# **Munich Cancer Registry**



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# ICD-10 C45: Mesothelioma

# **Incidence and Mortality**

Year of diagnosis	1998-2014
Patients	1,236
Diseases	1,238
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/bC45\_\_E-ICD-10-C45-Mesothelioma-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<sup>#</sup>, with a total of 4.64 million inhabitants, account for the frequency of cancer diseases<sup>##</sup> 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.

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

Code	Description
C45 C45.0 C45.1 C45.2 C45.7 C45.9	Mesothelioma Mesothelioma of pleura Mesothelioma of peritoneum Mesothelioma of pericardium Mesothelioma of other sites

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

### **INCIDENCE**

Table 1

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

					Prop.	
		DCO	Prop.	Prop. mult.	Prop.	actively
Year of	Cases	cases	DCO	primaries	deaths	followed
diagnosis	n	n	90	%	9	્ર
1998	40	9	22.5	10.0	100.0	100.0
1999	33	7	21.2	6.1	100.0	100.0
2000	41	20	48.8	9.8	97.6	100.0
2001	45	10	22.2	11.1	97.8	100.0
2002	60	18	30.0	16.7	96.7	100.0 #
2003	63	12	19.0	17.5	95.2	100.0
2004	81	10	12.3	13.6	96.3	98.8
2005	76	8	10.5	21.1	96.1	97.4
2006	74	8	10.8	21.6	94.6	95.9
2007	102	5	4.9	21.6	89.2	93.1 #
2008	101	7	6.9	19.8	97.0	98.0
2009	85	4	4.7	24.7	91.8	95.3
2010	99	9	9.1	28.3	89.9	94.9
2011	97	5	5.2	23.7	81.4	90.7
2012	102	6	5.9	24.5	81.4	94.1
2013	89	10	11.2	21.3	76.4	100.0
2014	50	8	16.0	22.0	42.0	98.0 ##
1998-2014	1238	156	12.6	20.0	89.1	96.8

<sup>#</sup> The increases of incident cases in 2002 and 2007 reflect the expansion to additional registry areas.

<sup>##</sup> 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 (incl. DCO)

Year of	All	Males	Females	Prop. males	
diagnosis	n	n	n	용	
1998	40	29	11	72.5	
1999	/33	25	8	75.8	
2000	41	32	9/	78.0	
2001	45	30	15	66.7	
2002	60	45	1/5	75.0	
2003	63	50	13 /	79.4	
2004	81	71	10	87.7	
2005	76	57	19	75.0	
2006	74	60	14	81.1	
2007	102	81	21	79.4	
2008	101	81	20	80.2	
2009	85	69	16	81.2	
2010	99	76	23	76.8	
2011	97	80	17	82.5	
2012	102	80	22	78.4	
2013	89	73	16	82.0	
2014	50	40	10	80.0	
1998-2014	1238	979	259	79.1	

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)

			Males	Fem.	Males	Fem.	Males	Fem.	Males	Fem.
Year of	Males	Females	Inc.	Inc.	Inc.	Inc.	Inc.	Inc.	Inc.	Inc.
diagnosis	n	n	raw	raw	WS	WS	ES	ES	BRD-S	BRD-S
1998	29	11	2.6	0.9	1.6	0.5	2.3	0.7	2.9	0.9
1999	25	8 /	2.2	0.7	1.3	0.4	2.0	0.5	2.5	0.6
2000	32	9 /	2.8	0.7	1.7	0.3	2.5	0.5	3.2	0.6
2001	30	15 <	2.6	1.2	1.6	0.6	2.3	0.9	2.7	1.1
2002	45	15	2.4	0.8	1.4	0.4	2.0	0.6	2.7	0.7
2003	50	13	2.7	0.7	1.5	0.3	2.2	0.4	2.8	0.5
2004	71	10	3.8	0.5	2.0	0.3	2.9	0.4	3.7	0.5
2005	57	19	3.0	1.0	1.6	0.5	2.3	0.6	3.1	0.8
2006	60	14	3.1	0.7	1.6	0.3	2.4	0.4	3.2	0.6
2007	81	21	3.7	0.9	1.8	0.4	2.8	0.6	3.7	0.8
2008	81	20	3.6	0.9	1.8	0.3	2.6	0.5	3.4	0.6
2009	69	16	3.1	0.7	1.5	0.2	2.2	0.4	3.0	0.5
2010	76	2,3	3.4	1.0	1.6	0.4	2.4	0.6	3.1	0.8
2011	80	17	3.5	0.7	1.6	0.2	2.4	0.4	3.3	0.6
2012	80	22	3.5	0.9	1.5	0.4	2.3	0.6	3.3	0.7
2013	73	16	3.2	0.7	1.5	0.3	2.2	0.4	3.0	0.5
2014	40	10	1.8	0.4	0.7	0.1	1.2	0.2	1.7	0.3
1998-2014	979	259	3.1	0.8	1.5	0.3	2.3	0.5	3.1	0.6

