Munich Cancer Registry

- Survival
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- *Deutsch*

ICD-10 C60: Penile cancer

Incidence and Mortality

Year of diagnosis	1998-2020
Patients	606
Diseases	608
Creation date	12/21/2021
Database export	12/20/2021
Population (males)	2.45 m

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

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

https://www.tumorregister-muenchen.de/en/facts/base/bC60__E-ICD-10-C60-Penile-cancer-incidence-and-mortality.pdf

Index of figures and tables

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

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

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

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

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

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

Munich Cancer Registry, December 2021

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

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

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

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

Code	Description
C60.-	Malignant neoplasm of penis
C60.0	Prepuce
C60.1	Glans penis
C60.2	Body of penis
C60.8	Overlapping lesion of penis
C60.9	Penis, unspecified

INCIDENCE

Table 1

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

Year of diagnosis	All cases n	DCO cases n	Prop. DCO %	Prop. at least 1 further malign. prior + synchron. %	Prop. at least 1 further malign. after %	Prop. deaths %	Prop. actively followed %
1998	11	1	9.1	27.3	14.4	90.9	100.0
1999	14			12.0	14.1	85.7	100.0
2000	10			11.4	13.9	60.0	80.0
2001	13	1	7.7	16.7	14.0	69.2	100.0
2002	28	1	3.6	13.2	13.7	64.3	92.9 #
2003	30	1	3.3	12.3	12.8	73.3	100.0
2004	20			15.9	13.1	80.0	95.0
2005	21	2	9.5	15.6	12.6	85.7	95.2
2006	23	2	8.7	15.3	12.5	60.9	91.3
2007	40	1	2.5	16.2	13.2	65.0	92.5 #
2008	35			16.7	12.2	68.6	97.1
2009	31	1	3.2	15.9	10.9	54.8	96.8
2010	44			16.6	11.0	56.8	97.7
2011	26	2	7.7	17.3	10.2	46.2	100.0
2012	39	3	7.7	17.9	10.1	48.7	100.0
2013	30			17.1	9.1	56.7	100.0
2014	30	1	3.3	18.0	7.9	53.3	100.0
2015	41	3	7.3	18.7	6.3	56.1	90.2
2016	33	1	3.0	19.1	6.7	36.4	93.9
2017	31	2	6.5	20.4	6.9	41.9	100.0
2018	29	1	3.4	20.4	5.4	20.7	100.0
2019	16			20.5	7.1	37.5	93.8
2020	13			20.6	7.7	30.8	100.0 ##
1998-2020	608	23	3.8	20.6	14.4	56.7	96.5

608 cases diagnosed 1998-2020 are related to a total of 606 patients. Currently, in 194 (32.0 %) of these 606 patients more than one malignancy of any cancer type has been registered. Hereby, groups of 135 / 45 / 14 (22.3 % / 7.4 % / 2.3 %) patients exist having 2 / 3 / 4+ malignancies.

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

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

How to interpret:
In 2018, a subgroup of 29 cases has been diagnosed, of which 20.4 % previously and/or concurrently (synchronously) had at least one other malignancy of any cancer type. In 5.4 % of cases, at least one new malignancy has occurred during the follow-up period (all numbers refer to the date of the database export, see cover sheet).

Table 2

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

Year of diagnosis	Cases n	Incidence raw	Incidence WS	Incidence ES	Incidence BRD-S
1998	11	1.0	0.6	0.9	1.5
1999	14	1.3	0.7	1.1	1.4
2000	10	0.9	0.5	0.8	1.0
2001	13	1.1	0.6	1.0	1.4
2002	28	1.5	0.9	1.2	1.6
2003	30	1.6	0.9	1.3	1.7
2004	20	1.1	0.5	0.8	1.1
2005	21	1.1	0.6	0.9	1.2
2006	23	1.2	0.7	0.9	1.2
2007	40	1.8	1.0	1.5	1.9
2008	35	1.6	0.8	1.2	1.6
2009	31	1.4	0.8	1.1	1.3
2010	44	2.0	1.0	1.5	1.9
2011	26	1.2	0.6	0.9	1.0
2012	39	1.7	0.8	1.2	1.6
2013	30	1.3	0.7	1.0	1.2
2014	30	1.3	0.6	0.9	1.2
2015	41	1.7	0.8	1.2	1.6
2016	33	1.4	0.7	1.0	1.2
2017	31	1.3	0.5	0.8	1.1
2018	29	1.2	0.6	0.8	1.1
2019	16	0.7	0.3	0.5	0.6
2020	13	0.5	0.3	0.4	0.5
1998–2020	608	1.3	0.7	1.0	1.3

