Nationale Krebsregistrierungsstelle
Organe national d'enregistrement du cancer
Servizio nazionale di registrazione dei tumori
National Agency for Cancer Registration

Cancer Incidence and Mortality in Switzerland presented by the National Agency for Cancer Registration (NACR)

Data and methods

1 Data sources

- The registration of cancers in Switzerland is organised at the cantonal level by the cancer registries (CRs). The data is collected and aggregated at the National Agency for Cancer Registration (NACR). The NACR is operated by the National Institute for Cancer Epidemiology and Registration (NICER). The data currently available online is composed of the data provided by 13 cancer registries, covering 23 cantons.
- The Cause of Death Statistics (CD) of the Swiss Federal Statistical Office (SFSO) records all deaths of persons resident in Switzerland.
- Mid-year population estimates were provided by the SFSO referring to all persons with permanent residence status in Switzerland.

2 General methodology

2.1 The calculation of rates and confidence intervals

All rates are presented as crude and age standardized rates (ASR) per 100,000 person-years (person-years at risk). Age-standardized rates were calculated using the European standard population (Waterhouse et al, 1976) as the reference population (direct method). The associated 95% confidence intervals (95% CI) were produced using the gamma method (Fay and Feuer, 1997).

References:

Waterhouse J, Muir CS, Correa P, Powell J, eds. Cancer incidence in five continents. Lyon: IARC, *1976*: 465.

Fay MP, Feuer EJ. Confidence intervals for directly standardized rates: a method based on the gamma distribution. Statistics in Medicine 1997, Apr 15; 16(7):791-801

2.2 The formation of the language regions

For reporting purposes we created two language regions (French-/Italian-speaking and German-speaking) based on cantonal borders. The cantons of Fribourg, Geneva, Jura, Neuchâtel, Ticino, Valais and Vaud form the French and Italian speaking region (presented combined). The remaining 19 cantons were combined to form the German-speaking region. This categorisation was based on the language spoken by the majority of the population within a canton. It serves only as an approximation of natural language regions (borders based on actual language-spoken) since some cantons have portions of their populations belonging to both categories.

3 Incidence statistics

3.1 Registration of new cancer cases in Switzerland

Share of the population covered by a cantonal cancer registry

Time period	German speaking region	French and Italian speaking region	Whole of Switzerland
1988-1992	45.7%	68.4%	52.2%
1993-1997	46.7%	76.7%	55.3%
1998-2002	46.6%	85.3%	57.8%
2003-2007	46.7%	91.9%	59.9%
2008-2012	53.6%	100.0%	67.4%
2013-2017	88.0%	89.7%	88.5%

The cantonal registries record all incident cancer cases diagnosed in their resident population with one exception: the cancer registry of Basel-Stadt and Basel-Landschaft excluded systematically incident cases of residents of the Laufen District from cancer registration up to including 2013. Since 1994 Laufen District is one of the five districts of the canton of Basel-Landschaft. Prior to 1994, it was a district of the canton of Bern. Hence, the population of Laufen District was subtracted from the cantonal population of Basel-Landschaft for the calculations of incidence rates for the respective years. The population of the Laufen District accounts for approximately 7% of the whole population of the canton of Basel-Landschaft.

3.2 Data quality

The published trends may have been influenced by the gradual introduction of cancer registration. The incidence data for the cantons of Valais and Grisons were first collected in 1989, for the cantons of Glarus in 1992, Ticino in 1996, Jura in 2005, Fribourg in 2006, Lucerne in 2010, Nidwalden, Obwalden, Uri and Zug in 2011, Thurgau in 2012, Aargau in 2013 and Bern in 2014. The cantons of Solothurn, Schaffhausen and Schwyz started cancer registration after the evaluation period.

For the year 2017, data from the cancer registries of Geneva and Vaud were not available at the time of the statistical analysis. The aggregation of all available data helps to improve

representativeness over time, but may limit comparability over time.
Until 2020, the legal basis for cancer registration was regulated to varying degrees at cantonal level, which may have led to limited data access in some cases.