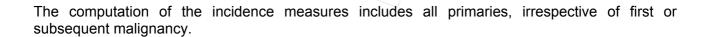


Table 3

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

Year of	Cases		Std.					Median		
diagnosis	n	Mean	dev.	Min.	Max.	10%	25%	50%	75%	90%
1998	40	66.8	10.3	48.8	89.2	54.5	59.1	66.1	71.4	84.0
1999	33	67.5	9.3	47.8	86.4	56.1	61.4	67.7	74.3	80.6
2000	41	67.9	15.9	8.5	92.8	55.9	59.3	66.2	78.7	88.4
2001	45	66.0	9.8	45.6	85.4	54.5	57.7	65.6	72.9	79.8
2002	60	67.7	12.5	27.9	88.5	49,6	60.9	66.0	76.2	84.7
2003	63	69.6	10.9	30.7	91.2	58.1	62.1	69.8	77.7	82.6
2004	81	69.9	8.1	44.9	90.1	61.9	65.1	68.8	73.7	81.5
2005	76	69.6	10.3	38.5	88.3	57.5	63.8	70.5	76.7	83.4
2006	74	70.1	9.9	40.6	87.8	57.0	64.9	71.2	77.8	81.7
2007	102	69.4	9.4	40.3	92.4	55.4	64.6	70.4	76.1	79.6
2008	101	71.9	8.8	42.4	88.1	61.9	67.4	71.8	77.2	84.2
2009	85	72.1	9.6	44.3	97.3	60.3	65.4	72.0	80.1	83.8
2010	99	71.4	9.9	36.2	93.6	57.3	66.9	72.1	78.1	83.1
2011	97/	73.3	8.4	52.5	87.3	62.0	67.4	73.5	79.8	84.1
2012	102	73.4	9.8	41.3	95.6	60.1	69.3	73.5	79.8	84.8
2013	89	72.0	9.2	49.4	95.4	59.7	65.3	72.4	77.6	85.2
2014	50	74.4	9.2	35.4	92.1	64.9	70.3	75.0	78.9	84.8
1998-2014	1238	70.7	10.1	8.5	97.3	58.0	64.7	71.2	77.6	83.5

Table 3a

Age distribution parameters by year of diagnosis (MALES)

(incl. DCO)

Year of	Cases		Std.					Median		
diagnosis	n	Mean	dev.	Min.	Max.	10%	25%	50%	75%	90%
1998	29	67.0	9.9	49.4	89.2	56.7	59.5	66.2	70.5	84.0
1999	25	67.1	9.1	50.8	86.4	56.1	60.9	67.3	74.1	80.6
2000	32	67.6	15.8	8.5	92.8	55.9	59.1	65.6	78.4	85.9
2001	30	64.0	9.3	45.6	83.2	51.5	57.1	64.0	69.1	77.3
2002	45	68.4	11.2	46.4	88.4	50.3	61.8	66.3	75.8	84.5
2003 —	50	68.5	10.5	30.7	90.3	58.0	62.1	69.6	74.8	80.6
2004	71	70.3	7.7	44.9	90.1	63.1	65.5	68.9	73.7	81.5
2005	57	69.9	9.4	45.1	86.8	57.5	64.5	70.5	76.5	83.4
2006	60	69.6	9.2	46.6	87.8	57.1	64.5	69.7	76.9	80.8
2007	81	70.1	8.8	44.4	92.4	58.2	64.8	70.6	76.1	79.6
2008	81	71.2	7.7	48.5	88.1	61.9	66.4	71.0	74.7	82.3
2009	69	71.2	9.6	44.3	97.3	59.0	65.2	70.5	79.6	82.6
2010	76	71.5	8.9	46.1	91.8	58.9	66.9	71.8	77.6	83.1
2011	80	72.7	8.4	52.5	87.0	61.6	66.6	73.3	78.7	84.0
2012	80	73.9	8.0	53.7	91.5	63.0	69.8	73.5	79.6	84.1
2013	73	71.6	8.6	49.4	92.4	61.0	65.7	72.1	77.5	80.9
2014	40	73.0	9.1	35.4	86.8	62.8	70.2	74.2	77.6	83.5
1998-2014	979	70.5	9.4	8.5	97.3	58.8	64.9	70.8	76.9	82.4

Table 3b

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

Year of	Cases		Std.					Median		
diagnosis	n	Mean	dev.	Min.	Max.	10%	25%	50%	75%	90%
1998	11	66.3	12.1	48.8	85.2	53.1	55.9	66.0	76.8	84.0
1999	8	68.8	10.6	47.8	81.3	47.8	63.7	70.7	76.0	81.3
2000	9	69.0	17.4	35.6	90.6	35.6	59.8	71.6	81.4	90.6
2001	15	69.9	9.7	54.5	85.4	56.4	64.4	70.0	79.8	83.6
2002	15	65.5	16.0	27.9	88.5	48.9	57.4	63.8	79.1	85.6
2003	13	74.0	11.6	57.3	91.2	58.1	62.7	77.8	82.6	88.3
2004	10	67.1	10.8	53.1	84.7	53.5	57.5	66.8	76.6	81.7
2005	19	68.5	12.9	38.5	88.3	39.9	62.8	70.9	77.1	84.2
2006	14	72.2	12.5	40.6	86.6	57.0	65.9	76.5	79.6	83.9
2007	21	66.8	11.5	40.3	81.1	49.8	64.6	68.8	76.0	79.3
2008	20	74.6	12.1	42.4	87.8	55.9	70.0	75.7	83.2	86.9
2009	16	75.8	9.0	62.3	87.1	63.3	66.8	77.1	84.0	86.9
2010	23	71.2	13.1	36.2	93.6	54.6	65.3	73.8	78.2	82.5
2011	17 /	76.3	7.9	57.9	87.3	66.6	71.3	77.2	83.9	85.2
2012	22	71.4	14.8	41.3	95.6	51.3	59.6	74.0	84.1	86.7
2013	16	73.7	11.7	55.8	95.4	58.3	64.4	73.0	83.5	90.0
2014	10	80.1	7.8	68.1	92.1	69.0	74.2	81.5	85.3	90.4
1998-2014	259	71.3	12.4	27.9	95.6	54.6	63.8	72.8	80.8	85.4

