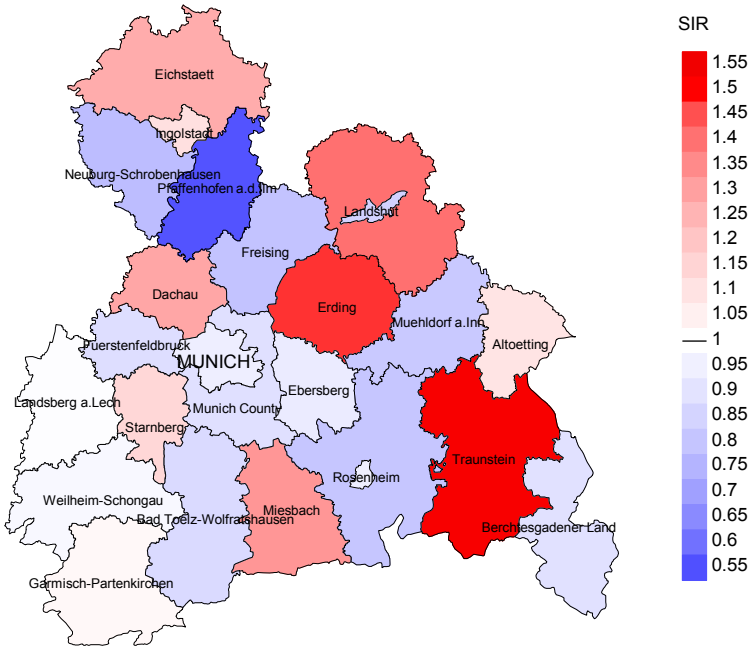


Figure 9b. Map of standardized incidence ratio (SIR, incl. DCO cases) by county averaged for period 2007 to 2014. According to their individual SIR values, the counties are displayed in different red and blue color temperatures where the fine white color indicates the population overall of 1.0 (males N=782, females N=720).

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 17 women were identified with newly diagnosed myelodysplastic syndrome. Therefore, the mean standardized incidence ratio (SIR) for this cancer type in this area can be calculated at 0.93. Though, the value of this parameter may vary with an underlying probability of 99% between 0.45 and 1.68, 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 4.64 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	49	100.0	49.0	47	95.9	97.9
1999	53	100.0	43.4	50	94.3	98.0
2000	66	100.0	56.1	62	93.9	100.0
2001	59	96.6	57.6	56	94.9	98.2
2002	110	98.2	51.8	107	97.3	99.1
2003	99	97.0	55.6	92	92.9	96.7
2004	110	99.1	61.8	100	90.9	99.0
2005	145	97.9	63.4	137	94.5	98.5
2006	151	94.7	55.0	130	86.1	99.2
2007	192	91.1	49.0	165	85.9	98.2
2008	201	91.5	47.3	175	87.1	100.0
2009	195	90.8	40.5	154	79.0	98.7
2010	197	87.8	44.7	160	81.2	99.4
2011	235	87.2	43.8	187	79.6	99.5
2012	194	93.3	54.1	162	83.5	98.1
2013	183	98.4	46.4	131	71.6	97.7
2014	107	98.1	81.3	92	86.0	97.8
1998-2014	2346	93.9	51.5	2007	85.5	98.7

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 4.64 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	49	37	100.0	25	51.0
1999	53	53	98.1	31	58.5
2000	66	60	100.0	41	62.1
2001	59	41	100.0	30	50.8
2002	110	62	100.0	58	52.7
2003	99	72	98.6	56	56.6
2004	110	74	97.3	68	61.8
2005	145	90	96.7	94	64.8
2006	151	104	99.0	88	58.3
2007	192	109	99.1	99	51.6
2008	201	120	98.3	108	53.7
2009	195	122	99.2	90	46.2
2010	197	120	99.2	100	50.8
2011	235	138	98.6	121	51.5
2012	194	137	99.3	114	58.8
2013	183	128	100.0	100	54.6
2014	107	129	99.2	89	83.2
1998-2014	2346	1596	98.9	1312	55.9

