CANCER
Registry of Norway
INSTITUTE OF POPULATION-BASED CANCER RESEARCH

Cancer in Norway 2014

Cancer incidence, mortality,
survival and prevalence in Norway

Special issue:
Catch-HPV

Cancer in Norway 2014

Editor-in-chief: Inger Kristin Larsen
Writing group: TB Johannesen, TK Grimsrud, IK Larsen, S Larønningen, B Møller, TE Robsahm, G Ursin
Coding staff: TV Antonsen, I Asklie, I Aune, HH Brenn, ØL Carlsen, M Dahl, AH Dahlen, K Eik, L Enerstvedt, I Forberg, SEO Frøland, Y Gjelsvik, K Grape, MN Haneborg, S Hansen, I Hatle, IH Heien, I Herredsvela, M Johansen, G Kjølberg, KO Knudsen, T Kristiansen, T Lane, HK Lie, TL Lindvik, KL Nilsen, S Nymoen, T Nygård, SS Olsen, AV Owren, M Schoultz, AH Seglem, LB Skard, IB Skaaret, IB Stange, A Sørstrøm, L Thyssell, A Tysvær, K Østby
Data management and analyses: Aa Johansen, S Larønningen, TÅ Myklebust, A Skog, B Sæther, SE Tysvær and B Aagnes
Layout and design: Gunther Zerener
Correspondence to: Inger Kristin Larsen - inger.kristin.larsen@kreftregisteret.no

Recommended reference:
Cancer Registry of Norway. Cancer in Norway 2014 - Cancer incidence, mortality, survival and prevalence in Norway. Oslo: Cancer Registry of Norway, 2015.

Special issue: Catch-HPV

Editor-in-chief: Mari Nygård
Writing group: EA Burger, E Enerly, B Engesæter, BT Hansen, E Jakobsen, S Kjær, TR Lopez, S Lönnberg, C Munk, M Nygård, M Orumaa, S Sen and S Campbell
Layout and design: Gunther Zerener

Recommended reference: Authors, Article title. In: Cancer in Norway 2014 - Cancer incidence, mortality, survival and prevalence in Norway. Oslo: Cancer Registry of Norway, 2015

ISBN: 978-52-90343-91-4

ISSN: 0332-9631

General requests for cancer information, data or possible research collaborations are welcome,
and should be sent to datautlevering@kreftregisteret.no

Cancer in Norway 2014

Cancer incidence, mortality, survival and prevalence in Norway

Special issue
Catch-HPV:

Foreword

The Cancer Registry of Norway released the numbers for 2013 in March 2015. We are therefore very pleased to present the 2014 numbers as early as December 2015. This improvement in timeliness of the cancer data is due to increased online reporting from clinicians, combined with a concentrated coding effort, and improvements in the Cancer Registry infrastructure.

There is one major change in the 2014 report in how we report the incidence rates. This year, we have used a Norwegian Standard Population, rather than the World Standard Population to estimate age- standardised rates. The practical implications of this is that the rates presented in this report are more comparable with the crude rates in Norway, but direct comparison with rates in other countries becomes more cumbersome. The change was necessary because the discrepancy between the World Standard Population and our own population had become too large. The World Standard Population was an artificial population defined in the 1960s, where 56% of the population was assumed to be under 30 years of age, and only 4% above age 70. Such an age structure is very different from the one we see in Norway today, where a majority of the population is above 30 (62%) or 70 years of age (11%). Using the new Norwegian Standard Population we get a more realistic picture of a population where many individuals have passed 50, and thus belong to an age group where most of the cancers occur. For direct comparisons with incidence rates in other countries, we suggest that our readers consult one of several international databases created for this purpose.

Additionally, the rates in this report are not directly comparable to our previous Cancer in Norway reports, and they will for many cancers appear to be higher than previously published rates. In order to facilitate comparisons over time, we refer our readers to the joint Nordic cancer database, NORDCAN, or to the online versions of our own data.

When interpreting cancer rates, we emphasise that cancer incidence, mortality and survival rates must be considered simultaneously. Improved survival of a cancer can be caused by improved treatment, but also of increased diagnosis of low-grade tumours. Currently, there is a discussion of whether low-grade ductal carcinomas in situ of the breast could remain untreated. This is an intriguing discussion, on a road paved with challenges. We know there is a substantial heterogeneity of breast tumours, and the initial subtype classification may not always provide the whole picture. There is still much uncertainty as to how breast and other tumours develop over time, and an indolent low-grade tumour may become more aggressive. Thus, although diagnostic methods increasingly move the cancer diagnosis to an earlier point in time, and even though there is a potential for overdiagnosis and overtreatment, cancer is not always what it seems and certainly not a disease that should be ignored.

This year´s cancer rates show that lung cancer continues the slight decrease in men. In women, however, lung cancer rates are still on the rise in those above 65. Malignant melanoma and non-melanoma skin cancers continue their increase in both genders. All these cancer types are highly preventable, with substantial potential for improvement in the occurrence. For other cancers that have shown an increase, such as leukemia and non-Hodgkin lymphoma, we have no clear-cut explanation.

This year we proudly present a Special report on human papilloma virus, HPV. Our understanding of HPV-related cancers and how they can be prevented, has changed tremendously over the past decade. We have no specific HPV cure, and therefor prevention remains our most important weapon against this virus and the cancers it causes. A large thank you to Mari Nygård and her team who have contributed to the report.

Reports such as this one would not be feasible without the efforts of our colleagues in the hospitals who report the cancer cases, as well as the large number of staff at the Cancer Registry who code the cancers and assist with the development of this report. We thank everyone for their efforts in continuing to improve coding and the contents of our report.

Last, but not least, let us not forget that the report is based on the legal framework of the Cancer Registry. We are still waiting to see the final revisions of the European data protection framework. Cancer reporting is important, and can only be done correctly with a legal framework that allows for recording of disease using personal identifying information. This ensures that every case is counted, and only counted once. It is essential for the Norwegian Cancer Registry, as well as for the other Nordic registries, that the final adopted regulations are not too strict. We hope the European politicians understand the importance of these registries for public health in Europe and globally.

Oslo, December 2015

Giske Ursin
MD PhD
Director

Cancer in Norway 2014

Table of contents

List of tables

List of figures

Summary

In this annual report, the Cancer Registry of Norway (CRN) provides incidence data on different cancers and the latest survival data.

Incidence/Cumulative risk

A total of 31 651 new cancer cases were reported in 2014: 53.8 per cent were among men and 46.2 percent among women. The rates for 2014 show that cancer in prostate, lung, colon and bladder were the most common cancers in men, whereas breast, colon, lung cancer and malignant melanoma were the most common cancers in women. The relative impact of cancers, however, varies considerably by age. Among children (0–14 years of age), leukaemia and cancer in the central nervous system were the most common. These represent 56 per cent and 57 per cent of all cancer cases in boys and girls, respectively. In males aged 15–49 years, testicular cancer was the most common cancer, whereas prostate cancer was most common in middle aged and older men (50+). In females, cancer in the central nervous system and Hodgkin lymphoma were the most common cancer types among 15–24 years old. Among 25–69 years old women breast cancer was most common, and among the oldest women (70+) colon cancer was slightly more common than breast cancer.

Cancer trends should be interpreted by examining rates over the past several years. This is because there is some random variation in incidence rates from one year to another. Further, the numbers for 2014 might be slightly underreported due to delayed notification of cancer cases.

The incidence rate for all sites combined has increased by 2.6 per cent in men and 3.9 per cent in women when we compare the two most recent five-year periods (from 2005–2009 to 2010–2014).

For the most common cancers in men, the largest incidence increase in rates was observed for malignant melanoma, leukaemia, non-melanoma skin cancer and non-Hodgkin lymphoma. On the positive side, the rates for lung and bladder cancer showed a reduction.

For the most common cancers in women, the strongest increase occurred in incidence rates of thyroid cancer, malignant melanoma, lung cancer, non-melanoma skin cancer, leukaemia and non-Hodgkin lymphoma. A reduction in rates was seen for ovary, corpus uteri, and rectal cancer.

We suspect that the rather large reduction seen for cancers in the central nervous system in men and women, at least to some extent, is due to under-reporting of cases. Among the more uncommon cancers, we see a steady increase in the incidence of liver cancers.

The probability of being diagnosed with a cancer before the age of 75 is 36 per cent in men and 29 per cent in women.

Prevalence

At the end of 2014 more than 242 000 Norwegians were alive after having had at least one cancer diagnosis at an earlier point in time.

Mortality

There were 10 971 deaths from cancer in Norway in 2014. Cancer of the lung, colon, rectum, prostate and female breast account for 50 per cent of the cancer mortality.

Survival

From the period 2005–2009 to 2010–2014 the estimated five-year relative survival changed from:

- 89 to 91 per cent for prostate cancer
- 88 to 88 per cent for breast cancer in women

- 12 to 13 per cent for lung cancer in men
- 17 to 19 per cent for lung cancer in women

- 59 to 59 per cent for colon cancer in men
- 62 to 63 per cent for colon cancer in women

- 64 to 66 per cent for rectal cancer in men
- 65 to 66 per cent for rectal cancer in women

Table 1. Summary of cancer statistics for selected cancers

ICD10	Site	Sex	Number of new cases, 2014	Age-standardised incidence rates per 100 000 person-years, 2010–14	Percent change in age-standardised incidence from the previous five-year period, 2005–09	Percent diagnosed with localised disease, 2010–14	Age-standardised mortality rates per 100 000 person-years, 2014	Five-year relative survival (%), 2005–09	Five-year relative survival (%), 2010–14
C00–96	All sites	M	17 024	718.0	2.6	…	…	66.5	68.9
		F	14 627	539.5	3.9	…	…	67.1	68.5
C18	Colon	M	1 359	59.2	6.0	19.7	24.8	58.7	58.9
		F	1 442	51.4	3.9	19.1	20.3	61.5	62.8
C19–20	Rectum, rectosigmoid	M	798	33.4	0.5	28.3	10.4	63.5	66.2
		F	567	20.7	-1.1	32.8	6.2	64.6	66.0
C33–34	Lung, trachea	M	1 596	68.0	-2.1	22.3	51.8	11.8	13.2
		F	1 423	52.5	12.9	25.0	35	16.8	19.2
C43	Melanoma of the skin	M	1 015	42.2	28.0	87.2	7.7	75.6	79.0
		F	988	37.1	28.9	91.6	5.2	87	87.5
C44	Skin, non-melanoma	M	1 005	46.7	9.1	…	…	…	…
		F	917	31.0	12.0	…	…	…	…
C50	Breast	F	3 324	126.5	4.2	39.4*	23.5	87.8	88.0
C53	Cervix uteri	F	338	13.3	-0.5	60.3*	2.3	77.1	80.4
C54	Corpus uteri	F	727	27.1	-2.3	80.0	2.9	81.6	82.2
C56	Ovary	F	424	15.8	-7.3	22.5	10.6	43.0	44.5
C61	Prostate	M	4 889	203.3	0.3	64.0	54.6	88.9	90.8
C62	Testis	M	321	12.2	0.4	83.3	0.2	97.5	98.2
C66–68	Bladder, ureter, urethra	M	1 087	47.4	-4.4	84.4	12.2	72.4	73.1
		F	363	13.1	1.0	80.5	3.8	63.2	65.1
C70–72, D32–33	Central nervous system	M	457	18.4	-7.0	49.9**	…	59.3	58.4
		F	502	19.1	-16.9	69.2**	…	76.3	75.1
C73	Thyroid	M	114	4.5	26.7	53.0	…	84.6	89.2
		F	239	9.3	29.0	63.3	…	91.5	92.9
C82–85, C96	Non-Hodgkin lymphoma	M	539	22.5	8.3	…	6.7	63.7	68.5
		F	443	16.3	7.8	…	4.6	70.6	72.6
C91-95, D45–47	Leukaemia	M	545	22.9	9.6	…	7.3	58.7	59.8
		F	457	16.6	9.5	…	5.7	62.7	63.2

* Stage I
** Non-malignant

Definitions*

Incidence

The number of new cases (of disease) in a defined population within a specific period of time.

Incidence rate

The number of new cases that arise in a population (incidence) divided by the number of people who are at risk of getting cancer in the same period. The rate is expressed per 100 000 person-years. Person-years is a metric that combines persons and time (in years) as the denominator in rates.

Crude rate

Unadjusted rates, often estimated for the entire population, with no standardisation by age.

Age-specific rate

A rate calculated by age strata, often with five-year intervals.

Age-standardised rate

Age-standardised (or age-adjusted) incidence rates are summary rates that would have been observed, given the schedule of age-specific rates, in a population with the age distribution of a given population. For this report, we use the Norwegian mid-year population in 2014.

Prevalence

Prevalence is the number or proportion of a population that has the disease at a given point in time. In this report we use lifetime cancer prevalence that can be defined as the number of living individuals having ever been diagnosed with cancer.

Relative survival

The observed survival after a given period of time in a patient group, divided by the expected survival of a comparable group in the general population with respect to key factors affecting survival such as age, sex and calendar year of observation. Relative survival is thus determined by the mortality experienced by the patients regardless of whether an excess mortality may be directly or indirectly attributable to the disease under investigation. A key advantage is that it does not require cause-of-death information.

Conditional relative survival

The probability of surviving an additional number of years given that the person has already survived X years. As the time from diagnosis lengthens, this statistic becomes more informative to survivors than the conventional relative survival estimate. A five-year conditional relative survival that reaches close to 100% some number of years after diagnosis indicates that from thereon, there is little or no excess mortality in the patient group.

* All the definitions are based on Last, 2001

About this publication

List of the ICD-10 codes with included and excluded morphologies

The list below gives a detailed description of specific morphologies that are included or excluded in all cancer statistics presented in the present report.

Table 2. Description of the ICD-10 codes

ICD-10	Site	Comments
C00 - 96	All sites	Includes the following D-diagnoses; D32–D33, D35.2–35.4, D42–D43, D44.3–D44.5 and D45–47 Excludes all basal cell carcinomas
C38	Mediastinum, pleura	Excludes mesotheliomas (which are included in C45)
C56	Ovary	Excludes borderline tumours
C64	Kidney except renal pelvis	Excludes non-invasive papillary tumours
C65	Renal pelvis	Includes non-invasive papillary tumours
C66	Ureter	Includes non-invasive papillary tumours
C67	Bladder	Includes non-invasive papillary tumours
C68	Other and unspecified urinary organs	Includes non-invasive papillary tumours
C70	Meninges	Includes benign tumours (D32–33, D42–43)
C71	Brain	Includes benign tumours (D32–33, D42–43)
C72	Spinal cord, cranial nerves and other parts of central nervous system	Includes benign tumours (D32–33, D42–43)
C75	Other endocrine glands and related structures	Includes benign tumours (D35.2–35.4, D44.3–44.5)
C92	Myeloid leukaemia	Includes myelodysplastic syndrome (D46)
C95	Leukaemia of unspecified cell type	Includes polycythaemia vera (D45) and other unspecified tumours in lymphatic or hematopoietic tissue (D47)

Some of the D-codes are not included in the subsequent tables and figures due to lack of space.

Changes from the previous version

- Age-standardised incidence rates are calculated using the Norwegian mid-year population in 2014 as the standard population. This is a major change from previous reports of Cancer in Norway, where the World standard population (Segi, 1960; Doll & al, 1966) was used. Note that this alteration results in higher age-standardised rates than previous reported. Details are given in the *Data sources and Methods* section.

- Relative survival is now estimated using the Ederer II method with age-standardisation. This gives more correct estimates for long-term survival than using the Hakulinen method that were used in previous reports. Of note is that the estimates tend to be somewhat lower. Details are given in the *Data sources and Methods* section.

- The practice in Norway in earlier reports has been to register all extragonadal germ cell tumors on either C56 (Ovary) or C62 (Testis), This is now changed, and they are now registered at the organ where the pathologist/clinician stated it has originated.

- In previous reports basal cell carcinomas in other organs than skin have been included. In the present report, we have excluded all basal cell carcinomas, and this has led to a slightly lower number of cases.

- The coding of C57 (Other female genital) is changed according to the new pathology descriptions of serous tumours in Adnexa uteri, and has probably led to some higher rates for this site.

Purpose and intended audience

The aim of the annual publication of Cancer in Norway is to provide detailed cancer statistics.This publication should help health professionals, policy-makers and researchers to identify and make decisions about areas that need more attention and investigation. This publication may also be valuable for the media, educators and members of the public with an interest in cancer.

Data sources and Methods

The population of Norway

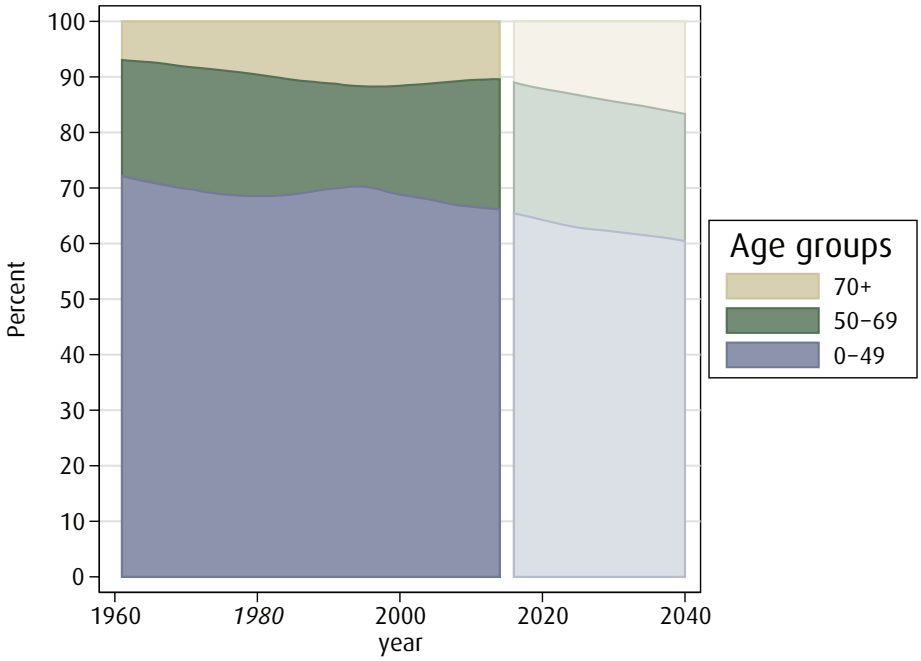
By 1st January 2015 the total number of inhabitants in Norway was nearly 5.2 million. The immigrant population (first-generation) comprises 13.0% of the total population, and an additional 2.6% are second-generation immigrants. About 49% of the first-generation immigrants are from EU/EEA, US, Canada, Australia and New Zealand, 28% from Asia (incl. Turkey), and 12% from Africa (Source: Statistics Norway).