Table 4

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

Age at									
diagnosis	Cases			Males			Females		
Years	n	90	Cum.%	n	%	Cum.%	n	왕	Cum.%
35-39	2	0.3	0.3	/ 1	0.2	0.2	1	0.7	0.7
40 - 44	7	1.0	1.2	2	0.3	0.5	5	3.4	4.1
45-49	8	1.1	2.3/	5	0.9	1.4	3	2.1	6.2
50-54	17	2.3	4.7	13	2.2	3.6/	4	2.8	9.0
55-59	37	5.1	9.8	31	5.3	9.0	6	4.1	13.1
60-64	67	9.2	19.0	58	10.0	19.0	9	6.2	19.3
65-69	141	19.4	38.5	118	20.3	39.3	23	15.9	35.2
70-74	175	24.1	62.6	152	26.2	65.5	23	15.9	51.0
75-79	124	17.1	79.7	99	17.1	82.6	25	17.2	68.3
80-84	94	13.0	92.7	69	11.9	94.5	25	17.2	85.5
85+	53	7.3	100.0	32	5.5	100.0	21	14.5	100.0
All ages	725	100.0		580	100.0		145	100.0	

Included in the statistics are 27.1% multiple primaries in males and 29.0% in females.



							Males	Females
			Males	Females	Males	Females	Prop.all	Prop.all
Age at			Age-	Age-	DCO rate	DCO rate	cancers	cancers
diagnosis	Males	Females	spec.	spec.	n=41	n=13	n=91183	n=89596
Years	n	n	incid.	incid.	%	%	%	%
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	1	0.1	0.1			0.1	0.1
40 - 44	2	5	0.1	0.3			0.1	0.1
45-49	5	3	0.3	0.2			0.2	0.1
50-54	13	4	1.0	0.3	7.7		0.3	0.1
55-59	31	6	2.9	0.5			0.4	0.1
60-64	58	9	5.9	0.8	6.9		0.5	0.1
65-69	118	23	12.3	2.2	5.1		0.8	0.2
70-74	152	23	16.7	2.2	5.9		0.9	0.2
75-79	99	25	18.0	3.5	6.1	4.0	0.8	0.2
80-84	69	25	19.8	4.5	14.5	16.0	0.8	0.3
85+	32	21	13.8	3.6	15.6	38.1	0.5	0.2
All ages	580	145			7.1	9.0	0.6	0.2
_								
Incidence								
Raw			3.2	0.8				
WS			1.5	0.3				
ES			2.3	0.4				
BRD-S			3.0	0.6				

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).



### ICD-10 C45: Mesothelioma

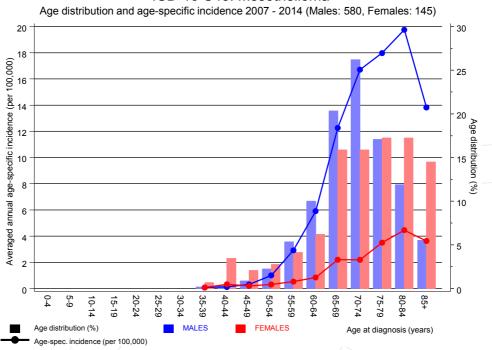


Figure 6. Age distribution and age-specific incidence



# ICD-10 C45: Mesothelioma Age-specific incidence rates: international comparison Average Period population 2007-2014 4.6 m 2007-2011 64.6 m MALES FEMALES Age at diagnosis (years)

**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.

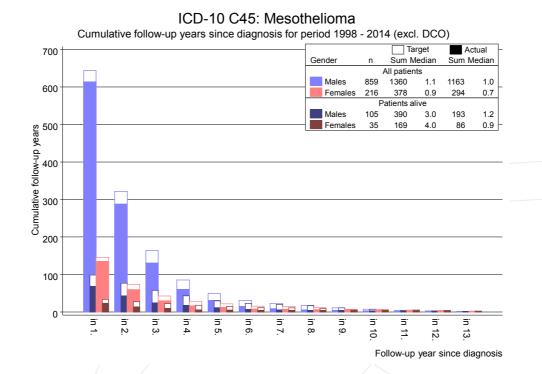


Figure 7. Cumulative follow-up years depending on time since diagnosis

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 Observed Expected LCL UCL DCO Diagnosis SIR 95% 95% EAR C18 Colon 3 2.0 1.5 0.3 4.3 8.1 C33-C34 Lung 12 2.5 4.7 2.4 8.3 # 80.1 83.3 C38, C45 Mesothelioma 2 0.2 13.3 1.6 47.9 # 15.7 2 0.9 2.2 0.3 7.9 9.2 50.0 C43 Malign. melanoma 5 6.5 -12.540.0 C61 Prostate 0.8 0.3 1.8 19.0 C64 Kidney 0.8 4.0 0.8 11.6 33.3 9 32.9 Other primaries 5.1 1.8 0.8 3.3 22.2 0 Not observed 3.6 0.0 0.0 1.0 -30.4All mult. primaries 36 21.6 1.7 1.2 2.3 # 122.1 44.4