Table 10c

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 2.51 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	37	48.6	51.4	97.3
1999	53	56.6	43.4	96.2
2000	60	65.0	35.0	96.7
2001	41	41.5	58.5	100.0
2002	62	74.2	25.8	98.4
2003	72	68.1	31.9	94.4
2004	74	64.9	35.1	100.0
2005	90	66.7	33.3	94.3
2006	104	74.0	26.0	97.1
2007	109	75.2	24.8	97.2
2008	120	73.3	26.7	96.6
2009	122	77.9	22.1	91.7
2010	120	72.5	27.5	91.6
2011	138	77.5	22.5	96.3
2012	137	79.6	20.4	94.1
2013	128	82.8	17.2	94.5
2014	129	67.4	32.6	88.3
1998-2014	1596	71.7	28.3	94.9

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	13	73.0	72.3	73.9	73.0
1999	26	81.1	77.6	85.2	80.9
2000	28	74.7	75.3	74.2	75.3
2001	18	78.9	75.4	81.7	78.9
2002	33	78.8	78.8	79.7	78.8
2003	39	77.4	77.2	81.6	77.3
2004	35	80.7	79.9	83.3	80.7
2005	41	77.9	76.5	79.8	78.2
2006	64	76.1	74.2	80.3	76.3
2007	60	79.0	79.3	78.4	79.4
2008	72	76.0	73.2	80.8	76.0
2009	59	76.7	76.7	77.2	77.4
2010	71	81.2	79.3	85.6	80.7
2011	68	78.0	78.0	78.1	78.0
2012	77	78.2	78.1	81.2	78.2
2013	72	79.5	79.0	83.4	79.0
2014	65	79.2	79.9	79.0	80.0
1998-2014	841	78.3	77.3	80.7	78.3

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	24	83.2	76.7	86.7	82.0
1999	27	84.7	84.2	85.1	83.7
2000	32	82.1	78.2	83.8	82.0
2001	23	84.9	81.0	88.2	84.9
2002	29	81.4	82.9	81.4	82.9
2003	33	84.5	82.2	84.8	84.5
2004	39	83.4	80.1	86.7	83.4
2005	49	83.4	81.2	85.8	83.6
2006	40	83.8	83.9	81.9	83.7
2007	49	84.2	83.7	85.6	84.2
2008	48	82.0	81.1	84.6	82.0
2009	63	78.2	78.3	78.2	78.8
2010	49	80.9	81.1	78.8	81.1
2011	70	82.1	80.5	83.4	82.6
2012	60	80.1	77.8	84.3	79.7
2013	56	80.3	81.3	79.4	81.3
2014	64	81.5	80.0	83.5	82.0
1998-2014	755	82.3	81.0	84.9	82.5

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
1998	6	0.5	0.38	0.3	0.30	0.5	0.35	0.6	0.34
1999	14	1.3	0.52	0.8	0.50	1.2	0.53	1.8	0.51
2000	19	1.7	0.51	0.9	0.47	1.5	0.50	2.1	0.52
2001	6	0.5	0.30	0.3	0.30	0.4	0.30	0.7	0.31
2002	20	1.1	0.33	0.5	0.32	0.9	0.34	1.4	0.34
2003	29	1.5	0.57	0.7	0.53	1.2	0.56	2.0	0.62
2004	25	1.3	0.38	0.6	0.32	1.0	0.35	1.7	0.42
2005	27	1.4	0.39	0.6	0.39	1.1	0.39	1.6	0.38
2006	48	2.5	0.55	1.2	0.50	1.9	0.51	2.7	0.55
2007	48	2.2	0.45	1.0	0.38	1.6	0.42	2.3	0.46
2008	54	2.4	0.59	1.1	0.57	1.7	0.58	2.4	0.56
2009	47	2.1	0.48	0.9	0.42	1.5	0.46	2.2	0.49
2010	50	2.2	0.45	0.9	0.44	1.5	0.45	2.2	0.44
2011	54	2.4	0.49	0.9	0.48	1.5	0.49	2.3	0.50
2012	64	2.8	0.63	1.2	0.57	1.9	0.60	2.7	0.62
2013	59	2.6	0.57	1.0	0.50	1.7	0.56	2.5	0.57
2014	44	1.9	0.73	0.7	0.74	1.2	0.73	1.9	0.72
1998-2014	614	1.9	0.50	0.8	0.47	1.4	0.49	2.1	0.51