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

Table 3

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

Year of diagnosis	Cases n	Mean	Std. dev.	Min.	Max.	10%	25%	Median 50%	75%	90%
1998	11	71.4	10.3	51.9	82.9	58.6	65.5	70.6	81.5	82.7
1999	14	66.4	13.5	44.7	92.4	49.0	59.2	61.7	75.2	83.9
2000	10	68.4	12.5	54.7	89.0	56.0	58.8	63.2	83.0	86.7
2001	13	65.2	17.6	31.6	85.5	35.6	58.7	70.3	77.2	82.1
2002	28	68.0	11.7	42.6	90.1	49.9	61.5	69.1	75.7	82.4
2003	30	68.1	12.6	43.2	93.1	52.8	60.4	67.0	79.5	82.5
2004	20	72.9	10.1	59.3	91.0	60.4	65.4	70.2	82.3	87.4
2005	21	69.7	10.9	44.2	85.0	55.7	65.2	71.4	77.6	80.0
2006	23	65.2	12.3	42.2	81.6	46.2	58.7	66.4	78.1	80.6
2007	40	68.4	14.5	41.4	94.5	48.5	59.6	66.6	81.4	89.7
2008	35	67.4	12.8	42.8	94.4	49.2	56.7	69.8	76.6	82.5
2009	31	65.0	12.0	42.1	89.4	48.2	56.0	65.2	74.0	80.9
2010	44	69.9	11.1	48.7	92.7	56.2	63.3	70.0	76.2	86.0
2011	26	67.3	11.0	40.8	89.9	54.3	59.2	70.6	73.9	81.9
2012	39	71.7	11.0	45.5	86.9	57.1	62.7	73.5	79.6	84.4
2013	30	68.1	12.6	40.4	92.3	52.4	60.1	66.7	77.9	85.4
2014	30	71.7	10.2	56.3	99.5	57.4	66.0	71.0	79.0	82.9
2015	41	71.7	11.6	44.5	90.9	51.2	65.8	74.1	78.2	83.9
2016	33	69.2	14.5	24.9	90.9	53.8	59.2	72.6	79.8	85.1
2017	31	73.0	11.1	51.0	89.9	58.4	65.4	75.5	82.3	86.0
2018	29	70.0	13.4	45.6	97.3	49.3	58.3	71.8	79.9	87.8
2019	16	67.2	16.4	37.1	88.7	39.2	54.4	71.7	77.8	83.5
2020	13	69.8	11.4	44.2	85.3	54.5	66.8	69.6	76.9	80.6
1998–2020	608	69.1	12.4	24.9	99.5	51.4	61.1	70.2	78.2	83.8

Table 4

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

Age at diagnosis Years	Cases n	%	Cum.%
0-4			
5-9			
10-14			
15-19			
20-24	1	0.2	0.2
25-29	0	0.0	0.2
30-34	0	0.0	0.2
35-39	3	0.7	0.9
40-44	11	2.5	3.4
45-49	17	3.9	7.3
50-54	26	5.9	13.2
55-59	41	9.4	22.6
60-64	50	11.4	34.0
65-69	61	13.9	47.9
70-74	73	16.7	64.6
75-79	62	14.2	78.8
80-84	55	12.6	91.3
85+	38	8.7	100.0
All ages	438	100.0	

Table 5

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

Age at diagnosis Years	Cases n	Age-spec. incidence	DCO rate n=15 %	Prop. all cancers n=153686 %
0- 4		0.0		
5- 9		0.0		
10-14		0.0		
15-19		0.0		
20-24	1	0.0		0.2
25-29		0.0		
30-34		0.0		
35-39	3	0.1		0.2
40-44	11	0.4		0.4
45-49	17	0.6		0.3
50-54	26	1.0	3.8	0.3
55-59	41	1.9	2.4	0.3
60-64	50	2.8	2.0	0.3
65-69	61	3.7		0.3
70-74	73	4.9	2.7	0.3
75-79	62	5.1	4.8	0.3
80-84	55	7.6	5.5	0.4
85+	38	8.1	10.5	0.4
All ages	438		3.4	0.3
Incidence				
Raw		1.3		
WS		0.7		
ES		1.0		
BRD-S		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).

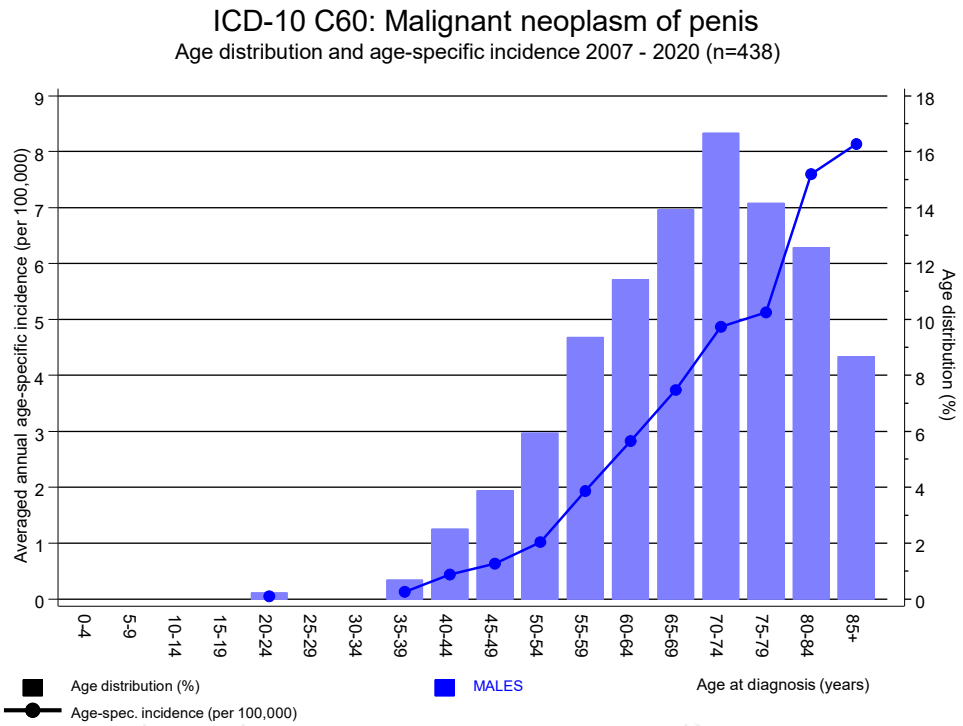

Figure 6. Age distribution (mean=69.5 yrs, median=70.7 yrs) and age-specific incidence.