Patients 892
Median age at second malignancy (years) 73.0
Person-years 1181
Mean observation time (years) 1.3
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"



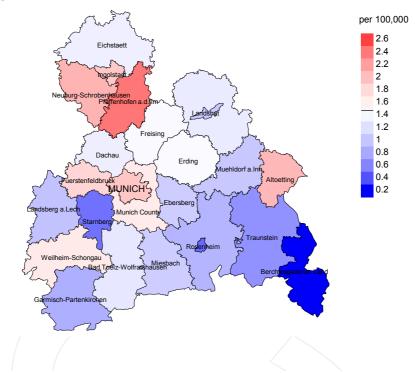
	Observed	Expected		LCL	UCL		DCO
Diagnosis	n	n	SIR	95%	95%	EAR	%
C33-C34 Lung	2	0.2	8.2	1.0	29.7	59.0	100.0
Other primaries	4	1.4	2.8	0.8	7.2	86.8	50.0
Not observed	0	1.5	0.0	0.0	2.4	-51.7	
All mult. primaries	6	3.2	1.9	0.7	4.1	94.1	66.7
<u> </u>							

Patients	226
Median age at second malignancy (years)	70.7
Person-years	298
Mean observation time (years)	1.3
Median observation time (years)	0.7

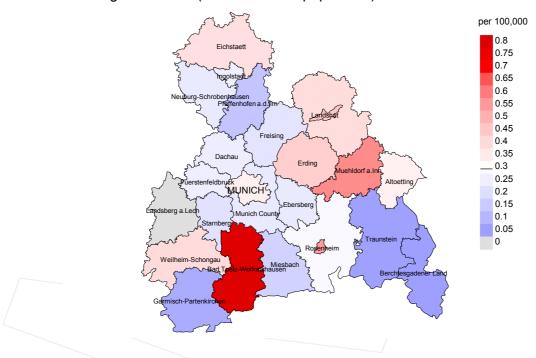
# The occurrence of second malignancy is statistically significant.

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

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



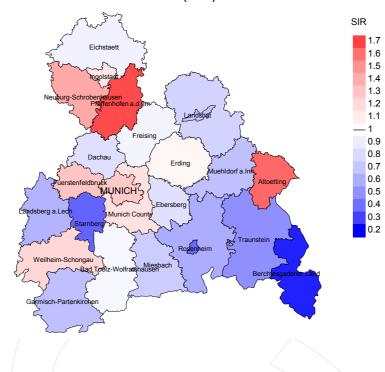
### Average incidence (world standard population) 2007 - 2014: Females



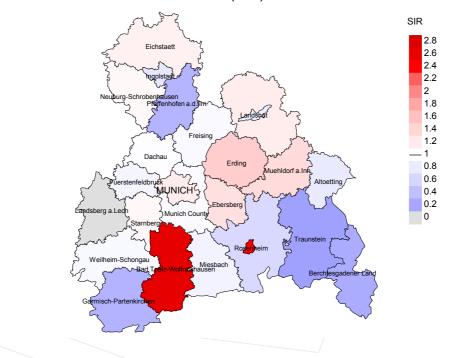
**Figure 9a.** Map of cancer incidence (world standard population, incl. DCO cases) by county averaged for period 2007 to 2014. According to their individual incidence rates, the counties are displayed in different red and blue color temperatures where the fine white color indicates the population mean (males 1.5/100,000 WS N=580, females 0.3/100,000 WS N=145).

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 5 women were identified with newly diagnosed mesothelioma. Therefore, the mean incidence rate for this cancer type in this area can be calculated at 0.2/100,000 (world standard population). Though, the value of this parameter may vary with an underlying probability of 99% between 0.0 and 0.8/100,000.

### 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=580, females N=145).

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 5 women were identified with newly diagnosed mesothelioma. Therefore, the mean standardized incidence ratio (SIR) for this cancer type in this area can be calculated at 1.30. Though, the value of this parameter may vary with an underlying probability of 99% between 0.28 and 3.69, 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)

		Prop.				Prop. deaths
	Incident	actively	Prop.		Prop.	with death
Year of	cases	followed	DCO	Deaths	deaths	certific.
diagnosis	n	9	90	n	%	용
1998	40	100.0	22.5	40	100.0	92.5
1999	33	100.0	21.2	33	100.0	93.9
2000	41	100.0	48.8	40	97.6	95.0
2001	45	100.0	22.2	44	97.8	90.9
2002	60	100.0	30.0	58	96.7	98.3
2003	63	100.0	19.0	60	95.2	95.0
2004	81	98.8	12.3	78	96.3	96.2
2005	76	97.4	10.5	73	96.1	100.0
2006	74	95.9	10.8	70	94.6	98.6
2007	102	93.1	4.9	91	89.2	97.8
2008	101	98.0	6.9	98	97.0	99.0
2009	85	95.3	4.7	78	91.8	94.9
2010	99	94.9	9.1	89	89.9	97.8
2011	97	90.7	5.2	79	81.4	98.7
2012	102	94.1	5.9	83	81.4	100.0
2013	89	100.0	11.2	68	76.4	98.5
2014	50	98.0	16.0	21	42.0	95.2
1998-2014	1238	96.8	12.6	1103	89.1	97.2