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	12	1.0	0.36	0.4	0.41	0.6	0.39	0.9	0.39
1999	16	1.3	0.62	0.4	0.62	0.7	0.62	1.0	0.61
2000	20	1.7	0.69	0.6	0.76	0.9	0.73	1.2	0.68
2001	11	0.9	0.28	0.3	0.25	0.5	0.27	0.7	0.30
2002	26	1.3	0.53	0.3	0.44	0.6	0.48	0.9	0.48
2003	20	1.0	0.42	0.3	0.37	0.5	0.40	0.7	0.41
2004	23	1.2	0.52	0.4	0.60	0.6	0.55	0.9	0.54
2005	33	1.7	0.44	0.5	0.39	0.8	0.42	1.2	0.46
2006	29	1.4	0.45	0.4	0.36	0.7	0.41	1.0	0.43
2007	34	1.5	0.40	0.4	0.31	0.7	0.35	1.0	0.37
2008	34	1.5	0.31	0.4	0.23	0.7	0.27	1.0	0.29
2009	48	2.1	0.49	0.7	0.44	1.0	0.45	1.5	0.47
2010	37	1.6	0.43	0.5	0.45	0.8	0.44	1.1	0.44
2011	53	2.2	0.43	0.6	0.38	1.0	0.40	1.5	0.42
2012	45	1.9	0.49	0.5	0.44	0.9	0.49	1.3	0.51
2013	47	2.0	0.59	0.7	0.62	1.0	0.61	1.4	0.60
2014	43	1.8	0.91	0.5	1.14	0.8	1.05	1.3	1.01
1998-2014	531	1.6	0.47	0.5	0.43	0.8	0.46	1.1	0.47

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.%
5-9	1	0.1	0.1	1	0.2	0.2			0.0
10-14	0	0.0	0.1			0.2			0.0
15-19	1	0.1	0.3			0.2	1	0.3	0.3
20-24	0	0.0	0.3			0.2			0.3
25-29	0	0.0	0.3			0.2			0.3
30-34	0	0.0	0.3			0.2			0.3
35-39	2	0.3	0.5	2	0.5	0.7			0.3
40-44	3	0.4	0.9			0.7	3	0.9	1.2
45-49	5	0.7	1.6	4	0.9	1.7	1	0.3	1.5
50-54	6	0.8	2.4	2	0.5	2.1	4	1.2	2.6
55-59	17	2.2	4.6	9	2.1	4.3	8	2.3	5.0
60-64	44	5.8	10.4	28	6.6	10.9	16	4.7	9.7
65-69	70	9.2	19.5	49	11.6	22.5	21	6.2	15.8
70-74	132	17.3	36.8	74	17.5	40.0	58	17.0	32.8
75-79	124	16.3	53.1	73	17.3	57.3	51	15.0	47.8
80-84	164	21.5	74.6	92	21.8	79.1	72	21.1	68.9
85+	194	25.4	100.0	88	20.9	100.0	106	31.1	100.0
All ages	763	100.0		422	100.0		341	100.0	

Included in the statistics are 63.9% multiple primaries in males and 45.8% 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
0- 4			0.0		0.0	
5- 9	1		0.1	0.33	0.0	
10-14			0.0		0.0	
15-19		1	0.0		0.1	0.50
20-24			0.0		0.0	
25-29			0.0		0.0	
30-34			0.0		0.0	
35-39	2		0.2	2.00	0.0	
40-44		3	0.0		0.2	1.50
45-49	4	1	0.3	0.44	0.1	0.33
50-54	2	4	0.2	0.20	0.3	0.50
55-59	9	8	0.8	0.64	0.7	0.35
60-64	28	16	2.9	0.72	1.5	0.64
65-69	49	21	5.1	0.53	2.0	0.47
70-74	74	58	8.1	0.60	5.5	0.64
75-79	73	51	13.3	0.48	7.1	0.43
80-84	92	72	26.3	0.59	12.8	0.53
85+	88	106	38.0	0.58	18.3	0.43
All ages	422	341				
Mortality						
Raw			2.3	0.54	1.8	0.47
WS			1.0	0.49	0.5	0.43
ES			1.6	0.52	0.9	0.46
BRD-S			2.3	0.54	1.3	0.47
PYLL-70						
per 100,000			4.4		3.2	
ES			3.9		2.8	
AYLL-70			7.3		9.3	