Table 3 shows the age structure by sex for the Norwegian mid-year population in 2014, while Figure 1 shows the age structure of the Norwegian population over time from 1960 with projections up to 2040 (Source: Statistics Norway). The elderly will represent an increasingly large proportion of the population of Norway in the next decades. Long-term projections up to 2060 show that 20% of the population will be 70 years or older (Tønnessen & al, 2014). The population of Norway has increased since recording began, and this growth is expected to continue the next few decades. The total number of inhabitants in Norway has increased by 44% from 1960 to 2015, largely because of rising life expectancy and, more recently, due to increases in net immigration. By 2031, the size of the population is expected to increase to about 6 million, and by 2065 it will reach 7 million[1].

Table 3 Norwegian mid-year population 2014, by five-year age group and sex

Age group	Males	Females	Total	Weight (per 100 000)
00–04	159 154	151 102	310 255	6 039
05–09	160 637	152 856	313 493	6 102
10–14	157 241	150 631	307 872	5 993
15–19	168 028	158 128	326 156	6 349
20–24	176 217	167 036	343 253	6 681
25–29	176 877	170 952	347 828	6 770
30–34	177 067	166 640	343 707	6 690
35–39	176 906	165 780	342 686	6 670
40–44	193 044	181 721	374 765	7 296
45–49	191 027	179 225	370 252	7 207
50–54	171 267	162 268	333 535	6 492
55–59	159 267	154 545	313 812	6 108
60–64	144 314	142 076	286 390	5 575
65–69	137 419	138 420	275 839	5 369
70–74	91 579	98 590	190 168	3 702
75–79	61 848	74 977	136 825	2 663
80–84	44 003	61 964	105 967	2 063
85+	37 239	77 394	114 632	2 231

Figure 1. Age structure of the Norwegian population 1960–2040, considered the scenario for medium national growth



[1]Considered the scenario of medium national growth

About the Cancer Registry of Norway

The Cancer Registry of Norway (CRN) has, since 1952, systematically collected notifications on cancer occurrence for the Norwegian population. The registration has from 1953 been considered to be close to complete, and a comprehensive study on data quality estimates the completeness to be 98.8% for the registration period 2001–05 (Larsen & al, 2009). The reporting of neoplasms has been mandatory since the implementation of a directive from the Ministry of Health and Social Affairs in January 1952. The CRN Regulations came into force in 2002 (Regulations for the collection and processing of data in the CRN).

Main objectives

The main objectives of the Cancer Registry of Norway can be summarized as follows:

- Collect data on cancer occurrence and describe the distribution of cancer and changes over time.
- Provide a basis for research on the aetiology, diagnostic procedures, the natural course of the disease, and the effects of treatment in order to determine appropriate preventive measures and to improve the quality of medical care.
- Provide advice and information to public authorities and the general public about preventive measures.
- Perform epidemiological research of high international standard.

Data items registered

The following must be reported to the CRN:

- All malignant neoplasms and precancerous disorders.
- All benign tumours of the central nervous system and meninges.

The incidence registry

The incidence registry contains the basic data items collected from clinicians and pathologists, as well as data from administrative patient discharge records and mortality sources. As of November 1st 2015, the incidence registry contained information registered since 1953 on 1 743 361 cancer cases (including pre-malignant and some benign conditions) in 1 392 636 persons. The incidence registry is updated continuously with information on both new cases and cases diagnosed previous years. The present report is based on data from the incidence registry.

A total of 4 381 214 notifications have been registered since 1969 (earlier notifications were not registered individually).

Clinical registries

Clinical registries, i.e. comprehensive registration schemes dedicated to specific cancers, have been established to provide more detailed information about diagnostic procedures, pathology-examinations, treatment and follow-up. The aims are to provide data for monitoring patient outcome and survival and to be an empirical base for scientific studies concerning prognostic factors and treatment outcomes, as well as for evaluation of the quality of cancer care.

Several clinical registries are now established, and the ongoing and expanding activities of these clinical registries are a major focus for CRN. Each clinical registry has a reference group - a panel of multi-disciplinary experts from clinical and research milieus in Norway. These experts advise on the contents and operations of each clinical registry, and its strategic direction. Registries are integrated in the CRN's coding and registration activities. Table 4 shows the status of these clinical registries as of December 2015.

Table 4. Status of the clinical registries, December 2015

Clinical registry for	Clinical reference/ project group	Established with extended data*	Clinical parameters for electronical report specified	Electronical report form in use	National status
Colorectal cancer	Yes	Yes	Yes	Yes	2009
Malignant melanoma	Yes	Yes	Yes	Yes	2013
Breast cancer	Yes	Yes	Yes	Yes	2013
Prostate cancer	Yes	Yes	Yes	Yes	2009
Lymphomas and lymphoid leukaemias	Yes	Yes	Yes	Yes	2013
Lung cancer	Yes	Yes	Yes	Yes	2013
Childhood cancer	Yes	Yes	Yes	Yes	2013
Gynecological cancer**	Yes	Yes	Yes	Yes	2013
Hematological cancer	Yes	No	Yes	No	Applied for
Central nervous system	Yes	No	Yes	No	Applied for
Oesophagus and stomach cancer	Yes	Yes	Yes	Yes	Applied for
Testicular cancer	Yes	No	Yes	No	Applied for
Sarcoma	Yes	No	No	No	Applied for

* Either by having a separate clinical report form and/or by having a database with extended information beyond the incidence registry.
** Established for ovarian cancer, will be extended to include all gynecological cancers.

Notifications and sources of information

The sources of information and the notification process are illustrated in Figure 2. Hospitals, laboratories, general practitioners and the Cause of Death Registry provide the key information that enables the CRN to collect, code and store data on cancer patients in Norway. Information from clinical notifications, pathology reports and death certificates are the main sources. Information from the Norwegian Patient Registry is an important additional source for identifying cancer cases.

Clinical and pathological notifications

The CRN Regulations, as issued by the Ministry of Health and Social Affairs, require all hospitals, laboratories and general practitioners in Norway to report all new cases of cancer to the CRN within two months. The cases should be reported irrespective of whether the patient is treated, admitted, or seen only as an outpatient. Cancers in the clinical registries are reported on specific forms with extended information relevant for each cancer site (see clinical registries). In addition, there are two forms (clinical notifications) for reporting of the solid or non-solid tumours not yet included in a clinical registry. These forms provide information on primary site, stage of disease, the basis for the diagnosis and primary treatment given to the patient. Pathology reports from hospitals and independent laboratories provide histological, cytological or autopsy information. The information is identified and linked by the personal identification number system that was established in Norway in 1964.

Clinical notifications should be sent using the CRN electronical reporting service (KREMT) at the Norwegian Health Network. All hospitals are informed that this system has replaced paper forms by 1st July, 2015 (January 1st, 2016 for the primary health care). More information about KREMT can be found at http://kreftregisteret.no/no/Registrene/Innmelding-til-Kreftregisteret/KREMT---Kreftregisterets-elektroniske-meldetjeneste/

As of December 2015, most laboratories still send paper copies of the pathology reports. A major focus for the future is to have more laboratories send electronical and structured pathology reports to the CRN.

Death certificates

Records held in the CRN are supplemented with relevant information on vital status from the National Population Registry. Records are regularly linked with the Cause of Death Registry run by the Norwegian Institute of Public Health. CRN receives and registers the death certificates in one or several batches every year. The automated procedure that matches registered cancer cases to death certificates is important for maintaining quality control, facilitating a high level of completeness and ensuring validity of the CRN data items. Death certificates also represent a complementary source of information on new cancer cases which have not been reported previously, or where the diagnosis differs. Cancer cases first identified from death certificates are traced back to the hospital or physician responsible for the treatment of the patient to verify whether the patient

had been diagnosed when alive or post mortem. If diagnosed when alive, clinical notifications and copies of pathology reports should be sent to the CRN.

The Norwegian Patient Registry

Since 2002, the CRN has received data files from the Patient Administrative Data System (PAS) used in all Norwegian hospitals. These files contain information about patients who have been treated for premalignant and malignant conditions since 1998, and therefore PAS has been a key source in finding information on unreported cases. Since 2010, the CRN has received this information from the Norwegian Patient Registry (NPR). The CRN receives all C-diagnoses, D00–D48 and some other diagnoses (ICD-10) from NPR and these can then be matched with current information in the CRN database. Reminders are sent to clinicians for those cases where no information about the diagnosis exists in the CRN (Figure 2).

Dispatching of reminders to clinicians

It is mandatory to report clinical information on new cases of cancer no later than two months after the diagnosis has been determined. Thus, except for some few cases (e.g. cases diagnosed at autopsy), at least one clinical notification should be registered for each cancer case. The CRN receives information on cancer cases from several sources (clinical notifications, pathology notifications, autopsies, death certificates, radiation therapy and NPR). In those cases where the clinical notification is missing for a cancer case notified from one of the other sources, a reminder is sent to the hospital/ward/physician responsible for the treatment. About 100 000 reminders are sent annually, including repeat requests for information. The procedure for cancer registration and the dispatching of reminders are illustrated in Figure 2.

Incidence and mortality data

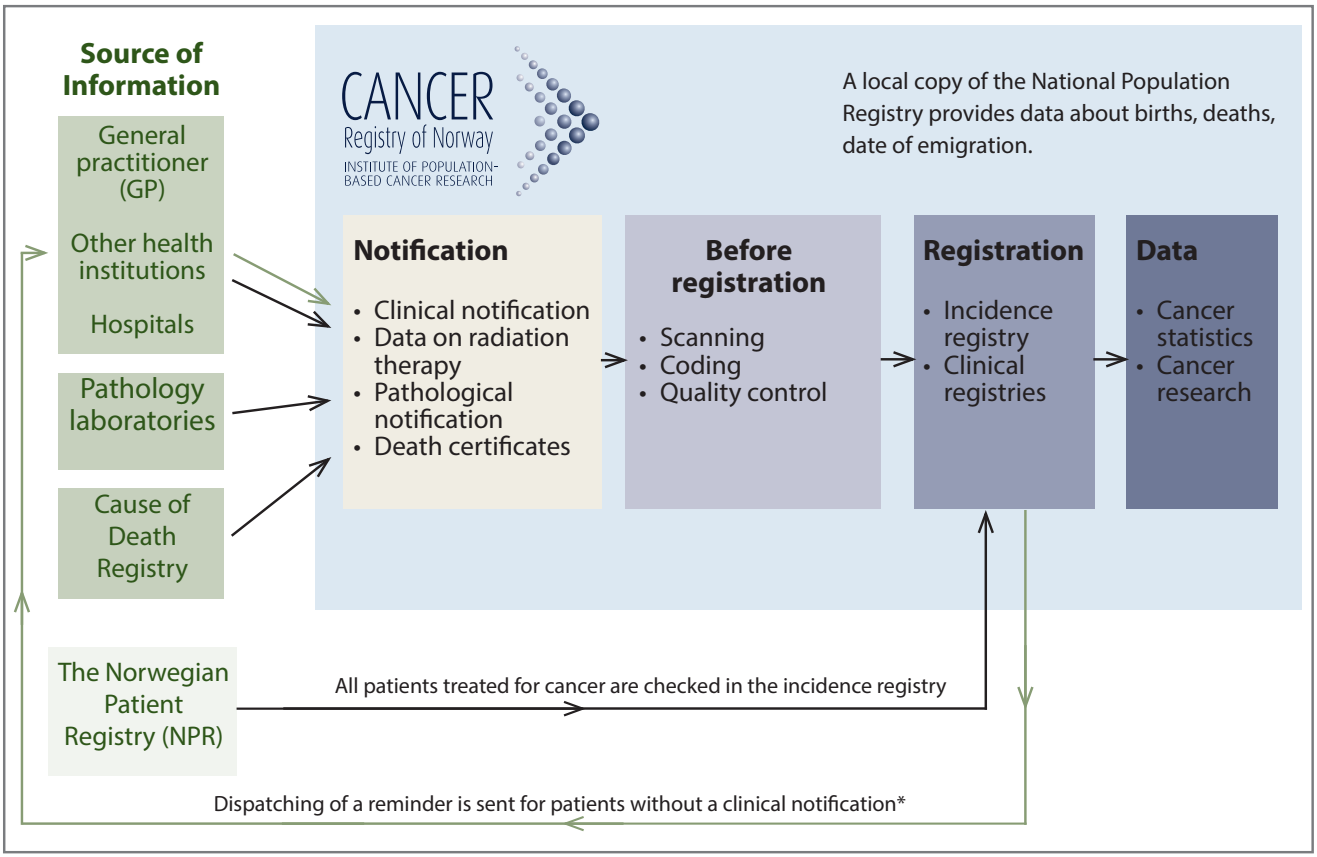
The incidence data presented in the first part of this report are based on an extraction from the incidence registry on 1st November 2015. The tables and figures in general represent either the latest year of complete incidence (2014) or the latest five-year period (2010–14).

A list of the inclusion and exclusion criteria applied to several sites with respect to morphology is shown in Table 2.

Briefly, atypical epithelial lesions are included in the lower urinary tract as well as invasive cancers. In the central nervous system both benign and malignant neoplasms are included. Ovarian borderline tumours and basal cell carcinomas of the skin are excluded.

Registered codes from ICD-7, ICD-O-2 and ICD-O-3 are converted to ICD-10 using a combination

Figure 2. Sources of information and the processes of cancer registration at the CRN



* Dispatching of reminders for clinical notifications are sent for cases only notified from the NPR or cases only notified by a pathology notification/death certificate on radiation therapy data.

of topography and morphology. Population data, stratified by year, sex and age, are provided by Statistics Norway. The main cancer types are tabulated according to their ICD-10 three-digit categories. The "all sites" figure comprises all malignant neoplasms (ICD-10 C00-96) and the D-diagnoses listed in Table 2. Corresponding mortality data coded in ICD-10 were obtained from the Cause of Death Registry and are presented in the same ICD-10 categories as for the rest of this report.

Multiple primary neoplasms

The coding and classification of multiple primary neoplasms follow the rules of the International Association of Research on Cancer – IARC (Fritz & al, 2000).

This version uses the IARC-rules with 12 different histological groups.

The rules of multiple primary neoplasms states that only one tumour is recognized as arising in an organ or pair of organs or tissue. This means that for this report only the very first invasive tumour of a defined histological type is counted within one three-character ICD-10 code (for example breast C50). A new cancer of the same histological group many years later in the same organ will not be counted. If there are different histological diagnoses, for example an adenocarcinoma and a sarcoma in the same organ, these will be counted as two cancers. Some organs are considered as only one organ in this respect (for example trachea C33 and lung C34).

Multifocal tumors are counted only once. This is also the case for the systemic cancers lymphomas, leukaemias, kaposi's sarcomas and mesotheliomas.

Metastases and changes in coding practice

For some cases, the Cancer Registry of Norway only receive histological reports and no clinical forms. In some of these cases, verified information on metastases at the time of diagnosis is missing. For patients diagnosed between 1953 and 2008 the guidelines for coding was to consider these patients as having unknown metastatic status.

A detailed investigation of the data for these patients, including survival analyses, showed that most of them probably had a localised disease. Based on additional information from radiation therapy and data from the Norwegian Patient Registry, the coding practice was changed for all patients diagnosed after 01.01.2009. If a patient has major surgery and there is no clinical information that indicates metastasis, then the patient is considered to have localized disease.

This change in coding practice may have an effect on trends in incidence and survival of localised and unknown stage over time.

Statistical methods used in this report

In this report, we use four measures to describe the burden and risk of disease: incidence, mortality, survival and prevalence.

Incidence and mortality

Incidence and mortality refer to the number of new cases and deaths, respectively. Both measures can be expressed as the absolute number, or as the rate, taking into account the size of the population at risk. Rates are essential for the comparisons of groups, and within a group over time. The denominator is the underlying person-time at risk in which the new cases or deaths in the numerator arise. Cancer incidence and mortality are presented in this report both as numbers and rates. Several different types of rates are also used in this report. We use the mid-year population (calculated as the mean of the population as obtained by the 1st January and 31st December) as the denominator in the calculation of rates. For periods with several years, we use the sum of mid-year populations.

Age-specific rates

There are compelling reasons for adjusting for the distribution of age when comparing cancer risk in populations. Age is a strong determinant of cancer risk. The crude rate, is a rate based on the frequency of cancer in the entire population irrespective of age. Although this measure is useful as an indicator of the total cancer burden, it's utility in comparing cancer risk between the group is severely limited when the age distribution differs between the groups, or where demographic changes in the size and age structure of a population have occurred over time.

To obtain a more accurate picture of the true risk of cancer, rates can be calculated for specific age strata, usually grouped in five-year intervals. The age-specific rate for age class i, denoted as r_i, is obtained by dividing the number of events, d_i, by the corresponding person-years, Y_i. As rates are most often given per 100 000 person-years we multiply by 100 000:

$$r_i = \frac{d_i}{Y_i} \cdot 100\,000$$

Usually, rates are provided separately for males and females, because of the different patterns by sex. Age- and sex-specific incidence and mortality rates are the basis of epidemiological analysis of cancer frequency data.

Age-standardised rates

To facilitate comparisons, a summary rate is derived that takes into account age-specific rates in each comparison group. The summary measure that appears in this report is the age-standardised rate (ASR), a statistic that is independent of the effects of age, thus allowing comparisons of cancer risk between different groups and over time. The calculation of the ASR is an example of direct standardisation, whereby the observed age-specific rates are applied to a standard population. The population size or proportion in each age class of the Standard Population are known as the weights to be used in the standardisation process. Many possible sets of weights, w_i, can be used.