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)

			Prop.		D
_			deaths		Prop.
Year of	Incident		with death	Deaths in	deaths in
diagnosis/	cases	Deaths	certific.	same year	same year
death	n	n	0/0	n	9
1998	40	39	94.9	22	55.0
1999	33	28	92.9	12	36.4
2000	41	40	95.0	17	41.5
2001	45	38	94.7	19	42.2
2002	60	51	96.1	25	41.7
2003	63	44	93.2	24	38.1
2004	81	59	96.6	25	30.9
2005	76	61	96.7	24	31.6
2006	74	68	98.5	23	31.1
2007	102	73	95.9	28	27.5
2008	101	94	98.9	36	35.6
2009	85	71	98.6	19	22.4
2010	99	90	96.7	31	31.3
2011	97	93	97.8	30	30.9
2012	102	98	100.0	36	35.3
2013	89	88	97.7	35	39.3
2014	50	68	100.0	19	38.0
1998-2014	1238	1103	97.3	425	34.3

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)

				Prop.
				cancer
		Prop.	Prop.	recorded
		cancer-	non-cancer-	on death
Year of	Deaths	related	related	certificate
death	n	olo	/ %	용
1998	39	87.2	12.8	97.3
1999	28	92.9	7.1	100.0
2000	40	92.5	7.5	100.0
2001	38	89.5	10.5	100.0
2002	51	94.1	5.9	100.0
2003	44	90.9	9.1	100.0
2004	59	89.8	10.2	98.2
2005	61	96.7	3.3	94.9
2006	68	97.1	2.9	98.5
2007	73	93.2	6.8	100.0
2008	94	97.9	2.1	100.0
2009	\ 71	97.2	2.8	100.0
2010	90	95.6	4.4	98.9
2011	93	92.5	7.5	97.8
2012	98	93.9	6.1	95.9
2013	88	96.6	3.4	98.8
2014	68	91.2	8.8	97.1
1998-201	1103	94.0	6.0	98.5

 $$\operatorname{\textsc{Table}}\xspace$  11a  $$\operatorname{\textsc{Medians}}\xspace$  of age at death according to the grouping in Table 10  $$\operatorname{\textsc{MALES}}\xspace$ 

					Age at
		Age at	Age at	Age at	death
		death	death	death	(according
		(all	(cancer-	(non-cancer-	to death
Year of	Deaths	causes)	related)	related)	certificate)
death	n	Years	Years	Years	Years
1998	31	67.5	69.1	65.5	68.3
1999	22	68.6	68.6		68.6
2000	27	67.3	66.8	79.6	67.5
2001	26	65.7	65.9	56.2	65.8
2002	42	66.2	67.0	57.9	66.8
2003	36	66.3	66.3	73.3	66.3
2004	47	71.0	71.0	71.3	71.0
2005	54	71.0	71.2	66.2	71.2
2006	56	72.7	73.1	55.1	73.1
2007	61	69.7	70.0	69.5	69.7
2008	75	70.3	70.3	69.3	70.1
2009	57	70.3	70.3	69.6	70.5
2010	70	74.3	73.9	76.7	74.5
2011	80	75.2	74.9	80.9	75.2
2012	78	74.0	73.8	79.1	73.7
2013	69	73.9	73.7	85.1	74.0
2014	55	74.0	73.9	75.1	74.0
1998-2014	886	71.6	71.6	73.2	71.7

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.

 $\begin{array}{c} \text{Table 11b} \\ \text{Medians of age at death according to the grouping in Table 10} \\ \text{FEMALES} \end{array}$ 

					Age at
		Age at	Age at	Age at	death
		death	death	death	(according
		(al/l	(cancer-	(non-cancer-	to death
Year of	Deaths	causes)	related)	related)	certificate)
death	n	Years	Years	Years	Years
		/ /			
1998	8	73.7	70.4	85.6	73.7
1999	6	62.8	66.1	55.0	66.1
2000	13	77.2	79.3	75.2	79.3
2001	12	70.5	70.6	60.9	70.6
2002	9	64.9	64.3	80.3	64.3
2003	8	81.3	81.3	80.5	82.6
2004	12	64.5	64.5		63.8
2005	7	75.1	75.1		75.1
2006	12/	75.1	75.1		75.1
2007	12	71.7	72.3	64.9	72.2
2008	19	72.2	72.2		72.2
2009	14	78.6	78.6		78.6
2010	20	75.9	75.9		75.9
2011	13	79.1	79.1		79.1
2012	20	76.4	75.0	81.2	77.1
2013	19	74.7	74.7		74.7
2014	13	74.4	70.1	87.6	74.4
1998-2014	217	74.4	73.9	77.0	74.3

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.