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

Table 15a

Multiple primaries in deaths in period 1998-2014
MALES

Diagnosis		Total n	Total %↓	Pre n	Pre ←%	Syn-chron ±30d n	Syn-chron ±30d ←%	Post n	Post ←%
C15	Oesophagus	4	1.0	2	50.0	1	25.0	1	25.0
C16	Stomach	9	2.3	6	66.7			3	33.3
C18	Colon	23	5.8	18	78.3	1	4.3	4	17.4
C19-C20	Rectum	11	2.8	6	54.5	2	18.2	3	27.3
C32	Larynx	5	1.3	4	80.0			1	20.0
C33-C34	Lung	16	4.0	3	18.8	1	6.3	12	75.0
C43	Malign. melanoma	11	2.8	11	100.0				
C44	Skin others	25	6.3	16	64.0	1	4.0	8	32.0
C61	Prostate	52	13.1	45	86.5	4	7.7	3	5.8
C67	Bladder	26	6.5	21	80.8			5	19.2
C82-C85	NHL	28	7.0	15	53.6	8	28.6	5	17.9
C90	Mult. myeloma	17	4.3	10	58.8	5	29.4	2	11.8
C91-C96	Leukaemia	145	36.4			52	35.9	93	64.1
Other primaries		26	6.5	21	80.8	4	15.4	1	3.8
All mult. primaries		398	100.0	178	44.7	79	19.8	141	35.4

Multiple primaries with number of cases 1 to 3 are pooled in category “Other primaries”

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 1998–2014
FEMALES

Diagnosis		Total n	Total %↓	Pre n	Pre ←%	Syn-chron ±30d n	Syn-chron ±30d ←%	Post n	Post ←%
C18	Colon	14	4.9	12	85.7			2	14.3
C19–C20	Rectum	3	1.0	2	66.7	1	33.3		
C33–C34	Lung	10	3.5	5	50.0	4	40.0	1	10.0
C43	Malign. melanoma	3	1.0	3	100.0				
C44	Skin others	17	5.9	11	64.7			6	35.3
C50	Breast	54	18.8	43	79.6	4	7.4	7	13.0
C51	Vulva	3	1.0	3	100.0				
C53	Cervix uteri	3	1.0	3	100.0				
C54	Corpus uteri	8	2.8	8	100.0				
C56	Ovary	4	1.4	4	100.0				
C64	Kidney	5	1.7	5	100.0				
C67	Bladder	5	1.7	4	80.0	1	20.0		
C70–C72	CNS cancer	4	1.4	3	75.0	1	25.0		
C73	Thyroid	6	2.1	5	83.3			1	16.7
C82–C85	NHL	13	4.5	9	69.2	3	23.1	1	7.7
C90	Mult. myeloma	4	1.4	1	25.0	1	25.0	2	50.0
C91–C96	Leukaemia	114	39.7			41	36.0	73	64.0
Other primaries		17	5.9	10	58.8	3	17.6	4	23.5
All mult. primaries		287	100.0	131	45.6	59	20.6	97	33.8

Multiple primaries with number of cases 1 to 2 are pooled in category “Other primaries”