For weight w_i in the ith age class of the standard, r_i is the age-specific rate in the ith age class. The ASR is calculated as:

$$ASR = \frac{\sum_i r_i w_i}{\sum_i w_i}$$

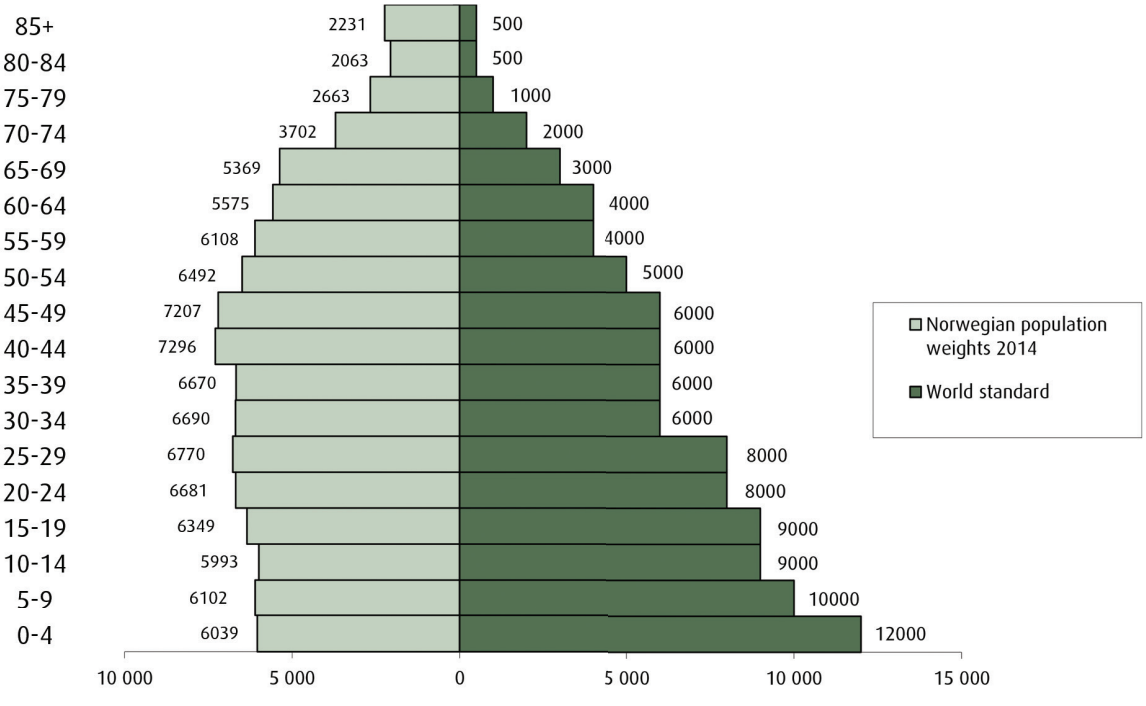
Note: In previous reports of Cancer in Norway the World Standard Population (Segi, 1960; Doll & al, 1966) has been used. Whereas in this report, the Norwegian mid-year population in 2014 is used as the reference population.

The main advantage of changing to this reference population is that we are getting age-standardised rates that resemble the crude rates for the Norwegian population. The main disadvantage is that the rates are not comparable with national rates from other countries. Table 7 shows the ASR in 2014 with different reference populations. Of notice is that the ASRs (Norway 2014) gives higher rates than the ASRs (World). In general, these changes have led to twice as high age-standardised rates. This is because the Norway 2014 reference population has higher weights for the oldest age groups. Cancers that have the highest incidence rates in the youngest age groups (e.g. testicular cancer) are less affected by the change of reference population (see Figure 4 and Table 7).

Age-standardised incidence rates (World) are available at: *http://kreftregisteret.no/no/Registrene/Kreftstatistikk/*

Figure 4 shows the age-standardised incidence rates for some selected cancers with different reference population

Figure 3. Comparison of population weights



Cumulative risk

The cumulative risk is the probability that an individual will develop the cancer under study during a certain age span, in the absence of other competing causes of death (Day, 1992). The age span over which the risk is accumulated must be specified, and in this report, the range 0–74 years is used and provides an approximation of the risk of developing cancer. If before the age of 75 the cumulative risk is less than 10%, as is the case for most cancer forms, it is reasonably approximated by the cumulative rate. The cumulative rate (CR) is the summation of the age- specific rates over each year of age from birth to a defined upper age limit. As age-specific incidence rates are computed according to five-year age groups, the cumulative rate is five times the sum of the age-specific rates calculated over the five-year age groups, assuming the age-specific rates are the same for allages within the five-year age stratum:

$$CR = 5 \sum_{i} r_i$$

The cumulative rate has several advantages compared to age-standardised rates. Firstly, as a form of direct standardisation, the problem of choosing an arbitrary reference population is eliminated. Secondly, as an approximation to the cumulative risk, it has a greater intuitive appeal, and is more directly interpretable as a measurement of lifetime risk, assuming no other causes of death are in operation. The precise mathematical relationship between the two is:

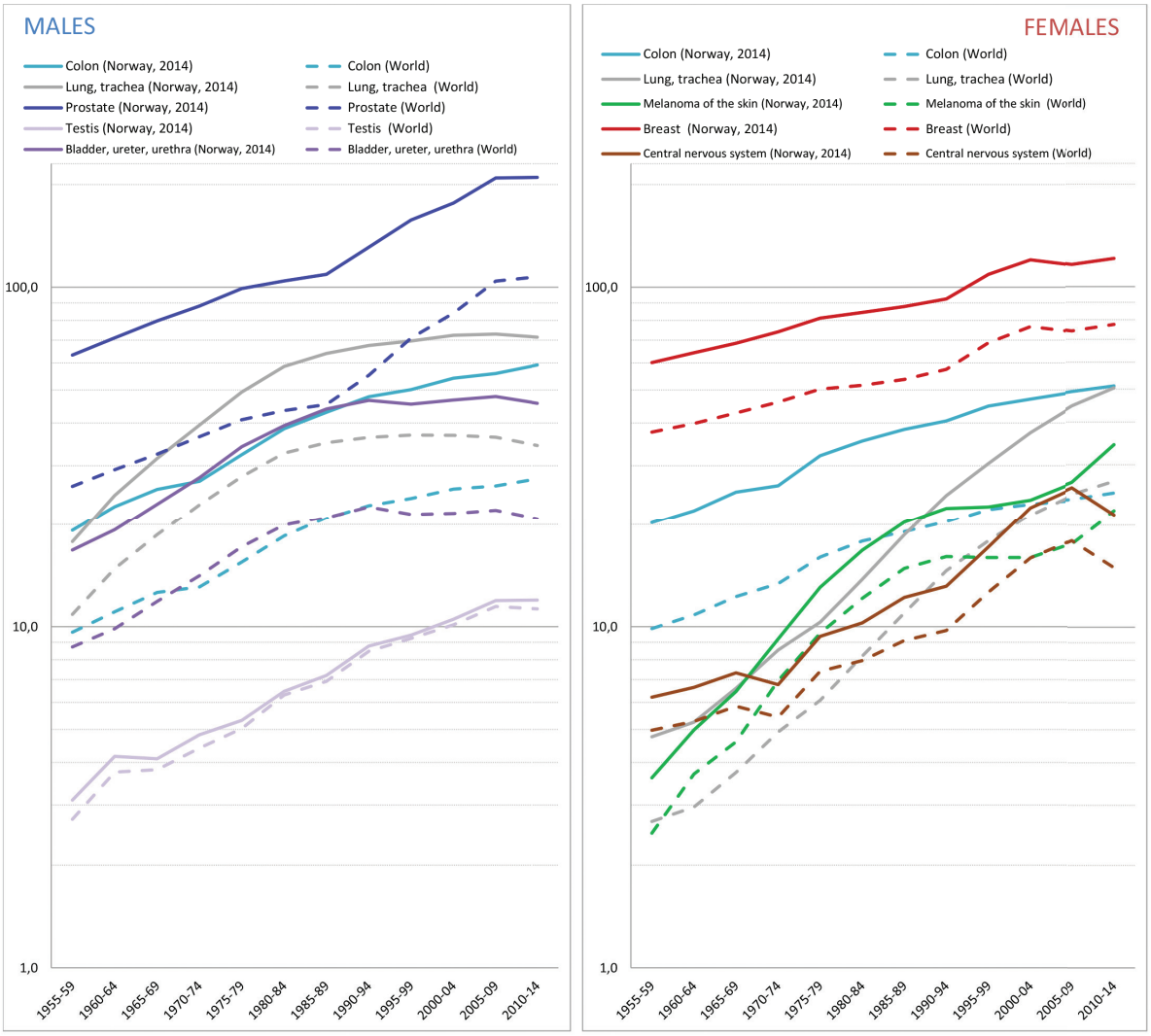
$$Cumulative\ risk = 1 - e^{-CR}$$

Prevalence

Prevalence is the number or proportion of a population that has the disease at a given point in time. It is a complex measure of cancer incidence, mortality, and other factors affecting individuals after diagnosis and treatment.

Prevalence is a useful measure of the number of persons requiring care for chronic illnesses such as hypertension and diabetes. For cancer, on the other hand, many patients diagnosed in the past may now

Figure 4. Age-standardised incidence trends in Norway for selected cancers, 1955–2014, the Norwegian mid-year population 2014 (Norway 2014) and the World Standard Population (World 1966) as reference populations.



be considered cured, that is to say they no longer have a greater risk of death. However, there may be special needs and disabilities subsequent to cancer disease and treatment, thus it is likely that the number of prevalent cancer cases also represents a useful measure.

Cancer prevalence can be defined as the number of persons alive having ever been diagnosed with cancer. Such a measure can easily be derived from the CRN data, given the registration of cases and complete follow up over many years. We provide additional estimates that may be useful for quantifying care burden. Therefore, this report shows the numbers of persons alive on 31st of December 2014 who were previously diagnosed with cancer during the last year, one to four years, five to nine years, and 10 or more years.

We also show the number of patients who have been diagnosed with metastatic disease or local recurrence with metastasis and who were alive at various specific time points. This is another estimate of how the cancer burden has increased over time.

Survival

The survival time of a cancer patient is defined as the time that elapse between a cancer diagnosis and subsequent death or end of follow-up.

Follow-up data

To estimate long-term survival patterns and trends, vital statistics of patients diagnosed with cancer during 1960–2014 were obtained from the National Population Registry and Statistics Norway through 31st of December 2014.

The 23 most common cancer sites were selected for analysis, and grouped according to their respective ICD-10 categories. About 2% of the cases were excluded as they were either registered as DCO cases (Death Certificate Only), emigrated before diagnosis, or had zero survival time.

It has been shown that exclusion of patients with a prior cancer diagnosis, which often is associated with a poorer prognosis, may give rise to artificially elevated estimates of survival (Brenner & Hakulinen, 2007). Therefore patients with previous cancer diagnoses were included in each site-specific analysis.

However, to provide an estimate of "all sites" survival, analysis was restricted to first primary cancers. While the inclusion of multiple primaries has been recommended for comparative purposes, the corresponding reduction in the overall survival estimates has been shown to be negligible; the effect of their inclusion has been shown to reduce five-year survival in Norway (for diagnoses 1995–2009) by less than a percentage point (Rosso & al, 2009).

Results should be interpreted with caution. Survival of prostate cancer and breast cancer in women has been affected by the impact of PSA testing and mammographic screening, respectively.

Relative survival (Net survival)

The most basic measure of survival is five-year survival, which represents the percentage of patients still alive 5 years after the date of diagnosis.

Not all deaths among cancer patients are due to the cancer under study. Deaths resulting from other causes will lower the survival and may possibly invalidate comparisons between populations. Relative survival is calculated to circumvent this problem by providing an estimate of *net survival*, and is defined as the observed survival proportion in a patient group divided by the expected survival of a comparable group in the general population with respect to age, sex and calendar year of investigation. At each time t (year) since diagnosis, the relative survival from the cancer, $R(t)$, is defined as follows:

$$R(t)=S_O(t)/S_E(t)$$

where $S_O(t)$ is the observed survival of cancer patients while the calculation of expected survival $S_E(t)$ is based on matching the major demographic characteristics of the patients to the general population. This requires the Norwegian population life tables from Statistics Norway by 1-year age group, sex, and 1-year calendar period.

Expected survival is calculated using the Ederer II method (Ederer & Heise, 1959), and the relative survival estimates are age-standardised applying the age distribution of the patients diagnosed during the most recent 5-year period. For patient cohorts with complete 5-year follow-up the cohort method is used.

With traditional cohort-based analyses, the most up-to-date estimates of long-term survival would have pertained to patients diagnosed in the distant past, with corresponding profiles of prognosis. Period-based analyses consider the survival experience in

recent years, and the survival that would have been observed in a hypothetical cohort of patients who experienced the same interval-specific survival as the patients who were actually at risk during a specific calendar period (Brenner & Hakulinen, 2002).

In this report, we have used a three-year period window (2012–2014) to estimate relative survival up to 15 years. Patients diagnosed in 2011–2014 contribute with (part of) their survival experience the first year of follow up, patients diagnosed in 2010–2013 contribute to the second year of follow-up, patients diagnosed in 2009–2012 contribute to the third year of follow-up etc. Thus, the period approach consists of the pieces of survival experience observed in the period 2012–2014 for all patients who have been diagnosed up to 15 years ago.

The period-approach was also used to estimate 5-year relative survival for the most recent period (2010-2014), where full 5-year follow-up is not observed. When analysing time trends in 5-year relative survival, we used a three-year moving period window from 1965 to 2014.

Detailed description of the methods are found in supplement URL: http://kreftregisteret.no/Global/Cancer in Norway/2014/CIN2014SupMeth.pdf

Conditional relative survival

Cancer survivors want information on their current prognosis, once they have survived a certain period of time. Conditional survival is a key indicator in this respect, estimating survival proportions given that patients have already survived a certain duration of time (Hankey & Steinhorn, 1982; Janssen-Heijnen & al, 2007).

The time where five-year relative survival reaches 100% is the point from where there is no excess mortality among the cancer patients, and prognosis is equivalent to that experienced in the general population. We present estimates of sex-specific five-year relative survival conditional on being alive 1 to 10 years after diagnosis.

Estimates were not plotted when there were less than twenty patients alive (n<20).

Data quality, completeness and timeliness

Data quality

A comprehensive assessment of the data quality in the CRN was conducted in 2007 (Larsen & al, 2009). Larsen & al. reported that the coding and classification systems, in general, follow international standards. Estimated overall completeness was 98.8% for the registration period 2001–2005, a lower completeness was observed for haematological malignancies and cancers of the central nervous system. Practical aspects and techniques for addressing the data quality at a cancer registry, including the documentation of comparability, validity and timeliness were reviewed in 2009 (Bray & Parkin, 2009). Methods for the evaluation of registry completeness were also assessed the same year (Parkin & Bray, 2009).

Two indicators of accuracy are shown in Table 5, namely the percentage of cases morphologically verified (MV%), and the percentage of death certificate only registrations (DCO%). See Larsen & al, 2009 for further details. The CRN follows the rules for registration and reporting of multiple neoplasms as defined by the International Association of Cancer Registries (IACR) and the International Agency for Research on Cancer (IARC) (Fritz & al, 2000).

Completeness and timeliness of incidence

Table 6 shows the number of cancer cases diagnosed in 2013 as extracted on 2nd February 2015 (for CiN 2013), and on the 2nd November 2015. The number of cancer cases diagnosed in 2013 reported and appearing in this issue (CiN 2014) are 395 (1.3%) more than those reported in the previous Cancer in Norway (CiN 2013).

Common cancers such as colon, prostate and breast cancers appear to have been almost complete when CiN 2013 was published (difference ≤1.0%). The largest differences were shown for rare cancers such as C38 Mediastinum, pleura (non-mesothelioma) (30%).

Table 5 Percentage distribution of MV (morphologically verified) and DCO (death certificate only) by primary site 2010–2014

ICD10	Site	Cases	MV%	DCO%
C00–96	**All sites**	**151621**	**95.1**	**1.1**
C00–14	**Mouth, pharynx**	**2762**	**99.3**	**0.3**
C00	Lip	610	100.0	0.0
C01–02	Tongue	576	99.8	0.0
C03–06	Mouth, other	486	99.4	0.6
C07–08	Salivary glands	271	98.9	0.4
C09–14	Pharynx	819	98.7	0.5
C15–26	**Digestive organs**	**31152**	**94.3**	**1.4**
C15	Oesophagus	1292	97.9	0.9
C16	Stomach	2419	97.7	1.2
C17	Small intestine	742	97.8	1.1
C18	Colon	13510	96.4	1.0
C19–20	Rectum, rectosigmoid	6487	98.7	0.2
C21	Anus	375	98.4	0.5
C22	Liver	1108	82.0	2.9
C23–24	Gallbladder, bile ducts	887	87.5	3.3
C25	Pancreas	3646	81.9	2.7
C26	Other digestive organs	686	80.8	11.2
C30–34, C38	**Respiratory organs**	**15512**	**90.8**	**1.8**
C30–31	Nose, sinuses	230	99.1	0.4
C32	Larynx, epiglottis	617	99.5	0.0
C33–34	Lung, trachea	14590	90.3	1.9
C38	Mediastinum, pleura (non-mesothelioma)	75	82.7	9.3
C40–41	**Bone**	**250**	**97.2**	**2.0**
C43	**Melanoma of the skin**	**8803**	**99.9**	**0.1**
C44	**Skin, non-melanoma**	**8472**	**99.8**	**0.1**
C45	**Mesothelioma**	**406**	**95.3**	**0.2**
C47	**Autonomic nervous system**	**49**	**98.0**	**0.0**
C48–49	**Soft tissues**	**769**	**97.8**	**0.5**
C50	**Breast**	**15577**	**99.4**	**0.3**
C51–58	**Female genital organs**	**8178**	**97.7**	**0.8**
C53	Cervix uteri	1547	99.5	0.3
C54	Corpus uteri	3644	99.3	0.3
C55	Uterus, other	39	74.4	20.5
C56	Ovary	2195	94.6	1.5
C51–52, C57	Other female genital	738	96.7	1.9
C58	Placenta	15	80.0	0.0
C60–63	**Male genital organs**	**25658**	**98.4**	**0.8**
C61	Prostate	23899	98.3	0.8
C62	Testis	1527	99.7	0.1
C60, C63	Other male genital	232	99.1	0.0
C64–68	**Urinary organs**	**11206**	**96.7**	**0.9**
C64	Kidney excl. renal pelvis	3887	93.5	1.4
C65	Renal pelvis	472	96.4	0.0
C66–68	Bladder, ureter, urethra	6847	98.5	0.7
C69	**Eye**	**356**	**59.0**	**0.0**
C70–72, D32–33	**Central nervous system**	**5094**	**65.5**	**1.7**
C73	**Thyroid gland**	**1610**	**99.6**	**0.1**
C37, C74–75	**Other endocrine glands**	**1128**	**67.7**	**0.6**
C39, C76, C80	**Other or unspecified**	**1596**	**61.3**	**16.0**
C81–96	**Lymphoid and haematopoietic tissue**	**13043**	**98.3**	**1.0**
C81	Hodgkin lymphoma	675	99.6	0.1
C82–86, C96	Non-Hodgkin lymphoma	4870	99.0	0.5
C88	Malignant immunoproliferative diseases	326	98.8	0.9
C90	Multiple myeloma	1928	97.9	1.4
C91–95, D45–47	Leukaemia	5244	97.7	1.4