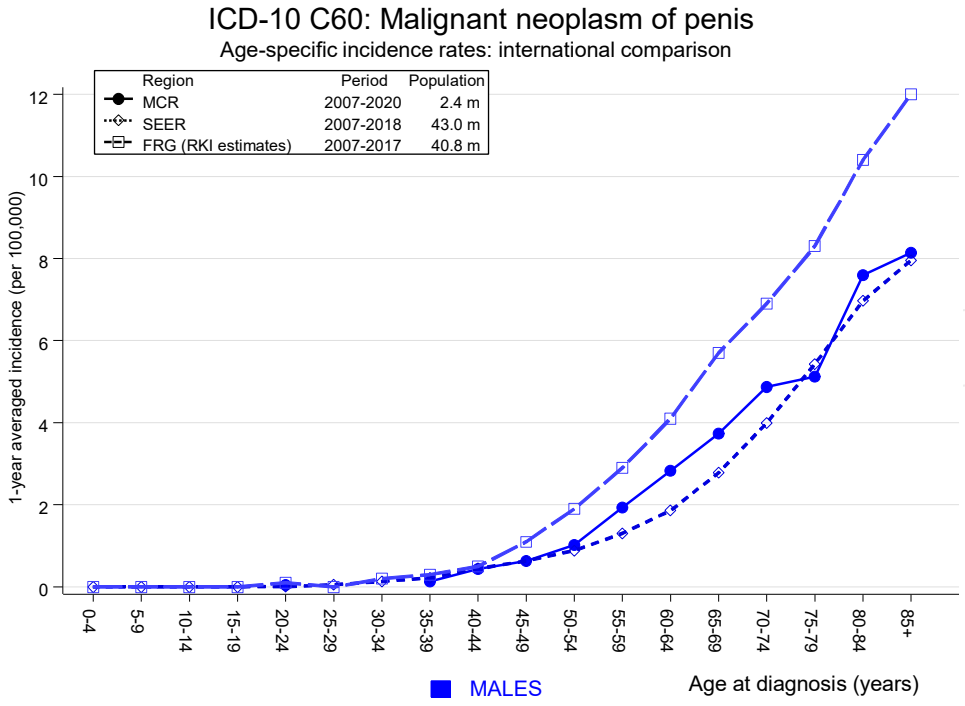

Figure 6a. Age-specific incidence in MCR registry areas compared to Germany (FRG, RKI estimates) and SEER (Surveillance, Epidemiology, and End Results, USA).

Reference:

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

Table 7

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

Diagnosis		Observed n	Expected n	SIR	CI 95%	CI 95%		EAR	DCO %
C03-C06	Oral cavity	1	0.3	3.7	0.1	20.5		3.5	
C12-C13	Hypopharynx	1	0.2	5.6	0.1	31.2		3.9	
C15	Oesophagus	3	0.7	4.3	0.9	12.6		11.0	
C16	Stomach	2	1.5	1.3	0.2	4.8		2.3	
C17	Small intestine	1	0.2	4.6	0.1	25.5		3.7	
C18	Colon	7	3.7	1.9	0.8	3.9		15.9	
C19-C20	Rectum	4	1.9	2.1	0.6	5.4		10.0	
C21	Anus/canal	1	0.1	11.8	0.3	66.0		4.4	
C22	Liver	2	1.0	1.9	0.2	6.9		4.6	
C23-C24	Bile	1	0.4	2.5	0.1	13.9		2.9	
C25	Pancreas	2	1.5	1.4	0.2	4.9		2.5	
C32	Larynx	2	0.3	5.9	0.7	21.5		7.9	
C33-C34	Lung	14	4.2	3.3	1.8	5.6	#	46.7	7.1
C43	Malign. melanoma	4	1.6	2.5	0.7	6.3		11.3	
C50	Breast	1	0.1	10.1	0.3	56.1		4.3	
C60	Penis	2	0.1	20.5	2.5	74.2	#	9.1	50.0
C61	Prostate	24	10.3	2.3	1.5	3.5	#	65.1	16.7
C64	Kidney	3	1.2	2.5	0.5	7.2		8.5	33.3
C67	Bladder	3	1.8	1.6	0.3	4.8		5.5	33.3
C68	Urethra	1	0.0	27.5	0.7	153.1		4.6	
C76-C79	CUP	1	0.6	1.6	0.0	8.7		1.7	
C81	Hodgkin lymphoma	1	0.1	12.8	0.3	71.3		4.4	
C82-C85	NHL	2	1.6	1.3	0.2	4.6		2.0	
C90	Mult. myeloma	1	0.5	2.0	0.1	11.2		2.4	
C91-C96	Leukaemia	1	0.6	1.7	0.0	9.6		2.0	
Not observed		0	2.4	0.0	0.0	1.5		-11.3	
All further malignancies		85	37.0	2.3	1.8	2.8	#	228.7	9.4

Patients	578
Median age at next malignancy (years)	71.4
Person-years	2098
Mean observation time (years)	3.6
Median observation time (years)	1.8

The occurrence of further specified malignancy is statistically significant.