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
0- 4			0.0		0.0	
5- 9	1		0.1	0.33	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	2		0.2	2.00	0.0	
40-44		2	0.0		0.1	1.00
45-49	3	1	0.2	0.38	0.1	0.33
50-54	2	2	0.2	0.22	0.2	0.67
55-59	7	4	0.7	0.64	0.4	0.25
60-64	23	12	2.3	0.70	1.1	0.80
65-69	32	12	3.3	0.53	1.1	0.44
70-74	47	35	5.2	0.64	3.3	0.66
75-79	42	34	7.6	0.46	4.8	0.40
80-84	47	51	13.5	0.55	9.1	0.57
85+	52	83	22.5	0.59	14.4	0.40
All ages	258	236				
Mortality						
Raw			1.4	0.53	1.3	0.46
WS			0.6	0.46	0.3	0.41
ES			1.0	0.51	0.6	0.44
BRD-S			1.4	0.52	0.8	0.46
PYLL-70						
per 100,000			3.6		1.8	
ES			3.3		1.5	
AYLL-70			8.1		8.6	

* 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
0- 4			0.0		0.0	
5- 9	1		0.1	0.33	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	1.00	0.0	
40-44			0.0		0.0	
45-49	1		0.1	0.20	0.0	
50-54	1	1	0.1	0.20	0.1	0.50
55-59	4	2	0.4	0.44	0.2	0.17
60-64	18	10	1.8	0.67	0.9	0.71
65-69	22	6	2.3	0.58	0.6	0.30
70-74	31	21	3.4	0.53	2.0	0.54
75-79	30	26	5.4	0.39	3.6	0.36
80-84	39	41	11.2	0.49	7.3	0.53
85+	41	75	17.7	0.53	13.0	0.38
All ages	189	182				
Mortality						
Raw			1.0	0.47	1.0	0.40
WS			0.4	0.41	0.2	0.34
ES			0.7	0.45	0.4	0.37
BRD-S			1.0	0.46	0.6	0.40
PYLL-70						
per 100,000			2.3		0.8	
ES			2.2		0.7	
AYLL-70			7.8		7.0	

* See corresponding tables with multiple primaries.

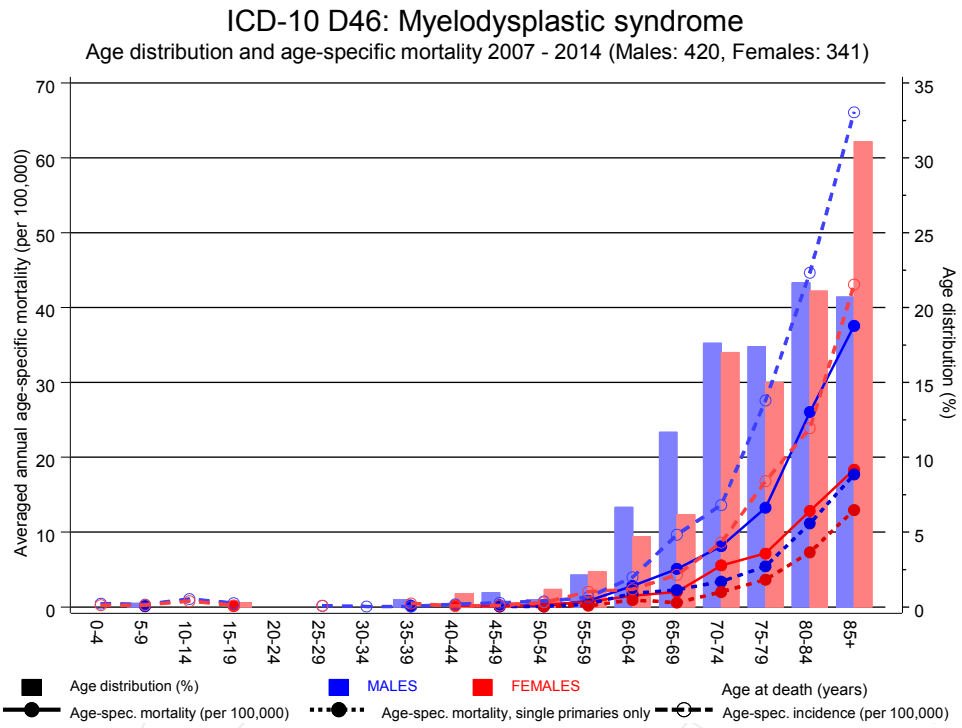
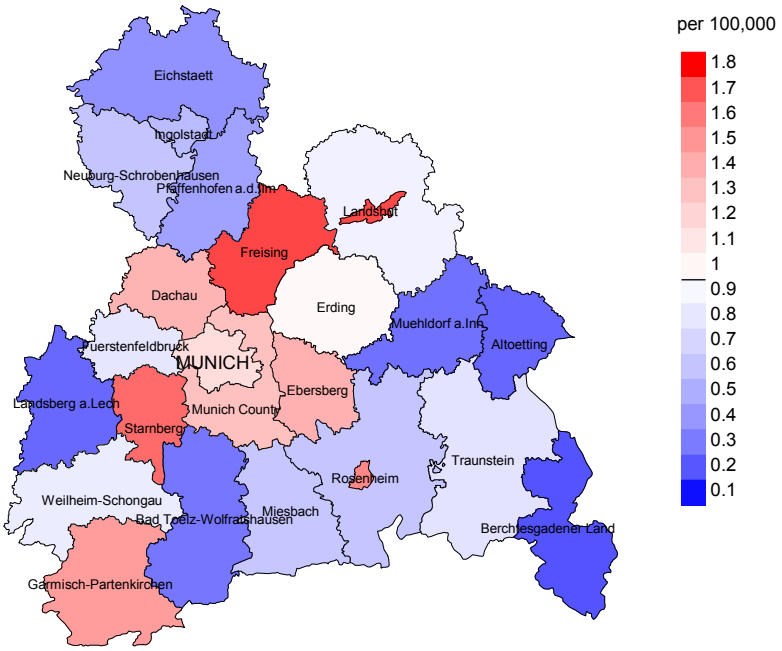