Year of	Deaths	Mort.	MI-Index	Mort.	MI-Index	Mort.	MI-Index	Mort.	MI-Index
death	n	raw	raw	WS	WS	ES	ES	BRD-S	BRD-S
1998	27	2.4	0.93	1.5	0.93	2.2	0.93	2.6	0.91
1999	22	2.0	0,88	1.2	0.88	/ 1.7	0.89	2.2	0.90
2000	25	2.2	0.78	1.3	0.76	2.0	0.78	2.5	0.79
2001	23	2.0	0.77	1.2	0.72	/ 1.7	0.72	2.1	0.76
2002	40	2.1	0.89	1.2	0.87	1.8	0.89	2.3	0.86
2003	34	1.8	0.68	1.0	0.70	1,5	0.68	1.9	0.68
2004	41	2.2	0.58	1.1	0.58	1,.7	0.59	2.3	0.61
2005	52	2.7	0.91	1.4	0.88	2.1	0.90	2.8	0.90
2006	54	2.8	0.90	1.3	0.82	2.0	0.85	3.0	0.93
2007	58	2.6	0.72	1.3	0.70	1.9	0.70	2.6	0.70
2008	73	3.3	0.90	1.6	0.92	2.4	0.93	3.2	0.95
2009	55	2.5	0.80	1.1	0.78	1.7	0.78	2.3	0.76
2010	66	2.9	0.87	1.3	0.84	2.0	0.86	2.8	0.90
2011	73	3.2	0.91	1.3	0.86	2.1	0.88	3.1	0.93
2012	74	3.2	0.93	1.4	0.96	2.2	0.95	3.1	0.95
2013	66	2.9	0.90	1.2	0.82	1.9	0.85	2.6	0.88
2014	51	2.2	1.28	1.0	1.38	1.5	1.33	2.1	1.28
1998-2014	834	2.6	0.85	1.3	0.83	2.0	0.84	2.6	0.86

Table 12b

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

Year of	Deaths	Mort.	MI-Index	Mort.	MI-Index	Mort.	MI-Index	Mort.	MI-Index
death	n	raw	raw	WS	WS	ES	ES	BRD-S	BRD-S
1998	7	0.6	0.64	0.3	0.53	0.4	0.57	0.6	0.65
1999	4	0.3	0.50	0.2	0.63	0.3	0.59	0.3	0.52
2000	12	1.0	1.33	0.4	1.11	0.6	1.17	0.8	1.40
2001	11	0.9	0.73	0.4	0.63	0.6	0.66	0.8	0.73
2002	8	0.4	0.53	0.2	0.49	0.3	0.50	0.3	0.49
2003	6	0.3	0.46	0.1	0.48	0.2	0.46	0.2	0.47
2004	12	0.6	1.20	0.3	1.30	0.5	1.27	0.5	1.20
2005	7	0.4	0.37	0.1	0.30	0.2	0.34	0.3	0.40
2006	12	0.6	0.86	0.3	0.95	0.4	0.90	0.5	0.88
2007	10	0.4	0.48	0.2	0.36	0.3	0.41	0.4	0.46
2008	19	0.8	0.95	0.4	1.18	0.5	1.10	0.6	0.99
2009	14	0.6	0.88	0.2	0.77	0.3	0.81	0.4	0.87
2010	20	0.9	0.87	0.3	0.67	0.4	0.71	0.6	0.76
2011	13	0.6	0.76	0.2	0.68	0.3	0.71	0.4	0.75
2012	18	0.8	0.82	0.3	0.72	0.4	0.75	0.6	0.81
2013	19	0.8	1.19	0.3	1.07	0.4	1.11	0.6	1.17
2014	11	0.5	1.10	0.2	1.75	0.3	1.49	0.3	1.19
1998-2014	203	0.6	0.78	0.2	0.74	0.4	0.75	0.5	0.77

Table 13

Age distribution of age at death (cancer-related) for period 2007-2014

(incl. multiple primaries)

Age at									
death	Cases			Males			Females		
Years	n	90	Cum.%	n	90	Cum.%	n	olo	Cum.%
40 - 44	5	0.8	0.8	/ 1	0.2	0.2	4	3.2	3.2
45-49	6	0.9	/ 1.7/	4	0.8	1.0	2	1.6	4.8
50-54	16	2.5	4.2	12	2.3	3.3	4	3.2	8.1
55-59	27	4.2	8.4	23	4.4	7.7	4	3.2	11.3
60-64	50	7.8	16.2	44	8.5	16.2	6	4.8	16.1
65-69	130	20.3	36.5	117	22.6	38,9	13	10.5	26.6
70-74	150	23.4	59.9	120	23.2	62.1	30	24.2	50.8
75-79	119	18.6	78.5	98	19.0	81.0	21	16.9	67.7
80-84	88	13.7	92.2	67	13.0	94.0	21	16.9	84.7
85+	50	7.8	100.0	31	6.0	100.0	19	15.3	100.0
All ages	641	100.0		517	100.0		124	100.0	

Included in the statistics are 27.1% multiple primaries in males and 29.0% 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 Females	Males Age- s spec. mortal. MI-index	Females Age- spec. mortal. MI-inde	Males Females Prop.all Prop.all cancers cancers x % %
0- 4 5- 9 10-14 15-19 20-24 25-29 30-34		0.0 0.0 0.0 0.0 0.0 0.0	0.0 0.0 0.0 0.0 0.0 0.0	
35-39 40-44 45-49 50-54 55-59 60-64 65-69 70-74 75-79 80-84 85+	1 4 2 12 4 23 4 44 6 117 13 120 30 98 21 67 21 31 19	0.0 0.1 0.3 0.80 0.9 0.92 2.2 0.74 4.5 0.76 12.2 0.99 13.2 0.79 17.8 0.99 19.2 0.97 13.4	0.0 0.3 0.80 0.1 0.67 0.3 1.00 0.4 0.67 0.6 0.67 1.2 0.57 2.9 1.30 2.9 0.84 3.7 0.84 3.3 0.90	0.2 0.4 0.6 0.7 0.2 0.7 0.2 0.9 0.2 1.6 0.2 1.3 0.5 1.2 0.3 0.9 0.3 0.5 0.2
All ages	517 124			1.0 0.3
Mortality Raw WS ES BRD-S		2.9 0.89 1.3 0.88 2.0 0.89 2.7 0.90	0.7 0.86 0.2 0.80 0.4 0.82 0.5 0.84	
PYLL-70 per 100,000 ES AYLL-70		7.7 6.6 6.2	2.2 1.8 10.7	