Table 6 Registered cancer cases in Norway, 2013 as obtained from the incidence registry extracted 2nd February 2015 and 1st November 2015

		Cases diagnosed 2013 as of			
ICD10	Site	02.02.2015	02.11.2015	Difference	%
C00–96	**All sites**	**30401**	**30796**	**395**	**1.3**
C00–14	**Mouth, pharynx**	**536**	**535**	**-1**	**-0.2**
C00	Lip	111	112	1	0.9
C01–02	Tongue	125	126	1	0.8
C03–06	Mouth, other	111	108	-3	-2.7
C07–08	Salivary glands	48	47	-1	-2.1
C09–14	Pharynx	141	142	1	0.7
C15–26	**Digestive organs**	**6354**	**6430**	**76**	**1.2**
C15	Oesophagus	255	261	6	2.4
C16	Stomach	457	464	7	1.5
C17	Small intestine	132	134	2	1.5
C18	Colon	2781	2788	7	0.3
C19–20	Rectum, rectosigmoid	1346	1377	31	2.3
C21	Anus	64	73	9	14.1
C22	Liver	249	251	2	0.8
C23–24	Gallbladder, bile ducts	193	197	4	2.1
C25	Pancreas	732	747	15	2.0
C26	Other digestive organs	145	138	-7	-4.8
C30–34, C38	**Respiratory organs**	**3037**	**3098**	**61**	**2.0**
C30–31	Nose, sinuses	48	51	3	6.3
C32	Larynx, epiglottis	123	126	3	2.4
C33–34	Lung, trachea	2856	2908	52	1.8
C38	Mediastinum, pleura (non-mesothelioma)	10	13	3	30.0
C40–41	**Bone**	**43**	**44**	**1**	**2.3**
C43	**Melanoma of the skin**	**1719**	**1738**	**19**	**1.1**
C44	**Skin, non-melanoma**	**1717**	**1719**	**2**	**0.1**
C45	**Mesothelioma**	**89**	**89**	**0**	**0.0**
C47	**Autonomic nervous system**	**11**	**12**	**1**	**9.1**
C48–49	**Soft tissues**	**170**	**169**	**-1**	**-0.6**
C50	**Breast**	**3256**	**3244**	**-12**	**-0.4**
C51–58	**Female genital organs**	**1590**	**1608**	**18**	**1.1**
C53	Cervix uteri	282	290	8	2.8
C54	Corpus uteri	768	768	0	0.0
C55	Uterus, other	8	8	0	0.0
C56	Ovary	388	399	11	2.8
C51–52, C57	Other female genital	143	142	-1	-0.7
C58	Placenta	1	1	0	0.0
C60–63	**Male genital organs**	**5219**	**5233**	**14**	**0.3**
C61	Prostate	4836	4856	20	0.4
C62	Testis	337	331	-6	-1.8
C60, C63	Other male genital	46	46	0	0.0
C64–68	**Urinary organs**	**2304**	**2308**	**4**	**0.2**
C64	Kidney excl. renal pelvis	760	764	4	0.5
C65	Renal pelvis	110	110	0	0.0
C66–68	Bladder, ureter, urethra	1434	1434	0	0.0
C69	**Eye**	**78**	**78**	**0**	**0.0**
C70–72, D32–33	**Central nervous system**	**878**	**970**	**92**	**10.5**
C73	**Thyroid gland**	**349**	**355**	**6**	**1.7**
C37, C74–75	**Other endocrine glands**	**178**	**218**	**40**	**22.5**
C39, C76, C80	**Other or unspecified**	**342**	**330**	**-12**	**-3.5**
C81–96	**Lymphoid and haematopoietic tissue**	**2531**	**2618**	**87**	**3.4**
C81	Hodgkin lymphoma	128	127	-1	-0.8
C82–86, C96	Non-Hodgkin lymphoma	971	968	-3	-0.3
C88	Malignant immunoproliferative diseases	55	69	14	25.5
C90	Multiple myeloma	380	393	13	3.4
C91–95, D45–47	Leukaemia	997	1061	64	6.4

Cancer incidence, prevalence, mortality and survival in Norway 2014

Incidence

In 2014, there were 31 651 new cases of cancer (in 30 996 persons) recorded in Norway, of which 17 024 occurred among men and 14 627 among women (Table 7). Cancers of the prostate, female breast, lung and colon were the most common cancers and accounted for 44% of the new cancer cases in 2014.

In men, prostate cancer continued to be the leading site for cancer incidence (4 889 cases), followed by lung (1 596 cases) and colon cancer (1 359 cases). Breast cancer remained the most frequent cancer in women, with 3 324 new cases in 2014, followed by colon and lung cancer, with 1 442 and 1 423 incident cases, respectively.

When comparing the last five-year period (2010–2014) with the previous one (2005–2009) we observe that:

- There has been an overall increase in rates for all cancers combined at about 3% for men and 4% for women.
- Prostate cancer rates appear to stabilise, while the rates for breast cancer have increased with 4%.
- The rates of malignant melanoma have increased remarkably for both men and women.
- Colon cancer rates have increased slightly, while the rates for rectum cancer have stabilised in both men and women.
- The steady rise in lung cancer rates for women are a matter of great concern. The rates did show some signs of stabilisation in the past three years, but in 2014, we observe a new peak in incidence. The rate for the last five-year period was still higher than for the previous period.
- The rates of lung and bladder cancer in men have declined slightly
- Among more uncommon cancer sites, there has been a notable increase in the rates for liver and thyroid cancer in both genders.
- It is also worth mentioning that we suspect the falling rates of CNS cancer to be due to an under-reporting of cases.

The vast majority of cancers in Norway, over 90% in men and 85% in women, are diagnosed among those aged 50 years and older (Figure 5). In men, nearly half are diagnosed at age 70 or older, while 44% of all new cases occur between the ages 50 and 69. In women, 45% are diagnosed at age 70 or older, and 40% are diagnosed between 50 and 69. A larger proportion of cancers are diagnosed in women than men at the age of 25 to 49, while slightly over 1% of the cancer burden, an equal proportion in males and females, occurs in children and young adults.

Figure 6 shows the cancer types that are at the most common at different ages. The most commonly occurring cancers in boys and girls (0–14 years old) are tumours in the central nervous system and leukaemia. For young women (15–24) tumours in the central nervous system and Hodgkin lymphoma were the most common cancers, while testicular cancer was by far the most common one diagnosed in young men. Prostate cancer was the most frequent cancer in men above 50, while breast cancer was the lead in women from age 25 through to 69. Colon cancer was the most common cancer in women above 70.

Figure 5. Percentage distribution of cancer incidence by age, 2010–2014

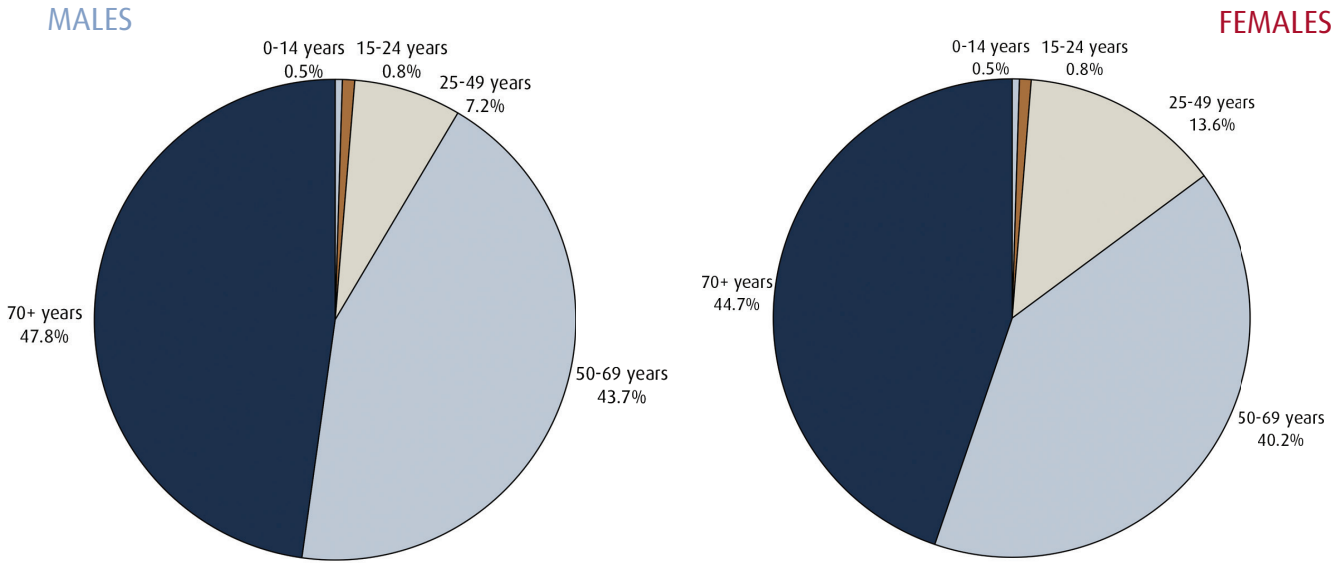


Table 7 Number of new cases by primary site and sex, 2014

		Cases			Rate (Norway 2014)		Rate (world standard)	
ICD10	Site	Males	Females	Total	Males	Females	Males	Females
C00–96	**All sites**	**17024**	**14627**	**31651**	**718.0**	**539.5**	**372.2**	**310.7**
C00–14	**Mouth, pharynx**	**401**	**219**	**620**	**16.3**	**8.1**	**9.5**	**4.8**
C00	Lip	75	48	123	3.3	1.7	1.5	0.8
C01–02	Tongue	83	49	132	3.3	1.8	2.1	1.1
C03–06	Mouth, other	60	51	111	2.4	1.8	1.4	1.0
C07–08	Salivary glands	45	26	71	1.9	1.0	1.1	0.7
C09–14	Pharynx	138	45	183	5.5	1.7	3.4	1.2
C15–26	**Digestive organs**	**3419**	**3043**	**6462**	**145.9**	**109.1**	**71.4**	**54.5**
C15	Oesophagus	220	69	289	9.2	2.5	4.7	1.3
C16	Stomach	301	187	488	12.9	6.7	6.2	3.4
C17	Small intestine	91	71	162	3.8	2.5	2.1	1.2
C18	Colon	1359	1442	2801	59.2	51.4	27.3	25.0
C19–20	Rectum, rectosigmoid	798	567	1365	33.4	20.7	17.5	11.0
C21	Anus	25	61	86	1.0	2.3	0.6	1.4
C22	Liver	136	83	219	5.6	3.0	3.0	1.5
C23–24	Gallbladder, bile ducts	74	101	175	3.0	3.6	1.6	1.7
C25	Pancreas	360	376	736	15.3	13.5	7.4	6.8
C26	Other digestive organs	55	86	141	2.4	2.9	1.1	1.2
C30–34, C38	**Respiratory organs**	**1748**	**1464**	**3212**	**74.5**	**54.0**	**35.8**	**28.7**
C30–31	Nose, sinuses	30	17	47	1.3	0.6	0.7	0.3
C32	Larynx, epiglottis	114	19	133	4.8	0.7	2.5	0.3
C33–34	Lung, trachea	1596	1423	3019	68.0	52.5	32.5	28.0
C38	Mediastinum, pleura (non-mesothelioma)	8	5	13	0.3	0.2	0.2	0.1
C40-41	**Bone**	**27**	**30**	**57**	**1.0**	**1.2**	**0.9**	**0.9**
C43	**Melanoma of the skin**	**1015**	**988**	**2003**	**42.2**	**37.1**	**23.3**	**23.2**
C44	**Skin, non-melanoma**	**1005**	**917**	**1922**	**46.7**	**31.0**	**17.7**	**12.6**
C45	**Mesothelioma**	**55**	**11**	**66**	**2.3**	**0.4**	**1.1**	**0.2**
C47	**Autonomic nervous system**	**6**	**9**	**15**	**0.2**	**0.3**	**0.2**	**0.4**
C48-49	**Soft tissues**	**61**	**86**	**147**	**2.5**	**3.3**	**1.6**	**2.4**
C50	**Breast**	**24**	**3324**	**3348**	**1.0**	**126.5**	**0.5**	**80.7**
C51–8	**Female genital organs**		**1687**	**1687**		**63.3**		**39.3**
C53	Cervix uteri		338	338		13.3		10.6
C54	Corpus uteri		727	727		27.1		15.3
C55	Uterus, other		12	12		0.4		0.2
C56	Ovary		424	424		15.8		9.5
C51–52, C57	Other female genital		184	184		6.7		3.6
C58	Placenta		2	2		0.1		0.1
C60–63	**Male genital organs**	**5268**		**5268**	**218.0**		**117.0**	
C61	Prostate	4889		4889	203.3		104.2	
C62	Testis	321		321	12.2		11.6	
C60, C63	Other male genital	58		58	2.5		1.3	
C64–68	**Urinary organs**	**1732**	**638**	**2370**	**73.7**	**23.3**	**36.5**	**12.4**
C64	Kidney excl. renal pelvis	579	235	814	23.4	8.8	13.5	5.2
C65	Renal pelvis	66	40	106	2.9	1.4	1.3	0.7
C66–68	Bladder, ureter, urethra	1087	363	1450	47.4	13.1	21.7	6.5
C69	**Eye**	**49**	**43**	**92**	**2.0**	**1.6**	**1.2**	**1.0**
C70–2, D32–33	**Central nervous system**	**457**	**502**	**959**	**18.4**	**19.1**	**12.8**	**13.0**
C73	**Thyroid gland**	**114**	**239**	**353**	**4.5**	**9.3**	**3.0**	**7.1**
C37, C74–75	**Other endocrine glands**	**111**	**90**	**201**	**4.4**	**3.5**	**3.1**	**2.6**
C39, C76, C80	**Other or unspecified**	**155**	**165**	**320**	**7.0**	**5.6**	**3.1**	**2.2**
C81–96	**Lymphoid and haemat-opoietic tissue**	**1377**	**1172**	**2549**	**57.4**	**42.8**	**33.2**	**24.6**
C81	Hodgkin lymphoma	76	58	134	3.0	2.3	2.5	2.1
C82-86, C96	Non-Hodgkin lymphoma	539	443	982	22.5	16.3	12.4	8.9
C88	Malignant immunoprolif-erative diseases	29	31	60	1.2	1.1	0.6	0.6
C90	Multiple myeloma	188	183	371	7.8	6.5	4.2	3.2
C91–95, D45–47	Leukaemia	545	457	1002	22.9	16.6	13.4	9.9

Figure 6. The most frequent types of cancer by age and sex, 2010–2014

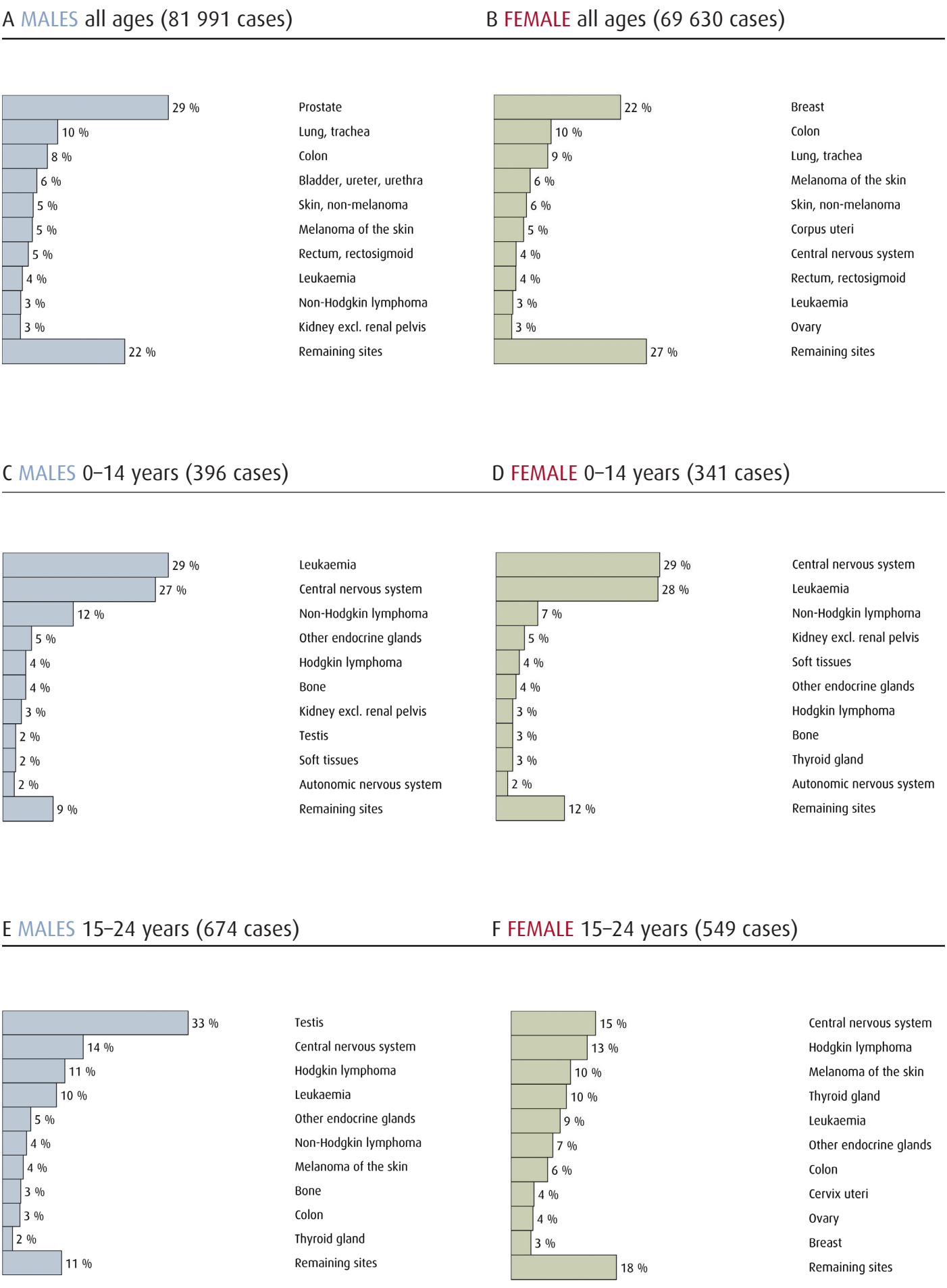
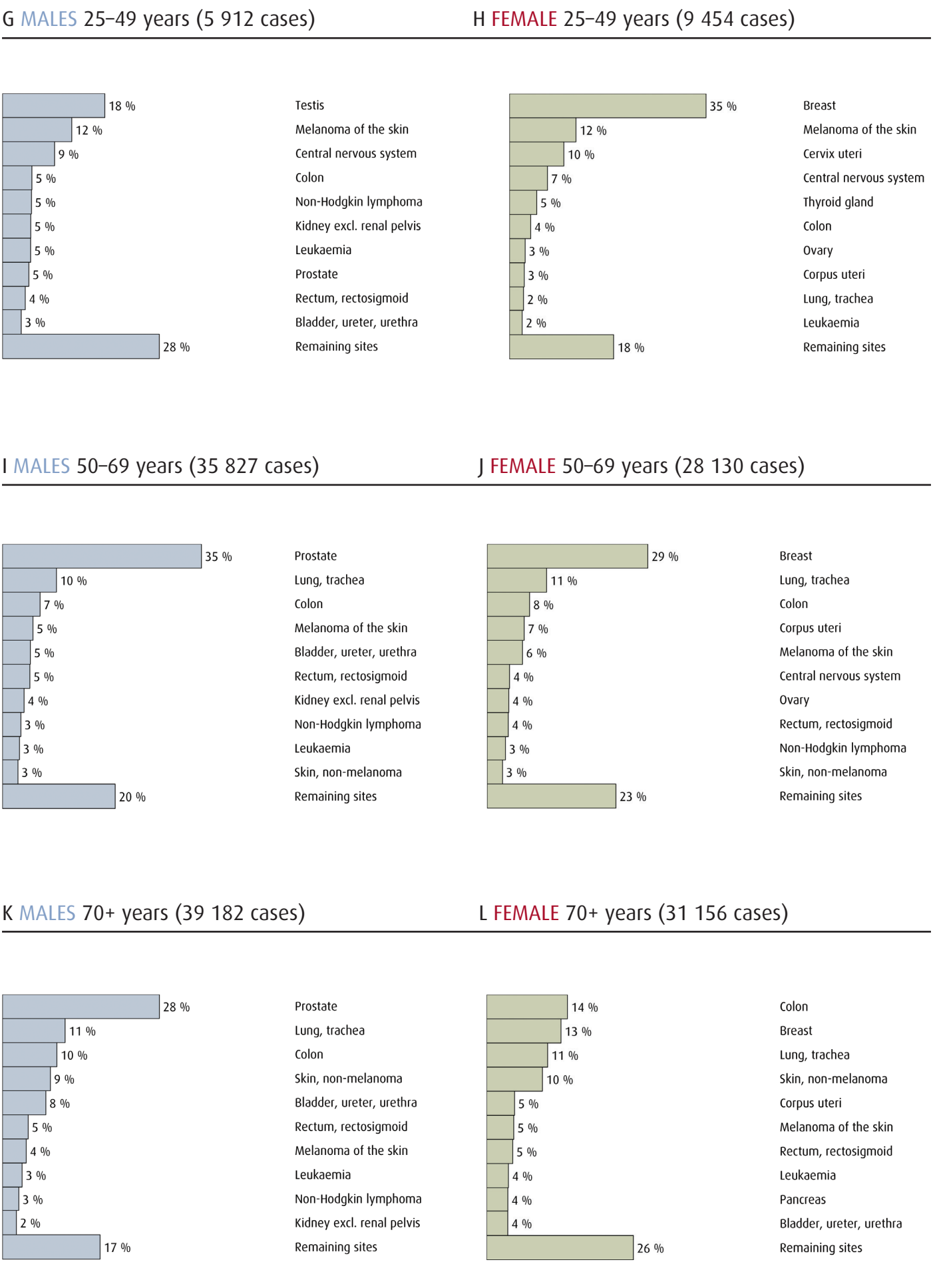