Figure 18. Distribution of age at death (bars) and age-specific mortality (all patients: solid line, patients with single primaries: dotted line). The age-specific incidence is additionally plotted for comparison (dashed line).

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

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



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

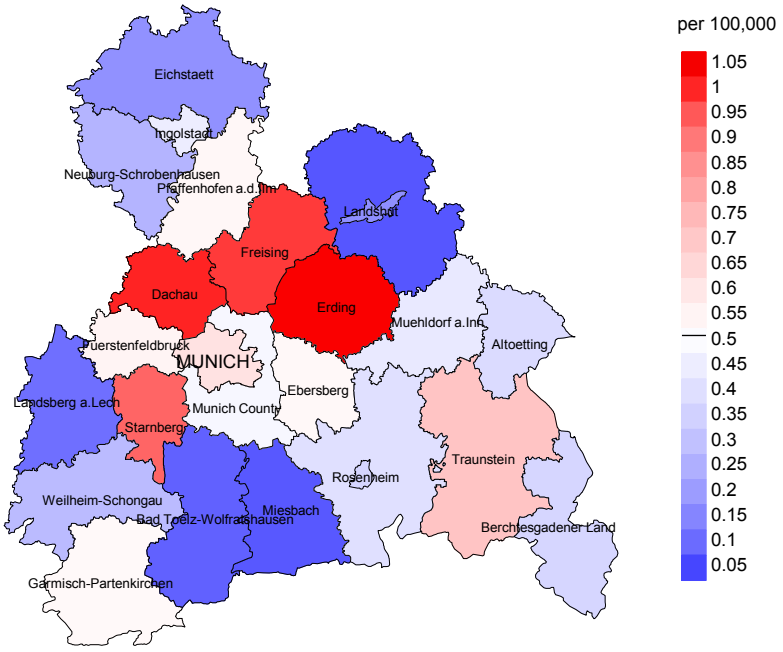
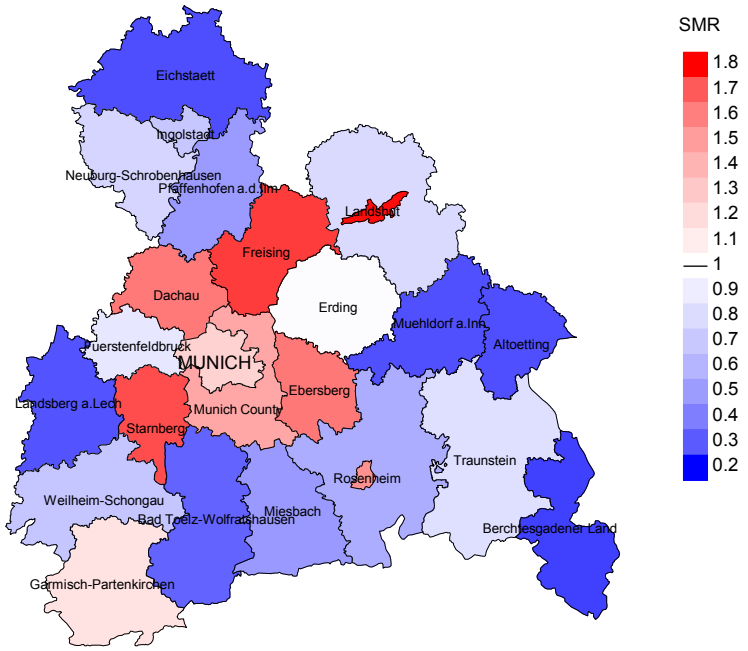