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

Table 15a

Multiple primaries in deaths in period 1998-2014

MALES

					Syn-	Syn-		
					chron	chron		
	Total	Total	Pre	Pre	±30d	±30d	Post	Post
Diagnosis	'n	%↓	n	<b>←%</b>	n	<b>←%</b>	n	<b>←</b> %
_		/						
C03-C06 Oral cavity	2 /	1.0	1	50.0			1	50.0
C09-C10 Oropharynx	/ 2 /	1.0	2	100.0				
C16 Stomach	7 <	3.6	6	85.7			1	14.3
C18 Colon	13	6.7	11	84.6	2	15.4		
C19-C20 Rectum	12	6.2	11	91.7	1	8.3		
C22 Liver	2	1.0	1	50.0	1	50.0		
C33-C34 Lung	15	7.8	3	20.0	3	20.0	9	60.0
C38,C45 Mesothelioma	3	1.6					3	100.0
C43 Malign. melanoma	17	8.8	15	88.2			2	11.8
C44 Skin others	17	8.8	12	70.6			5	29.4
C61 Prostate	50	25.9	43	86.0	3	6.0	4	8.0
C64 Kidney	9	4.7	6	66.7	_ 1	11.1	2	22.2
C67 Bladder	10	5.2	8	80.0	1	10.0	1	10.0
C70-C72 CNS cancer	3	1.6	1	33.3	1	33.3	1	33.3
C73 Thyroid	2	1.0	1	50.0			1	50.0
C76-C79 CUP	3	1.6	3	100.0				
C82-C85 NHL	10	5.2	7	70.0	3	30.0		
C90 Mult. myeloma	3	1.6	2	66.7			1	33.3
C91-C96 Leukaemia	4	2.1	2	50.0	2	50.0		
Other primaries	9	4.7	7	77.8			2	22.2
-								
All mult. primaries	193	100.0	142	73.6	18	9.3	33	17.1
-/								

Multiple primaries with number of cases 1 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

					Syn- chron	Syn- chron		
	Total	Total	Pre	Pre	±30d	±30d	Post	Post
Diagnosis	n	/ %↓	n	<b>←</b> %	n	<b>←%</b>	n	<b>←</b> %
C16 Stomach	/ 1	2.2	1	100.0				
C18 Colon	5	11.1	5	100.0		0.5.0		
C33-C34 Lung	4	8.9	1	25.0	1	25.0	2	50.0
C43 Malign. melanoma	2	4.4	2	100.0				
C44 Skin others	2	4.4	1	50.0			1	50.0
C50 Breast	10	22.2	9	90.0			1	10.0
C53 Cervix uteri	1	2.2	1	100.0				
C54 Corpus uteri	5	11.1	4	80.0			1	20.0
C56 Ovary	2	4.4			1	50.0	1	50.0
C67 Bladder	2	4.4	2	100.0				
C70-C72 CNS cancer	3	6.7	2	66.7			1	33.3
C73 Thyroid	4	8.9	4	100.0				
C81 Hodgkin lymphoma		2.2	1	100.0				
C82-C85 NHL	2	4.4	2	100.0				
C90 Mult. myeloma	1	2.2	1	100.0				
	4.5	100 0	2.6	0.0				15.0
All mult. primaries	45	100.0	36	80.0	2	4.4	7	15.6

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	cancers	Females Prop.all cancers
0- 4 5- 9 10-14 15-19 20-24 25-29 30-34 35-39			0.0 0.0 0.0 0.0 0.0 0.0		0.0 0.0 0.0 0.0 0.0 0.0 0.0			
40-44 45-49 50-54 55-59 60-64 65-69 70-74 75-79 80-84 85+	1 4 11 21 39 100 99 75 49 21	3 2 4 3 4 10 25 16 18 15	0.1 0.3 0.8 2.0 4.0 10.4 10.9 13.6 14.0 9.1	0.80 1.00 0.68 0.78 1.02 0.83 1.01 1.02	0.2 0.1 0.3 0.3 0.4 1.0 2.4 2.2 3.2 2.6	0.60 0.67 0.59 1.25 0.89	0.2 0.4 0.7 0.8 1.0 1.8 1.4 1.2 0.9	0.5 0.2 0.3 0.1 0.1 0.2 0.5 0.3 0.4
All ages  Mortality Raw WS ES BRD-S	420	100	2.3 1.1 1.6 2.2	0.91 0.89 0.90 0.92	0.5 0.2 0.3 0.4	0.88 0.83 0.85 0.87	1.1	0.3
PYLL-70 per 100,000 ES AYLL-70			7.0 6.0 6.3		1.8 1.5 11.2			