Figure 6. The most frequent types of cancer by age and sex, 2010–2014



The age-standardised rates and male to female ratio (M:F) for selected cancer types in 1980–1984 and 2010–2014 are compared in Table 8. Men tend to have higher incidence rates for most cancer types in both time periods, with the exceptions of melanoma of the skin, cancer in the gallbladder, cancer in anus and thyroid cancer. The highest M:F ratios were observed for several of the head and neck cancers.

Some cancers, including cancer of the bladder, kidney, liver, stomach, rectum and leukaemia, are consistently more common among men. The decline in the M:F ratios for several neoplasms over the last 25 years is largely the result of declining incidence trends in men and increasing pattern trends in women for a number of cancer types. This is especially striking for lung cancer.

Table 8 Sex ratios (male:female) of age-standardised rates (Norway, 2014) in 1980–1984 and 2010–2014 by primary site, sorted in descending order in last period

		1980–84			2010–14		
ICD10	Site	M	F	M:F ratio	M	F	M:F ratio
C32	Larynx, epiglottis	5.6	0.6	9.5	4.6	0.7	6.3
C15	Oesophagus	5.2	1.6	3.3	8.5	2.4	3.5
C66–68	Bladder, ureter, urethra	39.3	11.2	3.5	45.7	13.4	3.4
C09–14	Pharynx	2.9	1.0	3.0	4.9	1.8	2.8
C64	Kidney excl. renal pelvis	14.3	7.2	2.0	22.6	9.4	2.4
C22	Liver	3.6	1.9	1.9	6.1	3.0	2.1
C16	Stomach	37.1	18.8	2.0	13.5	6.6	2.1
C00	Lip	6.4	1.0	6.3	3.4	1.7	1.9
C01–02	Tongue	2.0	1.0	2.0	3.1	1.6	1.9
C65	Renal pelvis	1.8	0.7	2.6	2.5	1.4	1.7
C19–20	Rectum, rectosigmoid	30.1	19.0	1.6	33.3	20.3	1.6
C91–95, D45–47	Leukaemia	14.1	8.7	1.6	16.2	10.5	1.5
C90	Multiple myeloma	9.3	5.9	1.6	9.5	6.3	1.5
C82–86, C96	Non-Hodgkin lymphoma	11.2	8.4	1.3	23.5	16.5	1.4
C33–34	Lung, trachea	58.6	13.8	4.3	71.4	50.4	1.4
C81	Hodgkin lymphoma	2.9	1.8	1.7	3.0	2.4	1.2
C25	Pancreas	17.8	11.8	1.5	15.9	13.7	1.2
C18	Colon	38.5	35.4	1.1	59.2	51.1	1.2
C43	Melanoma of the skin	14.0	16.8	0.8	37.7	34.3	1.1
C23–24	Gallbladder, bile ducts	2.6	3.8	0.7	3.6	3.6	1.0
C21	Anus	0.6	1.1	0.6	1.0	2.0	0.5
C73	Thyroid gland	2.7	7.4	0.4	3.9	9.1	0.4

Figure 7 depicts time trends in incidence for a number of common cancers. Of note are:

The incidence has increased for most cancer types since the first observation period in Norway (1955–59). Among common cancers, the most pronounced increases were seen for lung cancer, skin cancer (both malignant melanoma and non-melanoma), non-Hodgkin lymphoma, tumours of the central nervous system, colon and rectum cancer, prostate cancer, and testicular cancer.

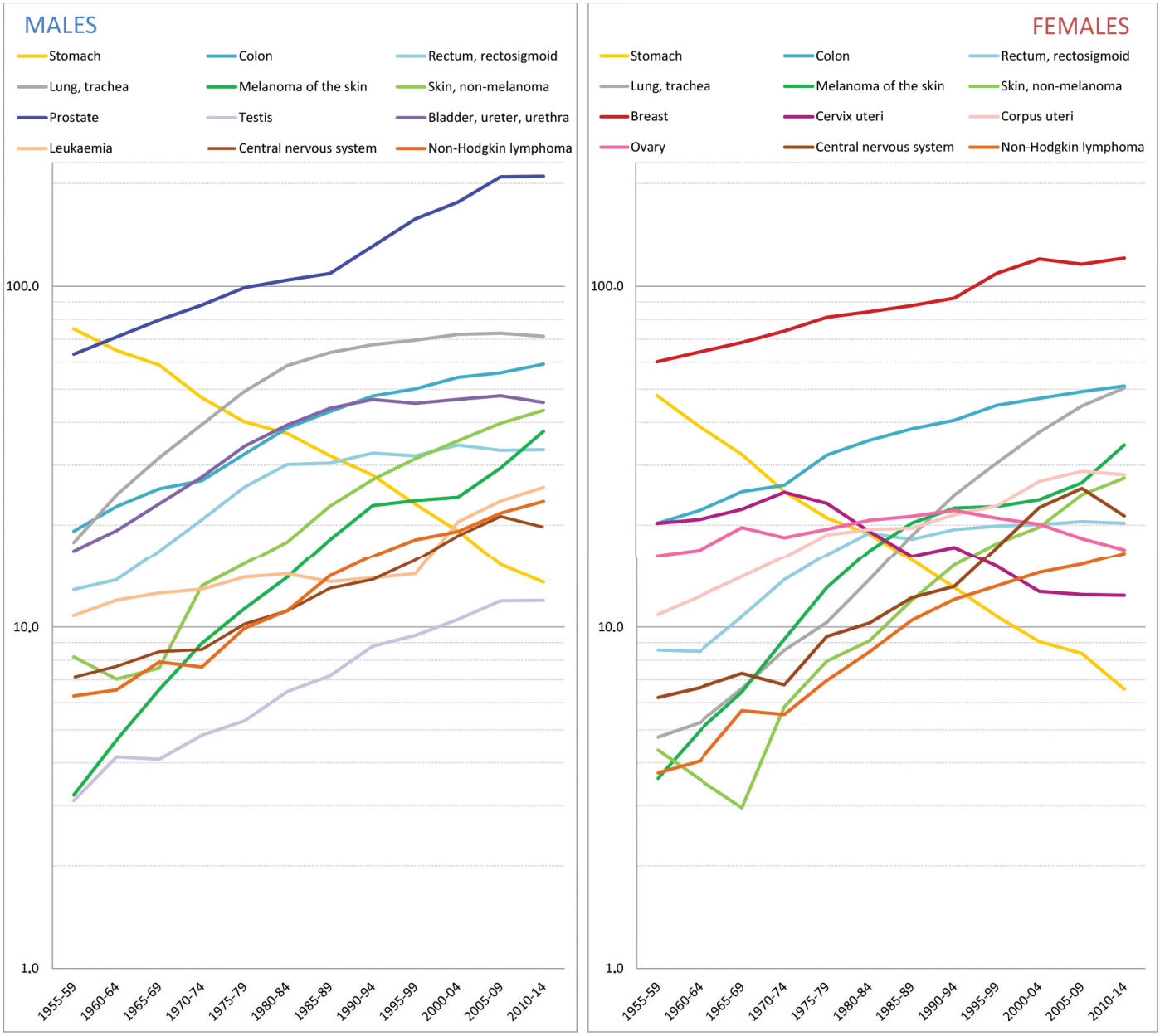
Stomach cancer is one of the few that demonstrates a declining trend. In the first observation period stomach cancer was the most common cancer in men and women combined, in line with observations of cancer mortality reported by Norwegian general practitioners one hundred years ago (Gade, 1916). The monotonous drop in incidence over 6 decades illustrates the vast potential for prevention that might be ascribed to improvement in hygiene and environmental exposures. Changes in the prevalence of Helicobacter pylori infection and in dietary habits (refrigerators) are likely contributors to this trend.

The incidence of prostate cancer has increased fourfold over the last 60 years. A dramatic upsurge from around 1990 illustrates the influence of changes in diagnostic pressure from general practitioners' screening practice and health exams. The introduction and subsequent widespread use of the Prostate Specific Antigen (PSA) test, followed by biopsies, is the main explanation for the doubling of the age-standardised incidence rate.

The incidence of breast cancer has doubled since the beginning of registration. The trend was monotonous upwards until 2005, somewhat steeper rise in the late 1990s following the implementation of the Norwegian Breast Cancer Screening Programme. During the last decade, the rate has varied from one year to another. This might be due to better diagnostic methods being used in the programme or locally in studies, but might also reflect random fluctuations.

In women, the incidence of lung cancer has increased almost tenfold since the beginning of the 1950's, and it is a highly disquieting cancer problem. The incidence of lung

Figure 7. Time trends in age–standardised incidence rates (Norway) in Norway for selected cancers (semi log-scale), 1955–2014



cancer among men has been flattening off in the last two decades, and we are now seeing a tendency toward a decline. This pattern is however not observed for women, were the overall trend is still increasing, and the incidence is currently at the same level as that of colon cancer.

Melanoma of the skin is another great concern. From being an uncommon cancer in 1953, it now ranges among the leading ones among men and women alike. After a period with levelling off during the 1990s, we have seen a consistent rise during the last decade, most probably caused by an increase in exposure to ultra-violet rays through sun tanning and solarium use.

The downward trend in cancer of the uterine cervix (cervical cancer) is a result of identification and treatment of premalignant conditions as part of an organised screening programme. In 2009, Vaccination against human papilloma virus (HPV) was introduced as part of the Childhood Immunisation Programme in Norway for girls born in 1997 and then after. Still, we do not expect this primary prevention to affect the incidence rate for another 15 to 20 years.

For many common cancers, the explanation for the increase in incidence rate is unknown or incompletely understood. Colon cancer has been associated with an affluent western lifestyle, such as diet, smoking, obesity and lack of exercise. For testicular cancer and non-Hodgkin lymphoma, genetic factors play a role, while other determinants are virtually unknown.

More detailed trends in incidence, mortality and survival for 23 cancers are provided later in this report.

Even if rates were to remain stable over the next 15 years, the number of new cases would increase as a result of the joint effects of population growth and ageing. The NORDCAN project (www-dep.iarc.fr/NORDCAN) provides access to online computations of short and long-term predictions of incidence and mortality in the Nordic countries.

Table 9 and Figure 8 show the cumulative risk of cancer for the 15 most common cancers in men and women. The cumulative risk of 13.5% for prostate cancer ranks highest in males, indicating that, one in seven men will develop this cancer before the age of 75. The corresponding risk of developing lung cancer is considerably lower in comparison, with about one in 24 men expected to have such a diagnosis before the age of 75.

The cumulative risk of breast cancer ranks the highest in women, with the figure of 8.4% indicating that about one in 12 Norwegian women develop this disease before she is 75. As with men, lung and colon cancers rank second and third.

Tables 10–19 provide further information on the distribution of cancer incidence in Norway. The number of incident cases and rates are tabulated according to year of diagnosis, age group, county of residence, and stage.

Further information

This report is available online at the website for Cancer Registry of Norway.

Figure 8. Cumulative risk of developing cancer (%) by the age of 75 for selected cancers by sex, 2010–2014

Table 9 Cumulative risk of developing cancer (%) by the age of 75 by primary site and sex, 2010–2014

ICD10	Site	Males	Females
C00–96	**All sites**	**36.0**	**29.1**
C00–14	**Mouth, pharynx**	**1.0**	**0.5**
C00	Lip	0.2	0.1
C01–02	Tongue	0.2	0.1
C03–06	Mouth, other	0.2	0.1
C07–08	Salivary glands	0.1	0.1
C09–14	Pharynx	0.4	0.1
C15–26	**Digestive organs**	**8.1**	**6.0**
C15	Oesophagus	0.5	0.1
C16	Stomach	0.7	0.3
C17	Small intestine	0.2	0.1
C18	Colon	3.1	2.8
C19–20	Rectum, rectosigmoid	2.1	1.3
C21	Anus	0.1	0.1
C22	Liver	0.4	0.2
C23–24	Gallbladder, bile ducts	0.2	0.2
C25	Pancreas	0.9	0.8
C26	Other digestive organs	0.1	0.1
C30–34, C38	**Respiratory organs**	**4.6**	**3.6**
C30–31	Nose, sinuses	0.1	0.0
C32	Larynx, epiglottis	0.3	0.0
C33–34	Lung, trachea	4.2	3.5
C38	Mediastinum, pleura (non-mesothelioma)	0.0	0.0
C40–41	**Bone**	**0.1**	**0.1**
C43	**Melanoma of the skin**	**2.4**	**2.4**
C44	**Skin, non-melanoma**	**1.5**	**1.1**
C45	**Mesothelioma**	**0.2**	**0.0**
C47	**Autonomic nervous system**	**0.0**	**0.0**
C48–49	**Soft tissues**	**0.2**	**0.2**
C50	**Breast**	**0.1**	**8.4**
C51–58	**Female genital organs**		**4.4**
C53	Cervix uteri		0.9
C54	Corpus uteri		2.0
C55	Uterus, other		0.0
C56	Ovary		1.2
C51–52, C57	Other female genital		0.3
C58	Placenta		0.0
C60–63	**Male genital organs**	**14.3**	
C61	Prostate	13.5	
C62	Testis	0.9	
C60, C63	Other male genital	0.1	
C64–68	**Urinary organs**	**4.1**	**1.5**
C64	Kidney excl. renal pelvis	1.6	0.6
C65	Renal pelvis	0.1	0.1
C66–68	Bladder, ureter, urethra	2.4	0.8
C69	**Eye**	**0.1**	**0.1**
C70–72, D32–33	**Central nervous system**	**1.4**	**1.5**
C73	**Thyroid gland**	**0.3**	**0.7**
C37, C74–75	**Other endocrine glands**	**0.3**	**0.3**
C39, C76, C80	**Other or unspecified**	**0.3**	**0.2**
C81–96	**Lymphoid and haematopoietic tissue**	**3.8**	**2.8**
C81	Hodgkin lymphoma	0.2	0.2
C82–86, C96	Non-Hodgkin lymphoma	1.5	1.1
C88	Malignant immunoproliferative diseases	0.1	0.1
C90	Multiple myeloma	0.5	0.4
C91–95, D45–47	Leukaemia	1.5	1.1