Figure 19a. Map of cancer mortality (world standard population) by county averaged for period 2007 to 2014. According to their individual mortality rates, the counties are displayed in different red and blue color temperatures where the fine white color indicates the population mean (males 0.9/100,000 WS N=419, females 0.5/100,000 WS N=336).

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 9 women died from myelodysplastic syndrome. 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 0.1 and 1.5/100,000.

Standardized mortality ratio (SMR) 2007 - 2014: Males



Standardized mortality ratio (SMR) 2007 - 2014: Females

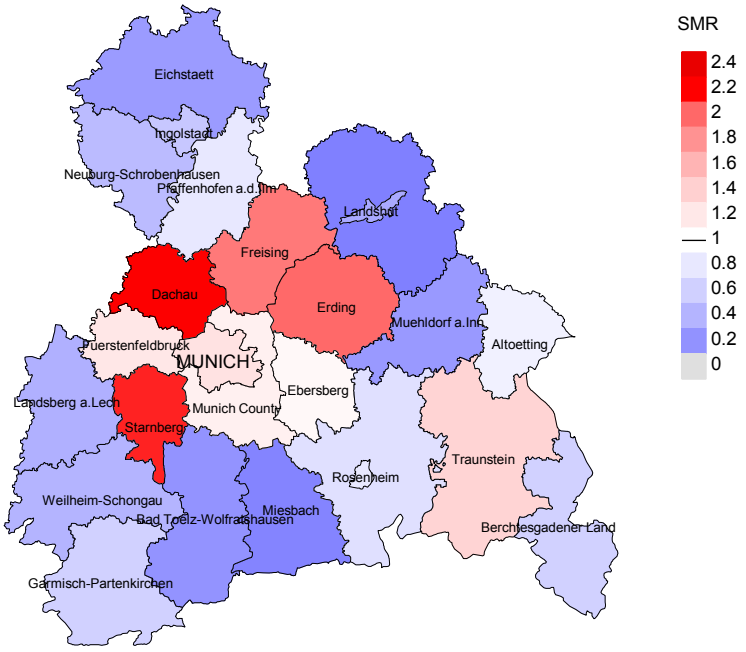


Figure 19b. Map of standardized mortality ratio (SMR, incl. DCO cases) by county averaged for period 2007 to 2014. According to their individual SMR values, the counties are displayed in different red and blue color temperatures where the fine white color indicates the population overall of 1.0 (males N=419, females N=336).

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 9 women died from myelodysplastic syndrome. Therefore, the mean standardized mortality ratio (SMR) for this cancer type in this area can be calculated at 1.05. Though, the value of this parameter may vary with an underlying probability of 99% between 0.37 and 2.34, 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

Recommended Citation

Munich Cancer Registry. ICD-10 D46: Myelodysplastic syndrome - Incidence and Mortality [Internet]. 2016 [updated 2016 Apr 13; cited 2016 Jun 1]. Available from: http://www.tumorregister-muenchen.de/en/facts/base/bD46__E-ICD-10-D46-Myelodysplastic-syndrome-incidence-and-mortality.pdf

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