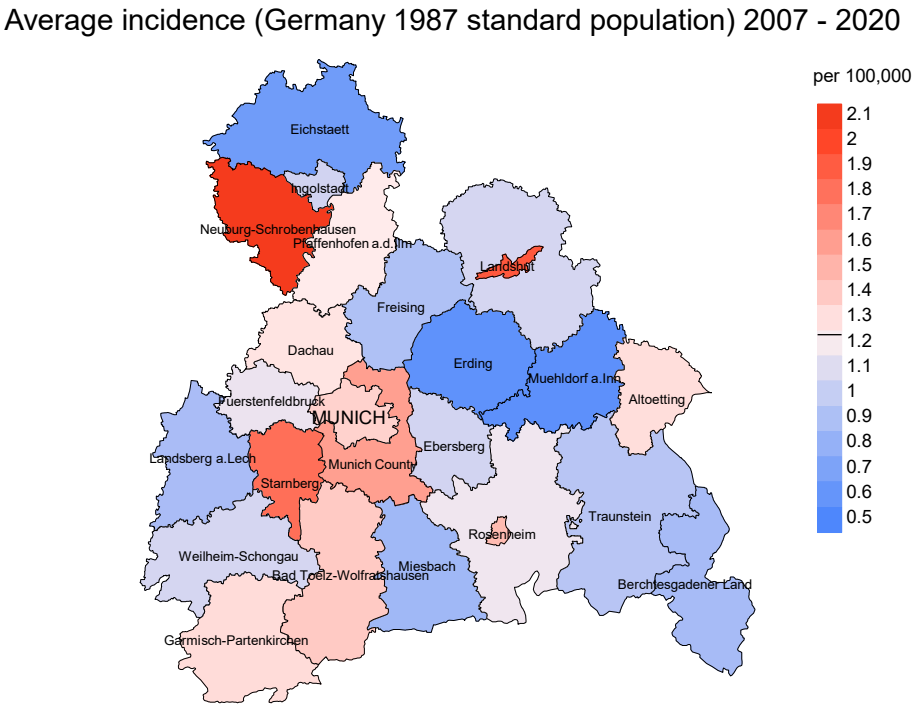

Figure 8a. Map of cancer incidence (german standard population, incl. DCO cases) by county averaged for period 2007 to 2020. According to their individual incidence rates, the counties are displayed in different red and blue hues, being the fine white color attributed to the population mean (1.2/100,000 WS N=438).

The results should be interpreted with caution! E.g., in county Ebersberg with a population of 66,702 male residents (averaged) in the period from 2007 to 2020 a total of 11 men were identified with newly diagnosed penile cancer. Therefore, the mean incidence rate for this cancer type in this area can be calculated at 1.1/100,000 (german standard population). Though, the value of this parameter may vary with an underlying probability of 99% between 0.4 and 2.2/100,000.

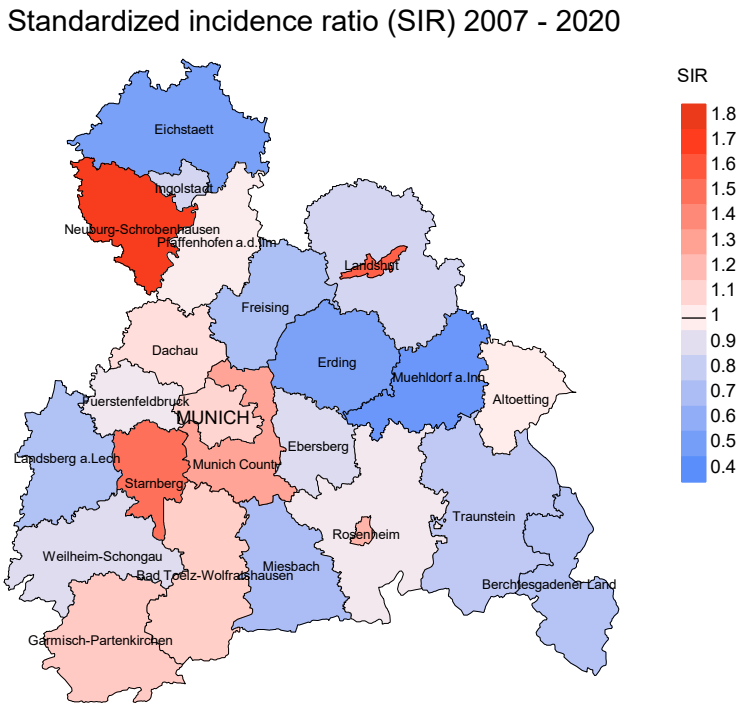

Figure 8b. Map of standardized incidence ratio (SIR, incl. DCO cases) by county averaged for period 2007 to 2020. According to their individual SIR values, the counties are displayed in different red and blue hues, being the fine white color attributed to the population overall of 1.0 (N=438).