Table 10a Number of new cases by primary site and year, 2005–2014

MALES

		Year									
ICD10	Site	2005	06	07	08	09	10	11	12	13	2014
C00–96	**All sites**	**13376**	**13665**	**14610**	**14793**	**15181**	**15286**	**16338**	**16671**	**16672**	**17024**
C00–14	**Mouth, pharynx**	**252**	**276**	**279**	**272**	**349**	**315**	**330**	**366**	**340**	**401**
C00	Lip	50	68	66	56	84	79	81	72	62	75
C01–02	Tongue	44	46	57	63	74	59	70	71	81	83
C03–06	Mouth, other	40	53	41	43	68	52	39	58	63	60
C07–08	Salivary glands	26	14	18	18	23	28	18	30	29	45
C09–14	Pharynx	92	95	97	92	100	97	122	135	105	138
C15–26	**Digestive organs**	**2776**	**2729**	**2859**	**2938**	**2954**	**3237**	**3135**	**3328**	**3413**	**3419**
C15	Oesophagus	133	148	132	161	149	188	182	176	198	220
C16	Stomach	304	303	337	300	263	299	324	286	302	301
C17	Small intestine	50	66	67	65	82	72	87	104	87	91
C18	Colon	1075	1076	1106	1174	1124	1300	1233	1301	1331	1359
C19–20	Rectum, rectosigmoid	670	640	636	675	731	745	695	750	798	798
C21	Anus	22	15	18	20	20	34	20	24	15	25
C22	Liver	78	89	98	99	98	129	132	136	170	136
C23–24	Gallbladder, bile ducts	85	58	59	66	74	87	58	87	96	74
C25	Pancreas	326	303	367	341	360	320	333	403	359	360
C26	Other digestive organs	33	31	39	37	53	63	71	61	57	55
C30–34, C38	**Respiratory organs**	**1552**	**1612**	**1627**	**1624**	**1663**	**1684**	**1771**	**1782**	**1722**	**1748**
C30–31	Nose, sinuses	23	16	27	24	23	19	22	32	32	30
C32	Larynx, epiglottis	101	116	78	113	90	106	100	98	105	114
C33–34	Lung, trachea	1418	1470	1503	1481	1542	1549	1639	1642	1577	1596
C38	Mediastinum, pleura (non-mesothelioma)	10	10	19	6	8	10	10	10	8	8
C40–41	**Bone**	**26**	**24**	**21**	**23**	**37**	**27**	**28**	**33**	**18**	**27**
C43	**Melanoma of the skin**	**595**	**560**	**581**	**672**	**703**	**746**	**871**	**891**	**842**	**1015**
C44	**Skin, non-melanoma**	**651**	**749**	**727**	**774**	**853**	**822**	**859**	**887**	**908**	**1005**
C45	**Mesothelioma**	**74**	**56**	**63**	**64**	**69**	**79**	**64**	**65**	**78**	**55**
C47	**Autonomic nervous system**	**7**	**7**	**7**	**9**	**7**	**6**	**5**	**5**	**6**	**6**
C48–49	**Soft tissues**	**50**	**62**	**67**	**49**	**71**	**52**	**67**	**81**	**78**	**61**
C50	**Breast**	**18**	**14**	**19**	**21**	**15**	**13**	**27**	**28**	**36**	**24**
C60–63	**Male genital organs**	**4007**	**4186**	**4788**	**4784**	**4746**	**4575**	**5309**	**5273**	**5233**	**5268**
C61	Prostate	3707	3897	4448	4434	4384	4262	4985	4907	4856	4889
C62	Testis	251	253	297	300	314	267	286	322	331	321
C60, C63	Other male genital	49	36	43	50	48	46	38	44	46	58
C64–68	**Urinary organs**	**1302**	**1328**	**1448**	**1434**	**1469**	**1467**	**1528**	**1586**	**1634**	**1732**
C64	Kidney excl. renal pelvis	366	363	400	416	427	489	524	533	536	579
C65	Renal pelvis	28	47	52	57	50	57	37	53	65	66
C66–68	Bladder, ureter, urethra	908	918	996	961	992	921	967	1000	1033	1087
C69	**Eye**	**28**	**37**	**29**	**40**	**26**	**37**	**26**	**29**	**34**	**49**
C70–72, D32–33	**Central nervous system**	**464**	**434**	**506**	**457**	**462**	**469**	**487**	**493**	**460**	**457**
C73	**Thyroid gland**	**69**	**77**	**67**	**58**	**73**	**81**	**77**	**93**	**107**	**114**
C37, C74–75	**Other endocrine glands**	**102**	**95**	**140**	**135**	**147**	**110**	**117**	**134**	**103**	**111**
C39, C76, C80	**Other or unspecified**	**216**	**201**	**176**	**170**	**171**	**144**	**167**	**126**	**152**	**155**
C81–96	**Lymphoid and haematopoietic tissue**	**1187**	**1218**	**1206**	**1269**	**1366**	**1422**	**1470**	**1471**	**1508**	**1377**
C81	Hodgkin lymphoma	63	67	68	77	81	77	67	81	74	76
C82–86, C96	Non-Hodgkin lymphoma	424	469	427	467	487	559	510	540	553	539
C88	Malignant immunoproliferative diseases	32	33	36	34	28	31	32	50	36	29
C90	Multiple myeloma	221	184	189	208	224	209	239	208	224	188
C91–95, D45–47	Leukaemia	447	465	486	483	546	546	622	592	621	545

Table 10b Number of new cases by primary site and year, 2005–2014

FEMALES

		Year									
ICD10	Site	2005	06	07	08	09	10	11	12	13	2014
C00–96	**All sites**	**12211**	**12457**	**12539**	**12736**	**13059**	**13334**	**13833**	**13712**	**14124**	**14627**
C00–14	**Mouth, pharynx**	**182**	**194**	**162**	**192**	**172**	**210**	**202**	**184**	**195**	**219**
C00	Lip	41	43	49	50	37	55	46	42	50	48
C01–02	Tongue	32	38	23	33	34	33	38	47	45	49
C03–06	Mouth, other	43	54	37	43	46	43	44	31	45	51
C07–08	Salivary glands	26	22	23	25	17	32	29	16	18	26
C09–14	Pharynx	40	37	30	41	38	47	45	48	37	45
C15–26	**Digestive organs**	**2624**	**2684**	**2695**	**2747**	**2855**	**2745**	**2874**	**2941**	**3017**	**3043**
C15	Oesophagus	60	45	56	59	54	65	60	71	63	69
C16	Stomach	235	218	216	212	222	177	199	182	162	187
C17	Small intestine	41	45	55	52	76	60	65	58	47	71
C18	Colon	1198	1286	1267	1281	1360	1271	1392	1424	1457	1442
C19–20	Rectum, rectosigmoid	519	516	506	518	519	529	529	497	579	567
C21	Anus	45	41	42	42	49	53	38	47	58	61
C22	Liver	58	44	54	66	66	78	80	83	81	83
C23–24	Gallbladder, bile ducts	82	78	83	82	85	92	88	103	101	101
C25	Pancreas	326	372	361	372	363	349	366	392	388	376
C26	Other digestive organs	60	39	55	63	61	71	57	84	81	86
C30–34, C38	**Respiratory organs**	**994**	**1077**	**1164**	**1200**	**1198**	**1322**	**1282**	**1361**	**1376**	**1464**
C30–31	Nose, sinuses	17	19	33	16	12	20	20	19	19	17
C32	Larynx, epiglottis	19	12	17	23	20	19	16	19	21	19
C33–34	Lung, trachea	951	1040	1106	1157	1158	1275	1239	1319	1331	1423
C38	Mediastinum, pleura (non-mesothelioma)	7	6	8	4	8	8	7	4	5	5
C40–41	**Bone**	**18**	**20**	**22**	**23**	**28**	**25**	**23**	**13**	**26**	**30**
C43	**Melanoma of the skin**	**573**	**661**	**639**	**621**	**729**	**790**	**876**	**888**	**896**	**988**
C44	**Skin, non-melanoma**	**660**	**642**	**670**	**676**	**745**	**707**	**780**	**776**	**811**	**917**
C45	**Mesothelioma**	**9**	**21**	**14**	**10**	**12**	**14**	**13**	**16**	**11**	**11**
C47	**Autonomic nervous system**	**3**	**8**	**5**	**7**	**5**	**5**	**1**	**0**	**6**	**9**
C48–49	**Soft tissues**	**86**	**82**	**94**	**80**	**102**	**90**	**83**	**80**	**91**	**86**
C50	**Breast**	**2822**	**2728**	**2751**	**2779**	**2748**	**2851**	**3105**	**2961**	**3208**	**3324**
C51–58	**Female genital organs**	**1561**	**1561**	**1528**	**1596**	**1586**	**1668**	**1671**	**1544**	**1608**	**1687**
C53	Cervix uteri	307	314	278	296	298	310	293	316	290	338
C54	Corpus uteri	679	660	672	720	713	758	744	647	768	727
C55	Uterus, other	6	9	3	8	11	6	6	7	8	12
C56	Ovary	433	457	445	459	429	447	486	439	399	424
C51–52, C57	Other female genital	130	118	129	113	133	144	137	131	142	184
C58	Placenta	6	3	1	0	2	3	5	4	1	2
C64–68	**Urinary organs**	**604**	**588**	**597**	**615**	**633**	**643**	**657**	**647**	**674**	**638**
C64	Kidney excl. renal pelvis	243	213	254	256	237	244	260	259	228	235
C65	Renal pelvis	18	26	23	28	38	33	39	37	45	40
C66–68	Bladder, ureter, urethra	343	349	320	331	358	366	358	351	401	363
C69	**Eye**	**25**	**30**	**29**	**31**	**38**	**30**	**33**	**31**	**44**	**43**
C70–72, D32–33	**Central nervous system**	**596**	**627**	**635**	**592**	**630**	**588**	**558**	**570**	**510**	**502**
C73	**Thyroid gland**	**169**	**148**	**162**	**176**	**185**	**204**	**220**	**227**	**248**	**239**
C37, C74–75	**Other endocrine glands**	**107**	**126**	**124**	**161**	**131**	**119**	**123**	**106**	**115**	**90**
C39, C76, C80	**Other or unspecified**	**270**	**242**	**233**	**191**	**200**	**185**	**167**	**157**	**178**	**165**
C81–96	**Lymphoid and haematopoietic tissue**	**908**	**1018**	**1015**	**1039**	**1062**	**1138**	**1165**	**1210**	**1110**	**1172**
C81	Hodgkin lymphoma	49	47	49	43	47	57	71	61	53	58
C82–86, C96	Non-Hodgkin lymphoma	335	388	381	374	403	406	447	458	415	443
C88	Malignant immunoproliferative diseases	22	25	19	17	27	27	26	31	33	31
C90	Multiple myeloma	158	147	170	164	163	182	145	181	169	183
C91–95, D45–47	Leukaemia	344	411	396	441	422	466	476	479	440	457

Table 11a Age-standardised (Norway, 2014) incidence rates per 100 000 person-years by primary site and year, 2005–2014 **MALES**

		Year									
ICD10	Site	2005	06	07	08	09	10	11	12	13	2014
C00–96	**All sites**	**687.6**	**686.6**	**719.9**	**713.6**	**720.6**	**709.2**	**739.7**	**737.1**	**719.2**	**718.0**
C00–14	**Mouth, pharynx**	**12.7**	**13.4**	**13.3**	**12.5**	**16.0**	**14.2**	**14.6**	**15.7**	**14.2**	**16.3**
C00	Lip	2.7	3.5	3.4	2.7	4.1	3.8	3.8	3.3	2.7	3.3
C01–02	Tongue	2.2	2.3	2.7	2.9	3.3	2.6	3.0	3.1	3.4	3.3
C03–06	Mouth, other	1.9	2.5	1.9	2.0	3.2	2.4	1.9	2.5	2.6	2.4
C07–08	Salivary glands	1.4	0.7	0.8	0.8	1.1	1.3	0.8	1.3	1.3	1.9
C09–14	Pharynx	4.5	4.4	4.5	4.1	4.3	4.2	5.1	5.5	4.2	5.5
C15–26	**Digestive organs**	**144.4**	**138.9**	**142.8**	**143.5**	**142.5**	**151.9**	**143.9**	**148.9**	**148.8**	**145.9**
C15	Oesophagus	6.7	7.5	6.5	7.8	7.0	8.8	8.1	7.7	8.6	9.2
C16	Stomach	16.3	15.8	16.8	14.7	12.9	14.0	14.9	12.8	13.2	12.9
C17	Small intestine	2.4	3.2	3.2	3.1	3.7	3.3	3.9	4.5	3.7	3.8
C18	Colon	55.9	55.0	55.8	57.6	55.0	61.8	57.5	58.8	59.0	59.2
C19–20	Rectum, rectosigmoid	34.8	32.1	31.4	32.7	34.7	34.3	31.5	33.5	34.0	33.4
C21	Anus	1.1	0.7	0.9	1.0	0.9	1.5	0.8	1.1	0.7	1.0
C22	Liver	3.9	4.5	4.7	4.6	4.7	6.1	5.9	5.9	7.3	5.6
C23–24	Gallbladder, bile ducts	4.4	2.9	3.0	3.3	3.7	4.0	2.6	4.0	4.2	3.0
C25	Pancreas	17.0	15.4	18.5	16.7	17.4	15.3	15.2	18.0	15.7	15.3
C26	Other digestive organs	1.8	1.8	2.1	1.9	2.6	3.0	3.4	2.8	2.5	2.4
C30–34, C38	**Respiratory organs**	**79.3**	**80.5**	**79.4**	**78.4**	**79.0**	**78.4**	**80.6**	**79.6**	**74.8**	**74.5**
C30–31	Nose, sinuses	1.2	0.8	1.3	1.2	1.1	0.8	1.0	1.4	1.4	1.3
C32	Larynx, epiglottis	5.1	5.7	3.7	5.3	4.2	4.9	4.4	4.3	4.5	4.8
C33–34	Lung, trachea	72.4	73.5	73.5	71.7	73.4	72.1	74.8	73.4	68.6	68.0
C38	Mediastinum, pleura (non-mesothelioma)	0.5	0.5	0.9	0.3	0.4	0.4	0.5	0.5	0.3	0.3
C40–41	**Bone**	**1.2**	**1.1**	**0.9**	**1.0**	**1.6**	**1.1**	**1.1**	**1.3**	**0.7**	**1.0**
C43	**Melanoma of the skin**	**29.4**	**26.8**	**27.5**	**31.1**	**32.1**	**33.2**	**38.3**	**38.6**	**35.7**	**42.2**
C44	**Skin, non-melanoma**	**35.4**	**40.0**	**38.4**	**40.7**	**43.8**	**41.5**	**42.5**	**42.8**	**43.2**	**46.7**
C45	**Mesothelioma**	**3.9**	**2.9**	**3.1**	**3.2**	**3.2**	**3.9**	**3.0**	**3.0**	**3.5**	**2.3**
C47	**Autonomic nervous system**	**0.3**	**0.4**	**0.3**	**0.4**	**0.3**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**
C48–49	**Soft tissues**	**2.4**	**2.9**	**3.1**	**2.2**	**3.4**	**2.3**	**2.8**	**3.4**	**3.2**	**2.5**
C50	**Breast**	**1.0**	**0.7**	**0.9**	**1.0**	**0.7**	**0.6**	**1.2**	**1.3**	**1.6**	**1.0**
C60–63	**Male genital organs**	**208.7**	**212.2**	**237.9**	**231.1**	**224.3**	**210.8**	**238.1**	**229.4**	**222.1**	**218.0**
C61	Prostate	195.5	199.6	223.2	216.3	209.2	197.9	225.0	215.0	207.2	203.3
C62	Testis	10.8	10.9	12.6	12.5	12.8	10.8	11.4	12.6	12.8	12.2
C60, C63	Other male genital	2.4	1.8	2.1	2.3	2.3	2.1	1.7	1.9	2.0	2.5
C64–68	**Urinary organs**	**66.8**	**67.0**	**71.2**	**69.5**	**70.1**	**68.9**	**69.6**	**70.8**	**71.0**	**73.7**
C64	Kidney excl. renal pelvis	18.0	17.8	19.1	19.3	19.6	21.8	22.9	22.6	22.3	23.4
C65	Renal pelvis	1.5	2.3	2.6	2.7	2.4	2.7	1.6	2.4	2.8	2.9
C66–68	Bladder, ureter, urethra	47.3	46.8	49.5	47.4	48.1	44.4	45.0	45.7	45.9	47.4
C69	**Eye**	**1.4**	**1.8**	**1.3**	**1.9**	**1.2**	**1.7**	**1.2**	**1.2**	**1.4**	**2.0**
C70–72, D32–33	**Central nervous system**	**21.9**	**20.0**	**23.3**	**20.4**	**20.5**	**20.6**	**20.6**	**20.6**	**18.7**	**18.4**
C73	**Thyroid gland**	**3.1**	**3.6**	**3.0**	**2.5**	**3.2**	**3.4**	**3.2**	**3.9**	**4.3**	**4.5**
C37, C74–75	**Other endocrine glands**	**4.7**	**4.3**	**6.3**	**6.0**	**6.4**	**4.7**	**4.9**	**5.5**	**4.2**	**4.4**
C39, C76, C80	**Other or unspecified**	**11.8**	**10.5**	**9.2**	**8.8**	**8.7**	**7.0**	**8.0**	**6.0**	**7.1**	**7.0**
C81–96	**Lymphoid and haematopoietic tissue**	**59.3**	**59.6**	**58.1**	**59.6**	**63.5**	**64.8**	**65.9**	**65.0**	**64.4**	**57.4**
C81	Hodgkin lymphoma	2.7	2.9	2.9	3.4	3.5	3.2	2.7	3.3	2.9	3.0
C82–86, C96	Non-Hodgkin lymphoma	21.1	22.7	20.3	21.7	22.6	25.2	22.7	23.7	23.4	22.5
C88	Malignant immunoproliferative diseases	1.5	1.7	1.8	1.7	1.3	1.5	1.5	2.2	1.5	1.2
C90	Multiple myeloma	11.4	9.3	9.3	9.9	10.6	9.7	10.8	9.5	10.0	7.8
C91–95, D45–47	Leukaemia	22.6	23.0	23.8	22.9	25.5	25.2	28.2	26.3	26.6	22.9

Table 11b Age-standardised (Norway, 2014) incidence rates per 100 000 person-years by primary site and year, 2005–2014 **FEMALES**

