ANNUAL REPORT

2025

Cancer in Norway

Technical Supplement: Statistical Methods

NIPH
Norwegian Institute of Public Health

Cancer in Norway 2025

Technical Supplement: Statistical Methods

Cancer Registry of Norway

Department of Registration

6th May 2026

1 Statistical methods

1.1 Target readership

The target readership for this technical supplement include statisticians and cancer epidemiologists.

1.2 Incidence and mortality rates

Rates are used to measure the frequency at which an event occurs in a defined population during a defined time period. Rates facilitate comparisons across groups of different sizes. Let d and Y denote the number of events and the number of person-years in the population, respectively. In Cancer in Norway 2025 (CiN2025) the mid-year population Y is calculated as the arithmetic mean of the population at the start and end of each calendar year. If the interest lies in calculating a rate over a period of more than one year, we first calculate the annual mid-year population, and then aggregate to determine the total number of person-years.

Rates are reported both as age-specific rates and age-standardised rates (ASR) per 100,000 person-years. The population is divided into 20 distinct five-year age groups. Let d_i and Y_i denote the number of events and the total number of person-years, respectively, for age group i. The age-specific rate r_i per 100,000 person-years, for age group i is then given by

$$r_i = \frac{d_i}{Y_i} \cdot 10^5$$

The age-standardised rate is calculated as

$$ASR = \frac{\sum_{i=1}^{20} w_i r_i}{\sum_{i=1}^{20} w_i}$$

where w_i is a weight, for age group i, given by the reference population.

The population weights for the World Standard Population and the Norwegian 2025 population are given in the table below. The World Standard Population has 18 age groups with the final age group, 85+. The World Standard Population places a higher weight on younger age groups and a lower weight on older age groups compared to the 2025 Norwegian population.

i	Age	Norway (2025)	Age	World (Doll/Segi)
1	0-4	4910	0-4	12000
2	5-9	5306	5-9	10000
3	10-14	5789	10-14	9000
4	15-19	6107	15-19	9000
5	20-24	5967	20-24	8000
6	25-29	6564	25-29	8000
7	30-34	7035	30-34	6000
8	35-39	7040	35-39	6000
9	40-44	6586	40-44	6000
10	45-49	6334	45-49	6000
11	50-54	6720	50-54	5000
12	55-59	6635	55-59	4000
13	60-64	5907	60-64	4000
14	65-69	5322	65-69	3000
15	70-74	4659	70-74	2000
16	75-79	4170	75-79	1000
17	80-84	2698	80-84	500
18	85-89	1439	85+	500
19	90-94	619	-	-
20	95+	193	-	-
Sum		100,000		100,000

1.3 Cumulative risk

Cumulative risk (CR) is an estimate of the risk of developing a certain type of cancer by a given age. In CiN2025 CR is estimated up to the age of 80. It is defined as

$$CR = 1 - e^{-\left(5 \sum_{i=1}^{N} r_i\right)}$$

where i denotes age group and N denotes the number of age groups used.

1.4 Prevalence

Prevalence is calculated as the number of people in the population that are alive and have been diagnosed with the cancer of interest at some point during their lifetime.

1.5 Relative survival (net survival)

Estimation was restricted to patients younger than 90 year at diagnosis. Estimation was not performed if the number of patients in the group to be analysed was less than 30.

To estimate net survival the Pohar Perme estimator (Perme *et al*, 2012) was used, applying the Stata command `stpp Version 1.4.8 2026-03-03` (Lambert and Rutherford, 2026). National general population life table by sex, year and age (annual) was used to provide the expected mortality rates. Age standardisation was performed using the Brenner method (Brenner *et al.*, 2004) applying individual weights (Rutherford *et al.*, 2020). The weights used were based on the age distribution of the group to be analysed in the last five-year period, 2021–2025. For all sites combined, sex specific weights were used, while for all other sites, weights were based on the combined male and female age distribution.

From five to three age groups were used for defining weights. The following preference rules were used to derive weights depending on data:

1. Weights based on age distribution quintiles if there were a minimum of three patients at the start of follow-up in each age group.
2. Weights based on age distribution quartiles if there were a minimum of three patients at the start of follow-up in each age group.
3. Weights based on age distribution tertiles if there were a minimum of three patients at the start of follow-up in each age group.

Estimation was not performed if failing the last criterion above, or the group to be analysed had less than 30 patients at start follow-up.

When plotting estimates without confidence intervals:

1. Estimates are not shown after the point there were less than 20 patients still at risk.
2. For the age group 80–89 estimates were plotted up to 10 years only.

The `stpp` command estimates net survival at every unique death/censoring time, but for plotting purposes estimates are stored at yearly intervals.