It is common practice to match cancer death certificates systematically against incidence data at registry level to capture missing cancer cases (death certificate only registration (DCOs), death certificate notifications (DCNs). Nevertheless, in some registries, a complete and systematic matching was not carried out for all years covered by registration. The respective years by canton/registry with no or incomplete matching are listed below:

- Basel-Stadt & Basel-Landschaft: 1981-2012
- For the canton of Zurich, the cancer registry of Zurich and Zug confirmed complete and systematic matching of incident cases and death records since incidence year 1997 (first available data: 1980). Whether matching was done entirely or only in part for the previous time period (1980-1996) could no longer be determined.

A registry's data quality is influenced by, among other factors, the completeness of the registered data. This is defined as the proportion of new cases occurring within a population, that were recorded by the registry covering that population. Completeness of registration of incident cancer cases should be as close to 100% as possible, so that comparisons of incidence rates between time period or regions can reflect true differences in cancer risk. Therefore, various indicators have been proposed to measure completeness of cancer registration. Currently, the results of three completeness indicators by cancer registry for selected cancers sites are provided as downloadable files.

- Proportion of death certificate only cases (%DCO) (.xlsx)
  Death certificates provide an important supplementary source of information for cancer registries. They function as a means of capturing information on cases that escaped the registration process during life. An elevated %DCO is suggestive of incompleteness. (Cancer Incidence in Five Continents, Vol. IX, p. 69).
- Proportion of cases microscopically verified (%MV)(.xlsx)
  The main value of the proportion of cases microscopically/histologically verified is an indicator of the validity of the diagnostic information. However, a very high proportion of cases diagnosed by cytology/histology (higher than might be reasonably be expected) suggest over-reliance on the pathology laboratory as a source of information, and failure to find cases diagnosed by other means (Cancer Incidence in Five Continents, Vol. IX, p. 69).
- Mortality-Incidence Ratio (.xlsx)
  This ratio is an important indicator of completeness comparing the number of deaths provided by the Swiss Federal Statistical Office (SFSO) with the number of new case obtained from cantonal cancer registries in the same period of time. Ratios greater than expected lead to a suspicion of incompleteness, especially if it is so for several different cancer sites (Parkin and Bray, 2009).

References:

Cancer Incidence in Five Continents, Vol IX. Lyon: IARC/WHO, 2007. IARC/WHO Scientific Publications No. 160.

D. M. Parkin and F. Bray. Evaluation of data quality in the cancer registries: Principles and methods Part II. Completeness. European Journal of Cancer 2009**;** 45, 756-764.

3.3 Inclusion criteria

Included are all malignant primary cancer cases with the exception of non-melanotic skin cancers (C00-43, C45-97, ICD-10). Primary cancers are selected following the rules of the IARC/IACR and ENCR (http://www.iacr.com.fr/images/doc/MPrules_july2004.pdf).

3.4 Estimation of incident cases and rates - language regions and whole of Switzerland

The average incidence rate is calculated for each language region (German-speaking Switzerland and French- and Italian-speaking Switzerland) by pooling cases from the relevant registries and their populations. This rate is determined separately by five-year age group, sex and cancer site. It is applied to the entire region assuming homogeneity of data between the geographical areas that are covered and those that are not covered. The Swiss estimate published by the Federal Statistical Office and NICER corresponds to the sum of estimated cases for each language region.

4 Mortality statistics

4.1 Cause of Death Statistics

The Cause of Death Statistics has existed since 1876 and has been available in electronic form since 1969. It is based on civil registries and on death certificates indicating the causes of death which are completed by the physicians who declare the death. The coding of death certificates and the selection of the underlying cause of death is carried out by the SFSO for the whole of Switzerland. The underlying cause of death is the one to be adopted as the cause for tabulation of mortality statistics.

4.2 Inclusion criteria

All deaths caused by malignant cancer (underlying cause of death as coded by the SFSO) (C00-C97, ICD-10).

4.3 Coding changes in 1995

Up to 1994 causes of death were coded according to the eighth revision of the International Classification of Diseases, Injuries and Causes of Death (ICD-8). Since 1995 the coding system of the tenth revision has been used. In addition, the coding rules were adjusted to the international standards. Before 1995, the definition of the underlying cause of death deviated from international standards, giving priority to causes according to national rules (e.g. poisoning and trauma, flu and cancer). In practice, the cause of death was 'cancer' if the word 'tumour' was found either as primary (underlying) cause or as associated cause, unless accident, poisoning, trauma or flu were mentioned elsewhere in the death certificate. As a consequence, trends in time series have to be interpreted with caution as rates prior 1995 are likely to be biased by an overestimation (Lutz et al., 2004, Schmidlin et al., 2013).