		Year									
ICD10	Site	2005	06	07	08	09	10	11	12	13	2014
C00–96	**All sites**	**503.1**	**509.2**	**507.0**	**509.0**	**514.9**	**521.0**	**532.0**	**520.8**	**528.3**	**539.5**
C00–14	**Mouth, pharynx**	**7.5**	**8.1**	**6.6**	**7.5**	**6.9**	**8.3**	**7.8**	**6.8**	**7.3**	**8.1**
C00	Lip	1.5	1.8	1.9	1.9	1.4	2.0	1.7	1.5	1.8	1.7
C01–02	Tongue	1.3	1.6	0.9	1.3	1.4	1.3	1.4	1.8	1.7	1.8
C03–06	Mouth, other	1.7	2.3	1.5	1.6	1.8	1.7	1.7	1.1	1.7	1.8
C07–08	Salivary glands	1.1	0.9	1.0	1.0	0.7	1.3	1.2	0.6	0.7	1.0
C09–14	Pharynx	1.8	1.6	1.3	1.7	1.6	2.0	1.8	1.9	1.5	1.7
C15–26	**Digestive organs**	**103.1**	**105.2**	**104.5**	**105.1**	**108.6**	**103.3**	**107.2**	**108.5**	**109.6**	**109.1**
C15	Oesophagus	2.4	1.8	2.1	2.3	2.1	2.4	2.3	2.6	2.3	2.5
C16	Stomach	9.1	8.4	8.3	7.9	8.2	6.5	7.2	6.7	5.9	6.7
C17	Small intestine	1.7	1.9	2.2	2.2	3.0	2.3	2.5	2.2	1.7	2.5
C18	Colon	46.9	50.0	48.8	49.1	51.2	47.7	51.8	52.5	52.3	51.4
C19–20	Rectum, rectosigmoid	20.8	20.9	20.6	20.1	20.2	20.2	20.1	18.6	21.5	20.7
C21	Anus	1.9	1.6	1.7	1.7	2.1	2.1	1.5	1.8	2.2	2.3
C22	Liver	2.4	1.6	2.1	2.4	2.5	2.9	2.9	3.0	3.0	3.0
C23–24	Gallbladder, bile ducts	3.2	3.0	3.2	3.2	3.2	3.6	3.3	3.8	3.7	3.6
C25	Pancreas	12.6	14.6	13.6	14.1	13.8	13.0	13.5	14.3	14.1	13.5
C26	Other digestive organs	2.3	1.4	2.0	2.2	2.3	2.6	2.1	3.0	2.9	2.9
C30–34, C38	**Respiratory organs**	**42.3**	**45.2**	**48.1**	**49.1**	**47.6**	**52.4**	**49.9**	**52.0**	**51.8**	**54.0**
C30–31	Nose, sinuses	0.7	0.8	1.3	0.6	0.5	0.8	0.8	0.7	0.7	0.6
C32	Larynx, epiglottis	0.9	0.5	0.7	0.9	0.8	0.8	0.6	0.7	0.8	0.7
C33–34	Lung, trachea	40.4	43.7	45.8	47.4	46.1	50.6	48.2	50.4	50.1	52.5
C38	Mediastinum, pleura (non-mesothelioma)	0.2	0.2	0.3	0.2	0.3	0.3	0.3	0.1	0.2	0.2
C40–41	**Bone**	**0.8**	**0.9**	**0.9**	**1.0**	**1.1**	**1.0**	**0.9**	**0.5**	**1.0**	**1.2**
C43	**Melanoma of the skin**	**24.4**	**27.8**	**26.2**	**25.3**	**29.5**	**31.6**	**34.2**	**34.6**	**34.2**	**37.1**
C44	**Skin, non-melanoma**	**24.2**	**23.4**	**24.3**	**24.6**	**26.3**	**24.9**	**26.9**	**26.9**	**27.6**	**31.0**
C45	**Mesothelioma**	**0.4**	**0.8**	**0.5**	**0.4**	**0.5**	**0.5**	**0.5**	**0.6**	**0.4**	**0.4**
C47	**Autonomic nervous system**	**0.1**	**0.3**	**0.2**	**0.3**	**0.2**	**0.2**	**0.0**	**0.0**	**0.2**	**0.3**
C48–49	**Soft tissues**	**3.7**	**3.4**	**4.0**	**3.3**	**4.1**	**3.6**	**3.2**	**3.1**	**3.5**	**3.3**
C50	**Breast**	**121.7**	**116.3**	**115.1**	**115.2**	**112.6**	**115.1**	**123.6**	**115.8**	**123.7**	**126.5**
C51–58	**Female genital organs**	**65.7**	**64.9**	**63.5**	**65.2**	**64.1**	**66.6**	**65.5**	**59.7**	**61.5**	**63.3**
C53	Cervix uteri	13.0	13.1	11.7	12.0	12.3	12.6	11.9	12.6	11.5	13.3
C54	Corpus uteri	28.8	27.6	28.1	30.0	29.1	30.3	29.1	24.9	29.3	27.1
C55	Uterus, other	0.2	0.3	0.1	0.3	0.4	0.3	0.2	0.2	0.3	0.4
C56	Ovary	18.1	18.9	18.5	18.6	17.1	17.9	18.9	16.9	15.2	15.8
C51–52, C57	Other female genital	5.3	4.7	5.0	4.2	5.2	5.4	5.2	4.9	5.2	6.7
C58	Placenta	0.3	0.1	0.0	0.0	0.1	0.1	0.2	0.2	0.0	0.1
C64–68	**Urinary organs**	**24.4**	**23.6**	**23.7**	**24.1**	**24.6**	**24.6**	**24.8**	**24.0**	**24.7**	**23.3**
C64	Kidney excl. renal pelvis	10.0	8.8	10.2	10.2	9.5	9.5	10.1	9.9	8.6	8.8
C65	Renal pelvis	0.7	1.0	0.9	1.1	1.5	1.3	1.5	1.3	1.7	1.4
C66–68	Bladder, ureter, urethra	13.7	13.8	12.7	12.9	13.6	13.8	13.2	12.7	14.4	13.1
C69	**Eye**	**1.0**	**1.2**	**1.2**	**1.3**	**1.5**	**1.2**	**1.2**	**1.2**	**1.7**	**1.6**
C70–72, D32–33	**Central nervous system**	**25.6**	**26.2**	**26.5**	**24.5**	**25.5**	**23.6**	**22.1**	**22.4**	**19.6**	**19.1**
C73	**Thyroid gland**	**7.1**	**6.3**	**6.8**	**7.4**	**7.6**	**8.3**	**8.9**	**9.1**	**9.8**	**9.3**
C37, C74–75	**Other endocrine glands**	**4.6**	**5.5**	**5.3**	**6.8**	**5.5**	**4.9**	**5.0**	**4.2**	**4.5**	**3.5**
C39, C76, C80	**Other or unspecified**	**10.0**	**9.1**	**8.4**	**7.0**	**7.1**	**6.6**	**5.6**	**5.5**	**6.1**	**5.6**
C81–96	**Lymphoid and haematopoietic tissue**	**36.6**	**41.0**	**41.2**	**41.0**	**41.6**	**44.2**	**44.5**	**45.9**	**41.2**	**42.8**
C81	Hodgkin lymphoma	2.2	2.0	2.1	1.8	2.0	2.4	2.9	2.5	2.1	2.3
C82–86, C96	Non-Hodgkin lymphoma	13.8	15.8	15.6	15.2	16.0	15.9	17.3	17.5	15.5	16.3
C88	Malignant immunoproliferative diseases	0.9	1.0	0.7	0.7	1.0	1.1	1.0	1.1	1.2	1.1
C90	Multiple myeloma	6.4	5.7	6.8	6.3	6.4	6.9	5.4	6.8	6.1	6.5
C91–95, D45–47	Leukaemia	13.4	16.5	16.0	17.0	16.2	17.9	18.0	18.0	16.2	16.6

Table 12a Average annual number of new cases by primary site and five-year age group, 2010–2014

ICD10	Site	0–4	5–9	10–14	15–19	20–24	25–29
C00–96	**All sites**	**33**	**24**	**22**	**51**	**83**	**101**
C00–14	**Mouth, pharynx**	**0**	**0**	**0**	**2**	**1**	**1**
C00	Lip	0	0	0	0	0	0
C01–02	Tongue	0	0	0	0	0	0
C03–06	Mouth, other	0	0	0	0	0	0
C07–08	Salivary glands	0	0	0	0	0	0
C09–14	Pharynx	0	0	0	1	0	0
C15–26	**Digestive organs**	**1**	**0**	**1**	**2**	**4**	**8**
C15	Oesophagus	0	0	0	0	0	0
C16	Stomach	0	0	0	0	1	1
C17	Small intestine	0	0	0	0	0	1
C18	Colon	0	0	0	1	3	3
C19–20	Rectum, rectosigmoid	0	0	0	0	1	2
C21	Anus	0	0	0	0	0	0
C22	Liver	1	0	0	0	0	0
C23–24	Gallbladder, bile ducts	0	0	0	0	0	0
C25	Pancreas	0	0	0	0	0	1
C26	Other digestive organs	0	0	0	0	0	0
C30–34, C38	**Respiratory organs**	**0**	**0**	**0**	**1**	**0**	**1**
C30–31	Nose, sinuses	0	0	0	0	0	0
C32	Larynx, epiglottis	0	0	0	0	0	0
C33–34	Lung, trachea	0	0	0	0	0	1
C38	Mediastinum, pleura (non-mesothelioma)	0	0	0	0	0	0
C40–41	**Bone**	**0**	**1**	**2**	**2**	**2**	**1**
C43	**Melanoma of the skin**	**0**	**0**	**0**	**1**	**4**	**6**
C44	**Skin, non-melanoma**	**1**	**0**	**0**	**1**	**1**	**1**
C45	**Mesothelioma**	**0**	**0**	**0**	**0**	**0**	**0**
C47	**Autonomic nervous system**	**1**	**0**	**0**	**1**	**0**	**0**
C48–49	**Soft tissues**	**1**	**0**	**0**	**1**	**1**	**1**
C50	**Breast**	**0**	**0**	**0**	**0**	**0**	**0**
C60–63	**Male genital organs**	**1**	**0**	**1**	**10**	**35**	**43**
C61	Prostate	0	0	0	0	0	0
C62	Testis	1	0	1	10	35	43
C60, C63	Other male genital	0	0	0	0	0	0
C64–68	**Urinary organs**	**2**	**0**	**1**	**1**	**1**	**4**
C64	Kidney excl. renal pelvis	2	0	0	0	0	2
C65	Renal pelvis	0	0	0	0	0	0
C66–68	Bladder, ureter, urethra	0	0	0	1	1	2
C69	**Eye**	**0**	**1**	**0**	**0**	**0**	**0**
C70–72, D32–33	**Central nervous system**	**7**	**7**	**7**	**10**	**9**	**12**
C73	**Thyroid gland**	**0**	**0**	**0**	**1**	**2**	**3**
C37, C74–75	**Other endocrine glands**	**2**	**1**	**1**	**2**	**4**	**2**
C39, C76, C80	**Other or unspecified**	**0**	**0**	**0**	**0**	**0**	**0**
C81–96	**Lymphoid and haematopoietic tissue**	**16**	**12**	**8**	**16**	**17**	**17**
C81	Hodgkin lymphoma	0	2	1	7	8	7
C82–86, C96	Non-Hodgkin lymphoma	3	4	3	3	3	3
C88	Malignant immunoproliferative diseases	0	0	0	0	0	0
C90	Multiple myeloma	0	0	0	0	0	0
C91–95, D45–47	Leukaemia	13	6	4	7	6	6

MALES

Age											
30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85+
155	**196**	**289**	**441**	**759**	**1360**	**2169**	**2877**	**2470**	**2122**	**1805**	**1439**
2	**4**	**9**	**14**	**35**	**44**	**55**	**58**	**43**	**35**	**24**	**21**
0	0	1	2	3	6	7	10	13	12	10	10
1	2	2	4	10	8	10	13	8	6	5	3
1	0	1	1	4	5	10	11	8	5	3	4
1	1	1	1	2	3	2	5	3	3	3	3
0	0	3	6	17	22	26	20	11	9	3	2
14	**29**	**51**	**83**	**154**	**277**	**401**	**549**	**489**	**479**	**436**	**329**
1	1	4	5	10	19	27	38	25	24	21	16
1	4	4	8	16	28	35	44	43	40	46	32
0	1	2	3	5	10	14	15	12	9	9	6
5	8	19	26	47	90	139	204	201	204	199	155
5	9	12	21	41	71	102	137	115	107	80	56
0	0	1	1	3	3	3	4	3	3	1	2
1	2	3	6	9	17	21	20	15	18	16	12
0	1	1	2	5	8	10	14	13	9	9	8
0	2	5	8	17	27	43	63	54	54	45	35
1	1	0	2	2	4	6	10	7	11	9	8
2	**5**	**11**	**27**	**67**	**129**	**237**	**328**	**298**	**267**	**227**	**142**
0	1	1	1	3	3	3	5	3	2	3	3
0	0	1	2	4	11	18	22	16	14	10	6
1	4	9	24	59	114	216	300	277	250	213	132
0	0	0	1	1	1	0	2	2	0	1	1
1	**1**	**1**	**1**	**2**	**2**	**2**	**3**	**2**	**1**	**1**	**1**
15	**25**	**46**	**53**	**65**	**82**	**107**	**136**	**105**	**87**	**80**	**60**
3	**6**	**7**	**10**	**16**	**27**	**54**	**102**	**122**	**153**	**176**	**217**
0	**0**	**0**	**1**	**1**	**3**	**7**	**13**	**14**	**13**	**9**	**7**
0	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**
2	**2**	**2**	**7**	**6**	**6**	**10**	**8**	**7**	**5**	**5**	**4**
0	**0**	**1**	**0**	**2**	**2**	**3**	**4**	**5**	**4**	**2**	**2**
55	**51**	**47**	**79**	**185**	**465**	**827**	**1119**	**854**	**599**	**436**	**322**
0	0	8	48	162	450	818	1108	848	592	429	316
54	50	38	29	19	11	4	5	2	2	1	1
0	1	1	3	4	4	5	6	5	6	6	4
6	**11**	**29**	**51**	**78**	**123**	**202**	**248**	**252**	**238**	**186**	**156**
4	7	18	28	46	59	82	88	80	58	35	20
0	0	0	2	2	3	6	9	9	10	10	5
2	4	11	21	30	62	114	150	163	170	141	131
1	**1**	**3**	**2**	**3**	**4**	**5**	**5**	**3**	**4**	**2**	**2**
20	**20**	**24**	**32**	**39**	**48**	**55**	**54**	**44**	**38**	**26**	**19**
5	**7**	**8**	**8**	**8**	**10**	**8**	**11**	**7**	**7**	**6**	**2**
4	**7**	**8**	**9**	**11**	**13**	**12**	**12**	**10**	**8**	**5**	**3**
0	**1**	**2**	**3**	**6**	**8**	**13**	**22**	**22**	**19**	**21**	**31**
23	**27**	**38**	**61**	**81**	**117**	**170**	**205**	**194**	**165**	**163**	**121**
6	5	5	7	4	5	5	4	5	2	1	1
8	11	16	22	34	44	68	89	73	60	57	38
0	0	0	1	1	4	3	7	6	6	6	2
1	2	4	8	12	19	26	30	32	28	30	22
8	8	13	24	29	45	68	75	78	68	70	57

Table 12b Average annual number of new cases by primary site and five-year age group, 2010–2014

ICD10	Site	0–4	5–9	10–14	15–19	20–24	25–29
C00–96	**All sites**	**30**	**15**	**23**	**42**	**68**	**123**
C00–14	**Mouth, pharynx**	**0**	**0**	**1**	**0**	**1**	**3**
C00	Lip	0	0	0	0	0	0
C01–02	Tongue	0	0	0	0	0	1
C03–06	Mouth, other	0	0	0	0	0	0
C07–08	Salivary glands	0	0	1	0	0	1
C09–14	Pharynx	0	0	0	0	0	0
C15–26	**Digestive organs**	**1**	**0**	**1**	**4**	**6**	**8**
C15	Oesophagus	0	0	0	0	0	0
C16	Stomach	0	0	0	0	0	0
C17	Small intestine	0	0	0	0	0	0
C18	Colon	0	0	1	3	4	5
C19–20	Rectum, rectosigmoid	0	0	0	0	0	1
C21	Anus	0	0	0	0	0	0
C22	Liver	1	0	0	0	1	0
C23–24	Gallbladder, bile ducts	0	0	0	0	0	0
C25	Pancreas	0	0	0	0	0	0
C26	Other digestive organs	0	0	0	0	0	0
C30–34, C38	**Respiratory organs**	**0**	**0**	**0**	**0**	**1**	**2**
C30–31	Nose, sinuses	0	0	0	0	0	0
C32	Larynx, epiglottis	0	0	0	0	0	0
C33–34	Lung, trachea	0	0	0	0	1	1
C38	Mediastinum, pleura (non-mesothelioma)	0	0	0	0	0	0
C40–41	**Bone**	**0**	**1**	**1**	**1**	**2**	**1**
C43	**Melanoma of the skin**	**0**	**0**	**0**	**2**	**9**	**19**
C44	**Skin, non-melanoma**	**0**	**1**	**0**	**1**	**1**	**1**
C45	**Mesothelioma**	**0**	**0**	**0**	**0**	**0**	**0**
C47	**Autonomic nervous system**	**1**	**0**	**0**	**0**	**0**	**0**
C48–49	**Soft tissues**	**1**	**1**	**1**	**1**	**2**	**2**
C50	**Breast**	**0**	**0**	**0**	**1**	**3**	**17**
C51–58	**Female genital organs**	**0**	**0**	**1**	**2**	**7**	**27**
C53	Cervix uteri	0	0	0	0	4	22
C54	Corpus uteri	0	0	0	0	0	1
C55	Uterus, other	0	0	0	0	0	0
C56	Ovary	0	0	1	2	2	3
C51–52, C57	Other female genital	0	0	0	0	0	0
C58	Placenta	0	0	0	0	0	1
C64–68	**Urinary organs**	**3**	**1**	**0**	**1**	**1**	**1**
C64	Kidney excl. renal pelvis	3	1	0	0	0	1
C65	Renal pelvis	0	0	0	0	0	0
C66–68	Bladder, ureter, urethra	0	0	0	0	0	0
C69	**Eye**	**1**	**0**	**0**	**0**	**0**	**1**
C70–72, D32–33	**Central nervous system**	**7**	**6**	**6**	**7**	**9**	**10**
C73	**Thyroid gland**	**0**	**0**	**2**	**3**	**8**	**10**
C37, C74–75	**Other endocrine glands**	**1**	**0**	**1**	**4**	**4**	**7**
C39, C76, C80	**Other or unspecified**	**0**	**0**	**0**	**0**	**0**	**0**
C81–96	**Lymphoid and haematopoietic tissue**	**12**	**5**	**9**	**15**	**13**	**14**
C81	Hodgkin lymphoma	0	0	2	8	7	7
C82–86, C96	Non-Hodgkin lymphoma	2	1	2	2	2	3
C88	Malignant immunoproliferative diseases	0	0	0	0	0	0
C90	Multiple myeloma	0	0	0	0	0	0
C91–95, D45–47	Leukaemia	10	4	5	5	4	4