1.5.1 Period analysis

Relative survival for the most recent five year calendar period, 2021–2025 was estimated using the *period approach* (Brenner and Rachet, 2004). The principle of this approach is to fix an observation window, we used 2021–2025, and use all survival experience that occurs within this window in the estimation. This means that patients are left-truncated at the start of the window and right-censored at the end of the window. For five-year relative survival patients diagnosed before 2016 are included in the analyses, but only with their survival experience occurring from January 1st 2021.

1.5.2 Trends in relative survival

The trends in relative survival shown in Chapter 8 were obtained following the rules outlined above. To increase robustness point estimates were calculated using survival experience from a larger time period. For years of diagnosis where we have complete five year follow-up (up to and including 2020) the *cohort approach* was used. That is, the five-year relative survival for 2020 was estimated using patients diagnosed in the period 2016–2020. The five-year estimate for 2019 was estimated using patients diagnosed 2015–2019.

Five-year relative survival for the last year (2025) was estimated using the *period approach* described in the previous subsection.

For the years 2021–2024 we use a combination of the cohort and period approaches, a *hybrid approach*. This is implemented by defining a time window, similar to the observation window described for the period approach. Patients diagnosed within the window contribute with all available survival time. Patients diagnosed before the start of the time window have their survival time left-truncated at the start of the time window. Patients diagnosed after the end of the time window are not included in the analyses. For example, the five-year relative survival estimate for 2021 is based on the survival experience from all patients diagnosed in the time window 2017–2021. In addition, all survival experience occurring from January 1st 2017 for patients diagnosed 2012–2016 are included. The idea behind the hybrid approach is that the incomplete survival for patients diagnosed within the time window, in the example this means patients diagnosed in 2021, are compensated by borrowing survival experience from patients diagnosed before the start of the time window.

1.5.3 Crude probabilities

Crude probabilities of death for cancer and other causes were estimated in the relative survival framework where other cause mortality rates are assumed to be the same as expected rates in the general population (Cronin and Feuer, 2000). The crude probability of death due to cancer and other causes sum to give the all-cause probability of death. Results are presented as percentages rather than proportions at five years after diagnosis. Estimates were obtained using the Stata command `stpp Version 1.4.8 2026-03-03`.

1.6 Completeness

Completeness was estimated using the capture-recapture method described in Parkin and Bray (Parkin and Bray, 2009).

This method has been used to estimate the size of a population, and is widely used in field biology to estimate the size of a closed animal population. In that purpose, and briefly explained, animals are captured, marked and released, followed by a new catch (recapture). The number of captured animals in the first catch, the number of new animals in the second catch and the number of recaptured animals are used to estimate the number of uncaught animals.

When this method is used to estimate completeness in a cancer registry context, we assume that cases are registered by two different data sources. Cases registered on pathology reports and/or death certificates (source A) is the first 'catch', and cases registered on clinical notifications (source B) is the second 'catch'. The number of cases registered in source A and/or B is illustrated in the table below.

		Source B	
		Yes	No
Source A	Yes	n_{11}	n_{10}
	No	n_{01}	n_{00}

The completeness (Comp) is then calculated by the following formula:

$$\widehat{Comp} = \frac{n_{11} + n_{10} + n_{01}}{(n_{10} + n_{11}) \cdot \frac{(n_{01}+n_{11})}{n_{11}}}$$

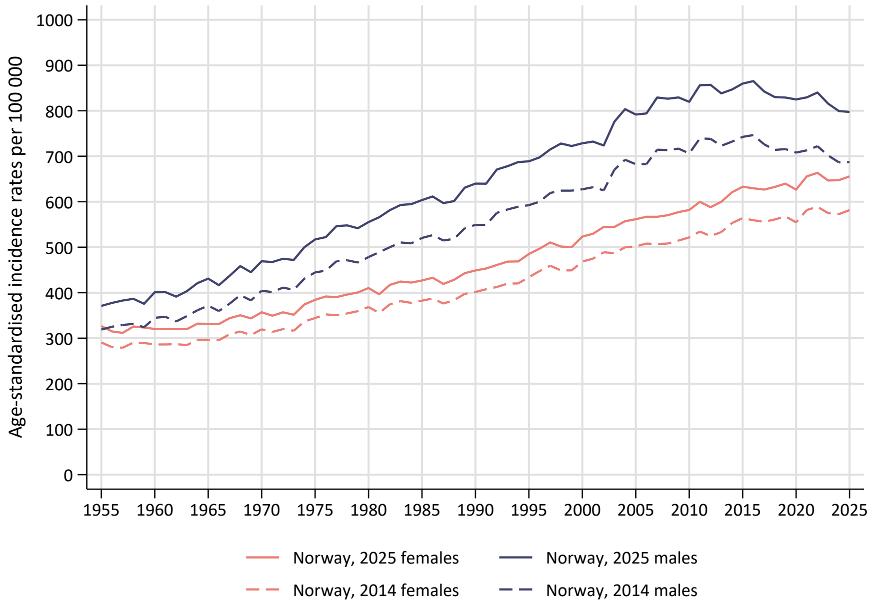
1.6.1 Changes from previous publication (CiN2024)