The results should be interpreted with caution! E.g., in county Ebersberg with a population of 65,991 male residents (averaged) in the period from 2007 to 2020 a total of 11 men were identified with newly diagnosed penile cancer. Therefore, the mean standardized incidence ratio (SIR) for this cancer type in this area can be calculated at 0.88. Though, the value of this parameter may vary with an underlying probability of 99% between 0.34 and 1.81, and is therefore not statistically striking.

MORTALITY

Table 9a

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

Year of diagnosis	Incident cases n	Prop. actively followed %	Prop. DCO %	Deaths n	Prop. deaths %	Prop. deaths with death certific. %
1998	11	100.0	9.1	10	90.9	90.0
1999	14	100.0		12	85.7	91.7
2000	10	80.0		6	60.0	100.0
2001	13	100.0	7.7	9	69.2	100.0
2002	28	92.9	3.6	18	64.3	94.4
2003	30	100.0	3.3	22	73.3	100.0
2004	20	95.0		16	80.0	87.5
2005	21	95.2	9.5	18	85.7	94.4
2006	23	91.3	8.7	14	60.9	85.7
2007	40	92.5	2.5	26	65.0	96.2
2008	35	97.1		24	68.6	95.8
2009	31	96.8	3.2	17	54.8	88.2
2010	44	97.7		25	56.8	88.0
2011	26	100.0	7.7	12	46.2	100.0
2012	39	100.0	7.7	19	48.7	100.0
2013	30	100.0		17	56.7	88.2
2014	30	100.0	3.3	16	53.3	100.0
2015	41	90.2	7.3	23	56.1	87.0
2016	33	93.9	3.0	12	36.4	91.7
2017	31	100.0	6.5	13	41.9	92.3
2018	29	100.0	3.4	6	20.7	83.3
2019	16	93.8		6	37.5	100.0
2020	13	100.0		4	30.8	100.0
1998-2020	608	96.5	3.8	345	56.7	93.3

Table 9b

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

Year of diagnosis/ death	Incident cases n	Deaths n	Prop. deaths with death certific. %	Deaths in same year n	Prop. deaths in same year %
1998	11	9	100.0	2	18.2
1999	14	8	87.5	1	7.1
2000	10	3	100.0		
2001	13	9	100.0	1	7.7
2002	28	9	88.9	3	10.7
2003	30	11	90.9	5	16.7
2004	20	18	100.0	2	10.0
2005	21	17	100.0	3	14.3
2006	23	12	83.3	1	4.3
2007	40	24	95.8	8	20.0
2008	35	20	95.0	4	11.4
2009	31	15	100.0	2	6.5
2010	44	19	100.0	2	4.5
2011	26	27	100.0	4	15.4
2012	39	21	100.0	5	12.8
2013	30	15	100.0	3	10.0
2014	30	18	94.4	5	16.7
2015	41	20	100.0	6	14.6
2016	33	23	100.0	1	3.0
2017	31	25	100.0	4	12.9
2018	29	24	66.7	2	6.9
2019	16	13	46.2	1	6.3
2020	13	28	89.3	2	15.4
1998-2020	608	388	93.3	67	11.0

Table 9c

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

Year of death	Deaths n	Prop. cancer-related %	Prop. non-cancer-related %	Prop. cancer recorded on death certificate %
1998	9	55.6	44.4	77.8
1999	8	75.0	25.0	85.7
2000	3	66.7	33.3	100.0
2001	9	44.4	55.6	66.7
2002	9	33.3	66.7	62.5
2003	11	54.5	45.5	70.0
2004	18	50.0	50.0	72.2
2005	17	52.9	47.1	76.5
2006	12	50.0	50.0	70.0
2007	24	83.3	16.7	87.0
2008	20	55.0	45.0	78.9
2009	15	60.0	40.0	80.0
2010	19	68.4	31.6	73.7
2011	27	63.0	37.0	74.1
2012	21	42.9	57.1	66.7
2013	15	66.7	33.3	73.3
2014	18	44.4	55.6	70.6
2015	20	65.0	35.0	85.0
2016	23	69.6	30.4	69.6
2017	25	60.0	40.0	68.0
2018	24	29.2	70.8	56.3
2019	13	53.8	46.2	66.7
2020	28	28.6	71.4	52.0
1998-2020	388	54.9	45.1	72.1

Table 10

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

Year of death	Deaths n	Age at death (all causes) Years	Age at death (cancer-related) Years	Age at death (non-cancer-related) Years	Age at death (according to death certificate) Years
1998	9	77.2	75.1	81.2	75.1
1999	8	75.0	75.0	67.8	80.6
2000	3	49.9	51.8	46.9	49.9
2001	9	81.8	77.5	82.1	79.8
2002	9	75.5	75.5	75.9	75.5
2003	11	77.5	73.5	77.5	77.5
2004	18	79.0	69.0	83.9	80.9
2005	17	76.4	76.4	78.9	73.8
2006	12	77.7	69.6	81.5	72.3
2007	24	73.7	71.5	86.7	71.5
2008	20	80.7	80.6	82.5	75.8
2009	15	76.6	71.3	77.5	71.4
2010	19	73.9	73.0	80.8	73.4
2011	27	74.2	74.2	74.7	74.5
2012	21	76.5	74.6	79.9	75.6
2013	15	75.7	73.9	77.0	73.7
2014	18	73.1	69.1	78.0	72.5
2015	20	82.8	81.7	86.9	83.9
2016	23	79.3	79.6	79.3	78.7
2017	25	80.7	79.7	82.5	80.3
2018	24	81.5	72.9	83.0	81.4
2019	13	77.8	77.8	76.1	72.5
2020	28	79.6	74.8	79.7	76.8
1998–2020	388	77.5	74.6	80.4	75.3