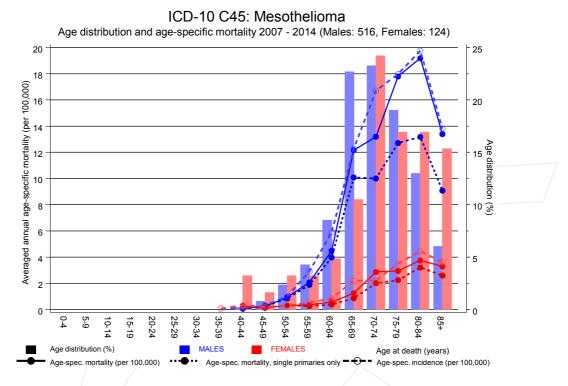
<sup>\*</sup> See corresponding tables with multiple primaries.

Table 17

Age-specific mortality (cancer-related) and proportion of all cancers for period 2007-2014 (Single primaries only \*)

Age at death Years	Males Females	Males Age- spec. mortal. M		Females Age- spec. mortal.	MI-index	Males Prop.all cancers	Females Prop.all cancers
0- 4 5- 9 10-14 15-19 20-24 25-29 30-34 35-39		0.0 0.0 0.0 0.0 0.0 0.0 0.0		0.0 0.0 0.0 0.0 0.0 0.0 0.0			
40-44 45-49 50-54 55-59 60-64 65-69 70-74 75-79 80-84 85+	1 3 4 2 11 4 20 3 39 4 97 9 91 21 70 16 46 18 21 15	0.1 0.3 0.8 1.9 4.0 10.1 10.0 12.7 13.2 9.1	0.50 0.80 1.00 0.65 0.78 1.01 0.82 0.99 0.98	0.2 0.1 0.3 0.3 0.4 0.9 2.0 2.2 3.2 2.6	0.75 0.67 1.00 0.60 0.67 0.56 1.17 0.89 0.95	0.3 0.5 0.8 0.9 1.1 2.0 1.6 1.4 1.1 0.6	0.6 0.2 0.3 0.2 0.2 0.3 0.5 0.4 0.4
All ages  Mortality Raw WS ES BRD-S	400 95	2.2 1.0 1.6 2.1	0.89 0.88 0.88 0.90	0.5 0.2 0.3 0.4	0.87 0.81 0.83 0.85	1.3	0.3
PYLL-70 per 100,000 ES AYLL-70		6.8 5.9 6.4		1.8 1.5 11.5			

<sup>\*</sup> See corresponding tables with multiple primaries.

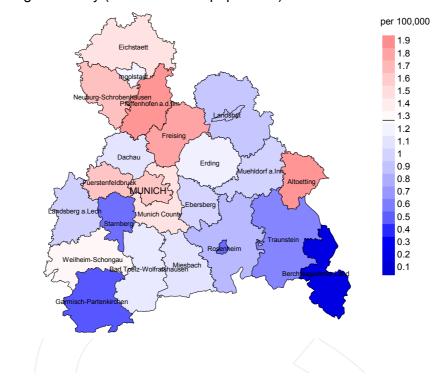


**Figure 18.** Distribution of age at death (bars) and age-specific mortality (all patients: solid line, patients with single primaries: dotted line). The age-specific incidence is additionally plotted for comparison (dashed line).

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



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



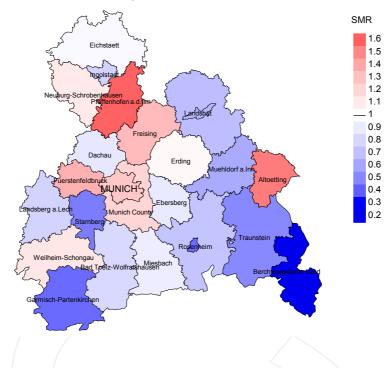
### Average mortality (world standard population) 2007 - 2014: Females



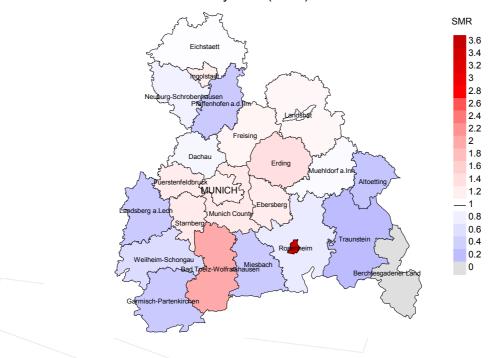
**Figure 19a.** Map of cancer mortality (world standard population) by county averaged for period 2007 to 2014. According to their individual mortality rates, the counties are displayed in different red and blue color temperatures where the fine white color indicates the population mean (males 1.3/100,000 WS N=512, females 0.2/100,000 WS N=123).

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 4 women died from mesothelioma. Therefore, the mean mortality rate for this cancer type in this area can be calculated at 0.2/100,000 (world standard population). Though, the value of this parameter may vary with an underlying probability of 99% between 0.0 and 0.8/100,000.

### 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=512, females N=123).

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 4 women died from mesothelioma. Therefore, the mean standardized mortality ratio (SMR) for this cancer type in this area can be calculated at 1.23. Though, the value of this parameter may vary with an underlying probability of 99% between 0.21 and 3.88, 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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