References:

Manual of the Eighth Revision of the International Statistical Classification of Diseases, Injuries and Causes of Death (ICD-8). Geneva. Geneva, Switzerland: World Health Organisation; 1967.

International Statistical Classification of Diseases and Related Health problems, 10th Revision, Geneva. Geneva, Switzerland: World Health Organisation; 1992.

Von Generation zu Generation: Entwicklung der Todesursachen 1970 bis 2004. Bern, Switzerland: Swiss Federal Statistical Office; 2008.

Lutz JM, Pury P, Fioretta G, Raymond L. The impact of coding process on observed cancer mortality trends in Switzerland. European journal of cancer prevention : the official journal of the European Cancer Prevention Organisation. 2004;13(1):77-81.

Schmidlin K, Clough-Gorr KM, Spoerri A, Egger M, Zwahlen M, Swiss National C. Impact of unlinked deaths and coding changes on mortality trends in the Swiss National Cohort. BMC medical informatics and decision making. 2013;13:1. Epub 2013/01/08.

5 Glossary

Age-specific rate

The age-specific rate is calculated by dividing the number of new cancers or cancer deaths observed in a given age category (generally five-year age groups) during a given time period by the corresponding number of person years in the population at risk in the same age category and time period. For cancer, the result is usually expressed as a rate per 100,000 person-years.

ASR (age-standardized rate)

An age-standardized rate (ASR) is a summary measure of the rate that a given population would have if it had a standard age structure. Standardization is necessary when comparing several populations that differ with respect to age because age has a powerful influence on the risk of cancer. The ASR is a weighted mean of the age-specific rates; the weights are given by population distribution of a standard population. One frequently used standard population is the European Standard Population. The calculated incidence or mortality rate is then called age-standardized incidence or mortality rate (European standard). It is also expressed per 100,000.

Age-distribution of the European standard population 1976

Age group	European standard population
0-4	8,000
5-9	7,000
10-14	7,000
15-19	7,000
20-24	7,000
25-29	7,000
30-34	7,000
35-39	7,000
40-44	7,000
45-49	7,000
50-54	7,000
55-59	6,000
60-64	5,000
65-69	4,000
70-74	3,000
75-79	2,000
80-84	1,000
85+	1,000
Total	100,000

References:

Waterhouse J, Muir CS, Correa P, Powell J, eds. Cancer incidence in five continents. Lyon: IARC, *1976*: 465.

Crude rate

A crude (unadjusted) rate is calculated by dividing the number of new cancers or cancer deaths observed during a given time period by the corresponding number of person-years in the population at risk. For cancer, the result is usually expressed a rate per 100,000 persons at risk.

Death certificate only (DCO)

A reportable case first identified as a non-matched cancer death during death clearance that the death certificate is the only source of information. Trace-back (TB) activities did not identify other source documents to confirm the diagnosis or the date of diagnosis.

Death certificate notification (DCN)

A new incident case first identified as a non- matched cancer death during the death clearance process. Confirmation of diagnosis from a recognized medical practitioner and date of diagnosis are identified through trace-back (TB) activities.

Incidence

Incidence is the number of new cases arising in a given period in a specified population. This information can only be collected by population-based cancer registries. It can be expressed as an absolute number of cases per year or as a rate per 100,000 persons per year.

Mortality

Mortality is the number of deaths occurring in a given period in a specified population. It can be expressed as an absolute number of deaths per year or as a rate per 100,000 persons per year.

Population at risk

The population at risk is the population susceptible to develop a specific cancer. It is counted in person-years. Population at risk is the ‘denominator’ for calculating rate. Mid-year population estimates are usually used to calculate cancer incidence/mortality rates.

Trace-back (TB)

The process of actively searching for additional information on potential incidence cases from sources such as hospitals, certifying physicians, nursing homes, other health care practitioners and facilities.

Underlying cause of death

The underlying cause of death refers to the disease or injury that initiated the train of morbid events leading directly to death or the circumstances of the accident or violence that produced the injury. The underlying cause of death is the one to be adopted as the cause for tabulation of mortality statistics.