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

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

Table 11

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

Year of death	Deaths n	Mort. raw	MI-Index raw	Mort. WS	MI-Index WS	Mort. ES	MI-Index ES	Mort. BRD-S	MI-Index BRD-S
1998	5	0.5	0.45	0.3	0.43	0.4	0.43	0.7	0.44
1999	6	0.5	0.43	0.3	0.40	0.5	0.45	0.6	0.44
2000	2	0.2	0.20	0.1	0.29	0.2	0.25	0.2	0.20
2001	4	0.3	0.31	0.2	0.29	0.3	0.34	0.5	0.35
2002	3	0.2	0.11	0.1	0.09	0.1	0.10	0.2	0.13
2003	6	0.3	0.20	0.2	0.17	0.2	0.18	0.4	0.21
2004	9	0.5	0.45	0.2	0.45	0.4	0.45	0.5	0.45
2005	9	0.5	0.43	0.2	0.43	0.4	0.44	0.5	0.47
2006	6	0.3	0.26	0.2	0.26	0.3	0.27	0.3	0.27
2007	20	0.9	0.50	0.4	0.44	0.7	0.45	1.0	0.52
2008	11	0.5	0.31	0.2	0.26	0.4	0.30	0.6	0.35
2009	9	0.4	0.29	0.2	0.24	0.3	0.27	0.4	0.30
2010	13	0.6	0.30	0.3	0.27	0.4	0.27	0.5	0.28
2011	17	0.8	0.65	0.4	0.66	0.6	0.70	0.7	0.72
2012	9	0.4	0.23	0.2	0.22	0.3	0.23	0.4	0.22
2013	10	0.4	0.33	0.2	0.27	0.3	0.28	0.4	0.32
2014	8	0.3	0.27	0.2	0.28	0.3	0.28	0.3	0.27
2015	13	0.5	0.32	0.2	0.29	0.4	0.31	0.5	0.31
2016	16	0.7	0.48	0.2	0.36	0.4	0.41	0.6	0.48
2017	15	0.6	0.48	0.2	0.45	0.4	0.45	0.5	0.49
2018	7	0.3	0.24	0.1	0.22	0.2	0.22	0.2	0.23
2019	7	0.3	0.44	0.1	0.31	0.2	0.36	0.2	0.41
2020	8	0.3	0.62	0.1	0.54	0.2	0.57	0.3	0.61
1998-2020	213	0.5	0.35	0.2	0.32	0.3	0.33	0.4	0.36

Table 12

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

Age at death Years	Cases n	%	Cum.%
0-4			
5-9			
10-14			
15-19			
20-24			
25-29			
30-34			
35-39			
40-44	1	0.6	0.6
45-49	5	3.1	3.7
50-54	5	3.1	6.7
55-59	9	5.5	12.3
60-64	13	8.0	20.2
65-69	24	14.7	35.0
70-74	26	16.0	50.9
75-79	22	13.5	64.4
80-84	32	19.6	84.0
85+	26	16.0	100.0
All ages	163	100.0	

Table 13

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

Age at death Years	Cases n	Age-spec. mortality	MI-index	Prop. all cancers %
0- 4		0.0		
5- 9		0.0		
10-14		0.0		
15-19		0.0		
20-24		0.0		
25-29		0.0		
30-34		0.0		
35-39		0.0		
40-44	1	0.0	0.09	0.2
45-49	5	0.2	0.29	0.4
50-54	5	0.2	0.19	0.2
55-59	9	0.4	0.22	0.2
60-64	13	0.7	0.26	0.2
65-69	24	1.5	0.39	0.3
70-74	26	1.7	0.36	0.2
75-79	22	1.8	0.35	0.2
80-84	32	4.4	0.58	0.3
85+	26	5.6	0.68	0.3
All ages	163			0.2
Mortality				
Raw		0.5	0.37	
WS		0.2	0.33	
ES		0.3	0.35	
BRD-S		0.5	0.37	
PYLL-70				
per 100,000		1.7		
ES		1.5		
AYLL-70		8.7		

Table 14

Further malignancies in deaths in period 1998–2020

Diagnosis		Total n	Total %↓	Pre n	Pre ←%	Syn-chron ±30d n	Syn-chron ±30d ←%	Post n	Post ←%
		1	0.8	1	100.0				
C11	Nasopharynx	1	0.8					1	100.0
C12–C13	Hypopharynx	1	0.8					1	100.0
C15	Oesophagus	1	0.8					1	100.0
C16	Stomach	3	2.5	1	33.3			2	66.7
C18	Colon	9	7.5	7	77.8			2	22.2
C19–C20	Rectum	7	5.8	4	57.1			3	42.9
C21	Anus/canal	2	1.7	1	50.0			1	50.0
C22	Liver	3	2.5					3	100.0
C25	Pancreas	3	2.5					3	100.0
C32	Larynx	1	0.8					1	100.0
C33–C34	Lung	13	10.8	4	30.8	2	15.4	7	53.8
C43	Malign. melanoma	2	1.7	1	50.0	1	50.0		
C44	Skin others	7	5.8	5	71.4			2	28.6
C60	Penis	4	3.3					4	100.0
C61	Prostate	35	29.2	23	65.7	5	14.3	7	20.0
C64	Kidney	5	4.2	2	40.0	1	20.0	2	40.0
C65	Renal pelvis	1	0.8	1	100.0				
C67	Bladder	7	5.8	3	42.9			4	57.1
C70–C72	CNS cancer	2	1.7					2	100.0
C73	Thyroid	1	0.8	1	100.0				
C76–C79	CUP	2	1.7	1	50.0			1	50.0
C81	Hodgkin lymphoma	1	0.8	1	100.0				
C82–C85	NHL	7	5.8	3	42.9	1	14.3	3	42.9
C90	Mult. myeloma	1	0.8					1	100.0
All further malignancies		120	100.0	59	49.2	10	8.3	51	42.5