Incidence and mortality rates:

In CiN2025, the standard population used for age standardisation is the Norwegian 2025 population, stratified into 20 age groups. The Norwegian 2025 population is older than the previously used Norwegian 2014 standard population. The table below presents the Norwegian 2025 and 2014 populations together with the World standard population (Doll/Segi), including their corresponding cumulative percentages (CP).

i	Age	Norway (2025)	Norway (2014)	World (Doll/Segi)	CP Norway (2025)	CP Norway (2014)	CP World (Doll/Segi)
1	0-4	4910	6039	12000	4.9	6.0	12.0
2	5-9	5306	6102	10000	10.2	12.1	22.0
3	10-14	5789	5993	9000	16.0	18.1	31.0
4	15-19	6107	6349	9000	22.1	24.5	40.0
5	20-24	5967	6681	8000	28.1	31.2	48.0
6	25-29	6564	6770	8000	34.6	37.9	56.0
7	30-34	7035	6690	6000	41.7	44.6	62.0
8	35-39	7040	6670	6000	48.7	51.3	68.0
9	40-44	6586	7296	6000	55.3	58.6	74.0
10	45-49	6334	7207	6000	61.6	65.8	80.0
11	50-54	6720	6492	5000	68.4	72.3	85.0
12	55-59	6635	6108	4000	75.0	78.4	89.0
13	60-64	5907	5575	4000	80.9	84.0	93.0
14	65-69	5322	5369	3000	86.2	89.3	96.0
15	70-74	4659	3702	2000	90.9	93.0	98.0
16	75-79	4170	2663	1000	95.1	95.7	99.0
17	80-84	2698	2063	500	97.7	97.8	99.5
18	85-89	1439	2231	500	99.2	100.0	100.0
19	90-94	619	-	-	99.8	-	-
20	95+	193	-	-	100.0	.	-
		100,000	100,000	100,000			

The figure show trends in ASR incidence for all cancer combined using the 2025 and 2014 standard populations.



Survival:

All survial estimates in CiN2025 are produced using `stpp Version 1.4.8 2026-03-03`. In CiN2024 `stnet` was used for most survival estimates.

2 References

Doll R, Payne P, Waterhouse J. (Eds) Cancer Incidence in Five Continents: A Technical Report. Springer-Verlag (for UICC), Berlin, 1966.

Perme P, Stare M, Estève J. On estimation in relative survival, Biometrics 2012; 68(1):113–20.

Lambert PC, Rutherford MJ. The stpp command for marginal relative survival and related measures, The Stata Journal 2026;1;7–37.

Brenner H, Arndt V, Gefeller O, Hakulinen T. An alternative approach to age adjustment of cancer survival rates Eur. J. Cancer 2024;40(15):2317–2322

Brenner H, Rachet B. Hybrid analysis for up-to-date long-term survival rates in cancer registries with delayed recording of incidence cases. Eur. J. Cancer 2024;40:2494–2501.

Rutherford M J, Dickman P W, Coviello E, Lambert P C. Estimation of age-standardized net survival, even when age-specific data are sparse. Cancer Epidemiology 2020;67:101745.

StataCorp. 2024. Stata Statistical Software: (StataNow/MP) Release 19.5. Revision 18 Feb 2026. College Station, TX: StataCorp LLC.

Statistical Methods in Cancer Research. Volume IV - Descriptive Epidemiology IARC Scientific Publications No. 128 Edited by Jacques Esteve, Ellen Benhamou, Luc Raymond. Lyon, 1994. http://publications.iarc.fr/_publications/media/download/3552/d7b5950a320bdfab86b18a7dd79678d88e9bbde2.pdf

Statistics Norway, Statistics Norway provides statistics on population size each year, www.ssb.no/befolkning/statistikker/folkemengde.

Cronin K A, Feuer E J. Cumulative cause-specific mortality for cancer patients in the presence of other causes: a crude analogue of relative survival. Statistics in Medicine 2000;19:1729–1740

Norwegian Institute of Public Health

Published by the Norwegian Institute of Public Health
Cancer Registry of Norway
[May 2026]
PO Box 5313 Majorstua
N-0304 Oslo
Tel.: (+47) 21 07 70 00
The report can be downloaded as a pdf at
www.fhi.no/kreft