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 further malignancy.

Table 15

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

Age at death Years	Cases n	Age-spec. mortality	MI-index	Prop. all cancers %
0- 4		0.0		
5- 9		0.0		
10-14		0.0		
15-19		0.0		
20-24		0.0		
25-29		0.0		
30-34		0.0		
35-39		0.0		
40-44	1	0.0	0.09	0.2
45-49	5	0.2	0.31	0.4
50-54	4	0.2	0.18	0.2
55-59	7	0.3	0.20	0.2
60-64	12	0.7	0.29	0.2
65-69	15	0.9	0.30	0.2
70-74	18	1.2	0.31	0.2
75-79	18	1.5	0.42	0.2
80-84	18	2.5	0.56	0.2
85+	13	2.8	0.54	0.2
All ages	111			0.2
Mortality				
Raw		0.3	0.33	
WS		0.2	0.29	
ES		0.2	0.31	
BRD-S		0.3	0.33	
PYLL-70				
per 100,000		1.5		
ES		1.2		
AYLL-70		9.7		

* See corresponding tables with multiple malignancies.

Table 16

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

Age at death Years	Cases n	Age-spec. mortality	MI-index	Prop. all cancers %
0- 4		0.0		
5- 9		0.0		
10-14		0.0		
15-19		0.0		
20-24		0.0		
25-29		0.0		
30-34		0.0		
35-39		0.0		
40-44	1	0.0	0.09	0.2
45-49	4	0.1	0.31	0.3
50-54	3	0.1	0.14	0.1
55-59	6	0.3	0.20	0.2
60-64	6	0.3	0.18	0.1
65-69	12	0.7	0.27	0.2
70-74	16	1.1	0.31	0.2
75-79	14	1.2	0.39	0.2
80-84	12	1.7	0.46	0.2
85+	9	1.9	0.41	0.2
All ages	83			0.2
Mortality				
Raw		0.3	0.28	
WS		0.1	0.25	
ES		0.2	0.26	
BRD-S		0.2	0.28	
PYLL-70				
per 100,000		1.1		
ES		0.9		
AYLL-70		10.0		

* See corresponding tables with multiple malignancies.

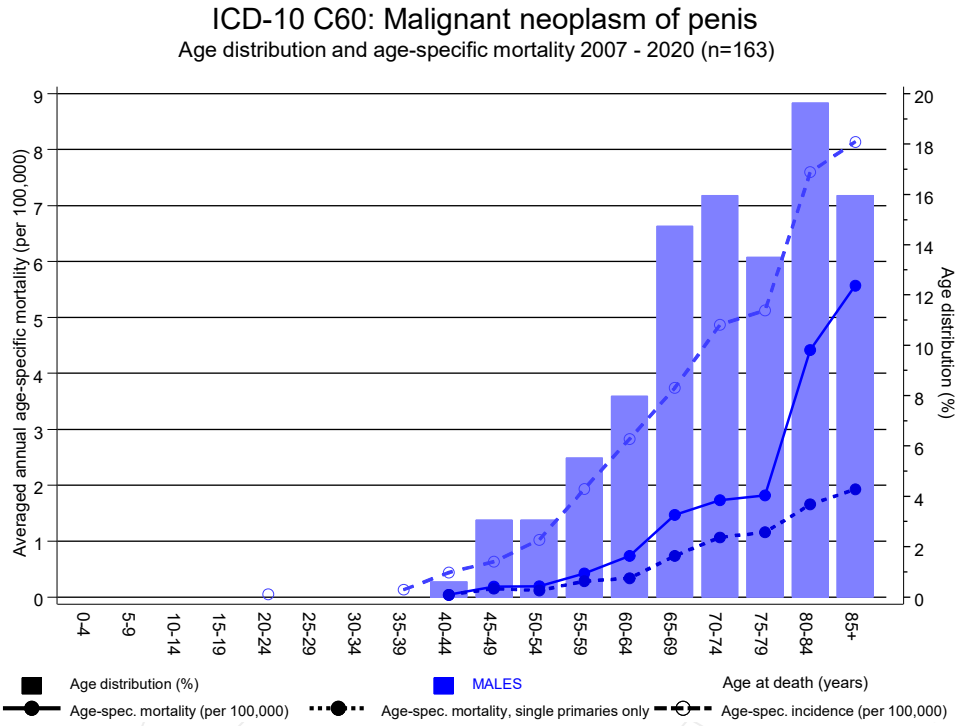

Figure 17. Distribution of age at death (bars; mean=70.2 yrs, median=70.4 yrs) and age-specific mortality (all patients: solid line, patients with single primaries: dotted line). The age-specific incidence is additionally plotted for comparison (dashed line).

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

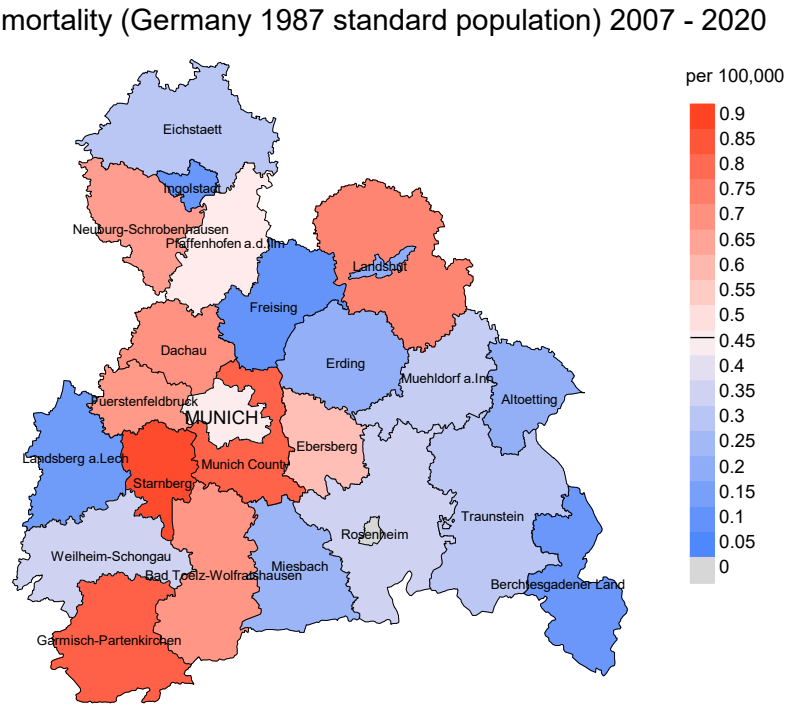

Figure 18a. Map of cancer mortality (german standard population) by county averaged for period 2007 to 2020. According to their individual mortality rates, the counties are displayed in different red and blue hues, being the fine white color attributed to the population mean (0.5/100,000 WS N=163).

The results should be interpreted with caution! E.g., in county Ebersberg with a population of 66,702 male residents (averaged) in the period from 2007 to 2020 a total of 6 men died from penile cancer. Therefore, the mean mortality rate for this cancer type in this area can be calculated at 0.6/100,000 (german standard population). Though, the value of this parameter may vary with an underlying probability of 99% between 0.1 and 1.6/100,000.

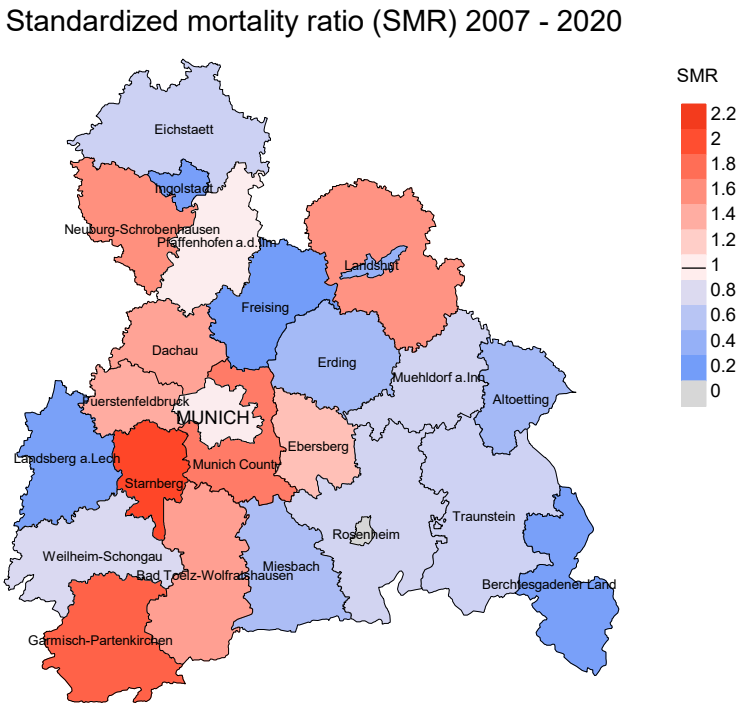

Figure 18b. Map of standardized mortality ratio (SMR, incl. DCO cases) by county averaged for period 2007 to 2020. According to their individual SMR values, the counties are displayed in different red and blue hues, being the fine white color attributed to the population overall of 1.0 (N=163).

The results should be interpreted with caution! E.g., in county Ebersberg with a population of 65,991 male residents (averaged) in the period from 2007 to 2020 a total of 6 men died from penile cancer. Therefore, the mean standardized mortality ratio (SMR) for this cancer type in this area can be calculated at 1.29. Though, the value of this parameter may vary with an underlying probability of 99% between 0.33 and 3.37, and is therefore not statistically striking.

Statistical Notes

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

1. **All multiple primaries included**

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

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

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

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

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

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

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

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

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

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

Shortcuts

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

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