FEMALES

Age											
30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85+
187	**334**	**516**	**730**	**965**	**1219**	**1556**	**1886**	**1530**	**1469**	**1447**	**1785**
1	**4**	**7**	**9**	**16**	**21**	**23**	**27**	**20**	**17**	**20**	**30**
0	1	1	1	2	3	4	5	6	5	8	12
1	1	1	2	4	4	6	6	3	4	5	5
0	0	1	1	3	4	4	7	6	4	5	8
1	2	1	1	2	2	2	3	2	2	2	3
0	1	3	3	6	8	6	6	3	3	1	3
15	**28**	**43**	**76**	**122**	**190**	**270**	**388**	**390**	**419**	**441**	**526**
0	0	1	1	2	4	7	13	8	9	7	14
0	4	2	6	10	9	13	22	19	25	29	40
1	0	2	3	3	5	7	8	7	8	8	8
8	10	16	32	51	80	114	181	191	211	233	258
3	6	12	18	29	48	60	75	76	70	66	76
0	1	2	4	4	6	7	7	5	5	5	5
1	1	0	3	3	5	8	9	10	10	13	16
0	1	1	2	4	7	10	14	14	13	15	16
2	3	6	5	13	23	37	50	51	56	56	71
0	0	1	2	2	3	6	9	9	11	11	21
3	**5**	**11**	**31**	**60**	**118**	**186**	**249**	**231**	**195**	**157**	**111**
0	1	0	1	1	2	3	1	3	1	2	2
0	1	1	0	1	3	2	3	2	3	2	1
3	4	10	30	57	113	182	243	225	191	152	106
0	0	0	0	1	0	1	1	1	0	1	1
2	**1**	**2**	**1**	**0**	**1**	**2**	**2**	**1**	**1**	**1**	**2**
23	**43**	**66**	**72**	**70**	**86**	**87**	**110**	**81**	**64**	**67**	**87**
2	**3**	**8**	**10**	**16**	**28**	**42**	**67**	**83**	**108**	**134**	**292**
0	**0**	**0**	**0**	**1**	**0**	**2**	**2**	**2**	**2**	**1**	**2**
0	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
2	**2**	**4**	**4**	**5**	**7**	**13**	**13**	**8**	**6**	**7**	**6**
38	**102**	**198**	**302**	**368**	**370**	**432**	**437**	**220**	**199**	**183**	**219**
41	**64**	**72**	**96**	**134**	**169**	**198**	**230**	**173**	**151**	**127**	**143**
32	47	41	39	24	20	20	18	13	10	9	10
3	6	13	27	54	86	104	126	96	87	67	59
0	0	0	0	1	0	0	1	1	0	2	2
4	9	14	23	45	50	57	64	47	41	34	44
1	2	4	7	10	13	17	21	16	13	15	29
1	0	0	0	0	0	0	0	0	0	0	0
2	**5**	**13**	**16**	**26**	**49**	**69**	**92**	**90**	**93**	**94**	**96**
1	4	9	8	15	19	31	38	34	32	26	23
0	0	0	0	1	4	4	5	5	8	8	4
1	1	3	8	11	27	34	49	50	53	61	69
1	**0**	**2**	**1**	**3**	**4**	**3**	**8**	**3**	**3**	**3**	**2**
18	**25**	**34**	**40**	**46**	**53**	**63**	**62**	**48**	**35**	**36**	**40**
14	**23**	**21**	**23**	**25**	**20**	**21**	**18**	**17**	**10**	**6**	**7**
6	**9**	**10**	**10**	**10**	**9**	**10**	**10**	**6**	**6**	**5**	**3**
1	**0**	**1**	**2**	**5**	**7**	**12**	**13**	**14**	**23**	**30**	**62**
19	**21**	**26**	**36**	**58**	**85**	**121**	**157**	**140**	**137**	**135**	**157**
7	5	4	3	2	1	2	4	3	3	3	1
5	8	10	13	27	40	54	62	55	52	47	48
0	0	0	1	1	2	5	5	5	5	4	3
0	1	2	3	8	13	18	25	20	28	25	29
7	6	10	15	21	29	42	61	58	49	57	76

Table 13a Age-specific incidence rates per 100 000 person-years by primary site and five-year age group, 2010–2014

ICD10	Site	0–4	5–9	10–14	15–19	20–24	25–29
C00–96	**All sites**	**20.9**	**15.2**	**14.1**	**30.7**	**49.3**	**60.6**
C00–14	**Mouth, pharynx**	**0.1**	**0.3**	**0.3**	**1.0**	**0.5**	**0.5**
C00	Lip	0.0	0.0	0.0	0.0	0.1	0.0
C01–02	Tongue	0.0	0.0	0.0	0.0	0.2	0.2
C03–06	Mouth, other	0.0	0.0	0.1	0.1	0.0	0.0
C07–08	Salivary glands	0.0	0.0	0.1	0.1	0.1	0.2
C09–14	Pharynx	0.1	0.3	0.0	0.7	0.0	0.0
C15–26	**Digestive organs**	**0.4**	**0.0**	**0.4**	**1.3**	**2.5**	**4.8**
C15	Oesophagus	0.0	0.0	0.0	0.0	0.0	0.0
C16	Stomach	0.0	0.0	0.0	0.1	0.4	0.5
C17	Small intestine	0.0	0.0	0.0	0.1	0.0	0.5
C18	Colon	0.0	0.0	0.1	0.8	1.7	1.8
C19–20	Rectum, rectosigmoid	0.0	0.0	0.0	0.0	0.5	1.1
C21	Anus	0.0	0.0	0.0	0.0	0.0	0.0
C22	Liver	0.4	0.0	0.1	0.1	0.0	0.1
C23–24	Gallbladder, bile ducts	0.0	0.0	0.0	0.0	0.0	0.0
C25	Pancreas	0.0	0.0	0.1	0.1	0.0	0.7
C26	Other digestive organs	0.0	0.0	0.0	0.0	0.0	0.1
C30–34, C38	**Respiratory organs**	**0.3**	**0.0**	**0.0**	**0.5**	**0.2**	**0.4**
C30–31	Nose, sinuses	0.0	0.0	0.0	0.1	0.1	0.0
C32	Larynx, epiglottis	0.0	0.0	0.0	0.0	0.0	0.0
C33–34	Lung, trachea	0.3	0.0	0.0	0.2	0.1	0.4
C38	Mediastinum, pleura (non-mesothelioma)	0.0	0.0	0.0	0.1	0.0	0.0
C40–41	**Bone**	**0.0**	**0.5**	**1.5**	**1.4**	**1.2**	**0.5**
C43	**Melanoma of the skin**	**0.0**	**0.1**	**0.3**	**0.5**	**2.5**	**3.7**
C44	**Skin, non-melanoma**	**0.4**	**0.1**	**0.1**	**0.6**	**0.5**	**0.8**
C45	**Mesothelioma**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
C47	**Autonomic nervous system**	**0.8**	**0.3**	**0.0**	**0.4**	**0.2**	**0.1**
C48–49	**Soft tissues**	**0.8**	**0.1**	**0.3**	**0.5**	**0.8**	**0.7**
C50	**Breast**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
C60–63	**Male genital organs**	**0.5**	**0.3**	**0.8**	**6.1**	**20.6**	**26.0**
C61	Prostate	0.1	0.0	0.0	0.2	0.0	0.0
C62	Testis	0.4	0.1	0.6	5.8	20.6	26.0
C60, C63	Other male genital	0.0	0.1	0.1	0.0	0.0	0.0
C64–68	**Urinary organs**	**1.4**	**0.3**	**0.4**	**0.6**	**0.7**	**2.2**
C64	Kidney excl. renal pelvis	1.1	0.3	0.3	0.2	0.1	1.2
C65	Renal pelvis	0.0	0.0	0.0	0.0	0.0	0.0
C66–68	Bladder, ureter, urethra	0.3	0.0	0.1	0.4	0.6	1.0
C69	**Eye**	**0.3**	**0.4**	**0.0**	**0.1**	**0.1**	**0.0**
C70–72, D32–33	**Central nervous system**	**4.5**	**4.5**	**4.4**	**6.0**	**5.6**	**7.4**
C73	**Thyroid gland**	**0.0**	**0.0**	**0.1**	**0.5**	**0.9**	**2.0**
C37, C74–75	**Other endocrine glands**	**1.5**	**0.6**	**0.4**	**1.4**	**2.6**	**1.3**
C39, C76, C80	**Other or unspecified**	**0.3**	**0.0**	**0.0**	**0.1**	**0.1**	**0.1**
C81–96	**Lymphoid and haematopoietic tissue**	**9.8**	**7.7**	**5.3**	**9.8**	**10.3**	**10.0**
C81	Hodgkin lymphoma	0.1	1.2	0.8	4.1	4.8	4.2
C82–86, C96	Non-Hodgkin lymphoma	1.6	2.8	1.8	1.7	1.8	2.0
C88	Malignant immunoproliferative diseases	0.0	0.0	0.0	0.0	0.0	0.0
C90	Multiple myeloma	0.0	0.0	0.0	0.0	0.0	0.0
C91–95, D45–47	Leukaemia	8.0	3.7	2.8	4.1	3.7	3.7

MALES

Age											
30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85+
91.3	**109.1**	**150.7**	**241.2**	**454.9**	**877.4**	**1493.8**	**2303.4**	**2997.9**	**3585.3**	**4101.9**	**4009.1**
1.4	**2.1**	**4.6**	**7.9**	**21.1**	**28.5**	**38.0**	**46.7**	**52.2**	**59.5**	**55.4**	**59.0**
0.1	0.2	0.5	1.1	1.7	4.0	4.7	7.7	15.5	21.0	22.3	26.7
0.5	0.9	1.3	2.1	5.9	5.3	7.0	10.7	10.0	10.5	10.5	7.8
0.4	0.2	0.6	0.7	2.4	3.5	6.9	8.6	9.7	8.1	7.7	11.7
0.4	0.6	0.7	0.8	1.2	1.7	1.7	3.8	4.1	5.4	7.7	7.8
0.1	0.2	1.5	3.3	10.0	14.1	17.8	15.9	12.9	14.5	7.3	5.0
8.5	**16.0**	**26.7**	**45.3**	**92.6**	**178.6**	**275.9**	**439.6**	**592.9**	**808.8**	**991.3**	**916.9**
0.5	0.7	2.0	3.0	6.2	12.5	18.7	30.7	30.8	40.2	47.3	45.1
0.5	2.1	2.2	4.6	9.5	17.8	24.0	35.4	52.4	67.9	105.0	88.0
0.2	0.4	1.1	1.7	2.9	6.3	9.9	12.2	14.3	15.2	21.4	17.3
3.2	4.7	9.7	14.4	28.4	57.8	96.0	163.0	243.7	344.4	451.8	432.3
2.7	4.8	6.1	11.5	24.5	45.7	70.1	109.5	139.8	180.1	182.7	156.5
0.0	0.1	0.4	0.8	1.7	1.8	1.9	3.4	3.2	4.7	3.2	5.0
0.8	1.0	1.5	3.1	5.3	11.1	14.7	15.9	18.7	29.7	36.4	32.3
0.0	0.6	0.7	1.0	2.8	5.3	6.6	11.4	15.8	15.9	20.9	22.3
0.1	1.1	2.7	4.2	10.1	17.4	29.8	50.6	65.5	91.6	102.7	96.9
0.5	0.6	0.2	1.1	1.3	2.8	4.1	7.7	8.7	18.9	20.0	21.2
1.2	**2.6**	**5.9**	**14.9**	**40.2**	**83.2**	**163.5**	**262.2**	**361.4**	**450.5**	**515.0**	**395.5**
0.2	0.4	0.6	0.7	1.7	1.9	1.9	3.7	3.4	3.0	5.9	7.2
0.0	0.1	0.5	0.9	2.6	6.8	12.5	17.5	19.2	24.3	23.2	17.8
0.8	2.0	4.6	13.0	35.5	73.5	148.9	239.8	336.6	422.5	484.0	367.7
0.1	0.0	0.2	0.3	0.4	0.9	0.1	1.3	2.2	0.7	1.8	2.8
0.5	**0.4**	**0.7**	**0.8**	**1.0**	**1.3**	**1.7**	**2.6**	**2.4**	**2.4**	**1.4**	**1.7**
9.1	**13.7**	**24.0**	**29.1**	**39.1**	**53.0**	**73.4**	**108.7**	**127.2**	**147.7**	**182.3**	**166.6**
1.9	**3.2**	**3.8**	**5.7**	**9.5**	**17.2**	**36.9**	**81.3**	**147.8**	**258.6**	**400.4**	**603.8**
0.0	**0.0**	**0.0**	**0.3**	**0.7**	**1.9**	**5.1**	**10.7**	**16.7**	**21.6**	**20.5**	**19.5**
0.2	**0.0**	**0.0**	**0.0**	**0.2**	**0.0**	**0.4**	**0.8**	**0.2**	**0.0**	**0.0**	**0.6**
1.2	**1.3**	**0.9**	**3.6**	**3.4**	**3.9**	**6.9**	**6.2**	**8.5**	**8.4**	**10.5**	**10.6**
0.0	**0.1**	**0.7**	**0.1**	**1.0**	**1.3**	**2.3**	**3.4**	**5.6**	**6.1**	**4.5**	**6.7**
32.3	**28.4**	**24.4**	**43.3**	**111.0**	**300.1**	**569.7**	**895.8**	**1036.8**	**1012.9**	**991.7**	**897.4**
0.0	0.1	4.0	26.0	97.2	290.4	563.3	886.6	1029.3	1000.4	975.4	881.3
32.0	27.7	19.9	15.9	11.1	7.1	2.8	4.2	1.9	2.7	1.8	3.9
0.2	0.6	0.5	1.4	2.6	2.6	3.6	5.0	5.6	9.8	14.5	12.3
3.7	**6.3**	**15.1**	**27.8**	**46.6**	**79.6**	**139.3**	**198.5**	**306.1**	**401.5**	**422.2**	**434.5**
2.5	3.9	9.4	15.4	27.8	37.9	56.5	70.6	97.3	98.7	80.4	56.3
0.0	0.1	0.2	0.9	1.0	1.9	4.4	7.5	11.2	16.2	21.8	12.8
1.2	2.3	5.5	11.5	17.9	39.7	78.4	120.4	197.6	286.6	320.0	365.4
0.4	**0.3**	**1.4**	**1.0**	**2.0**	**2.3**	**3.2**	**3.8**	**4.1**	**6.8**	**5.0**	**5.6**
11.9	**11.4**	**12.7**	**17.5**	**23.6**	**31.2**	**38.0**	**43.2**	**52.9**	**63.9**	**58.6**	**52.9**
3.1	**4.0**	**4.4**	**4.2**	**4.8**	**6.6**	**5.8**	**8.6**	**8.7**	**12.5**	**12.7**	**6.7**
2.6	**3.8**	**4.3**	**4.9**	**6.4**	**8.1**	**8.0**	**9.4**	**12.6**	**14.2**	**11.8**	**8.4**
0.0	**0.4**	**1.1**	**1.6**	**3.4**	**5.3**	**9.0**	**17.8**	**26.5**	**31.8**	**48.2**	**86.3**
13.5	**14.9**	**20.0**	**33.3**	**48.4**	**75.3**	**116.8**	**163.8**	**235.2**	**278.2**	**370.4**	**336.5**
3.5	3.0	2.5	3.7	2.3	3.1	3.4	3.5	5.6	3.4	2.7	2.8
4.7	6.1	8.5	12.0	20.6	28.5	46.8	70.9	88.8	102.1	129.1	106.4
0.0	0.0	0.2	0.5	0.7	2.3	1.9	5.6	7.3	9.5	12.7	6.7
0.6	1.1	2.0	4.2	7.3	12.4	18.0	23.7	38.8	48.0	67.3	61.3
4.7	4.7	6.8	12.9	17.5	29.0	46.6	60.0	94.7	115.3	158.6	159.3

Table 13b Age-specific incidence rates per 100 000 person-years by primary site and five-year age group, 2010–2014

ICD10	Site	0–4	5–9	10–14	15–19	20–24	25–29
C00–96	**All sites**	**20.0**	**10.3**	**14.9**	**26.8**	**41.7**	**76.2**
C00–14	**Mouth, pharynx**	**0.3**	**0.0**	**0.5**	**0.1**	**0.7**	**2.0**
C00	Lip	0.1	0.0	0.0	0.0	0.0	0.1
C01–02	Tongue	0.0	0.0	0.0	0.0	0.1	0.5
C03–06	Mouth, other	0.0	0.0	0.1	0.1	0.1	0.2
C07–08	Salivary glands	0.0	0.0	0.4	0.0	0.2	0.9
C09–14	Pharynx	0.1	0.0	0.0	0.0	0.2	0.2
C15–26	**Digestive organs**	**0.5**	**0.3**	**0.8**	**2.4**	**3.5**	**4.7**
C15	Oesophagus	0.0	0.0	0.0	0.0	0.1	0.0
C16	Stomach	0.0	0.0	0.0	0.0	0.2	0.2
C17	Small intestine	0.0	0.0	0.0	0.1	0.1	0.1
C18	Colon	0.0	0.1	0.7	2.0	2.3	3.4
C19–20	Rectum, rectosigmoid	0.0	0.0	0.0	0.0	0.0	0.7
C21	Anus	0.0	0.0	0.0	0.0	0.0	0.0
C22	Liver	0.5	0.1	0.1	0.1	0.4	0.1
C23–24	Gallbladder, bile ducts	0.0	0.0	0.0	0.0	0.0	0.0
C25	Pancreas	0.0	0.0	0.0	0.1	0.2	0.0
C26	Other digestive organs	0.0	0.0	0.0	0.0	0.0	0.1
C30–34, C38	**Respiratory organs**	**0.1**	**0.0**	**0.0**	**0.1**	**0.9**	**1.0**
C30–31	Nose, sinuses	0.0	0.0	0.0	0.0	0.2	0.2
C32	Larynx, epiglottis	0.0	0.0	0.0	0.0	0.0	0.0
C33–34	Lung, trachea	0.1	0.0	0.0	0.1	0.6	0.7
C38	Mediastinum, pleura (non-mesothelioma)	0.0	0.0	0.0	0.0	0.0	0.0
C40–41	**Bone**	**0.3**	**0.5**	**0.5**	**0.9**	**1.4**	**0.9**
C43	**Melanoma of the skin**	**0.1**	**0.1**	**0.3**	**1.5**	**5.6**	**11.5**
C44	**Skin, non-melanoma**	**0.3**	**0.4**	**0.1**	**0.6**	**0.6**	**0.9**
C45	**Mesothelioma**	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**	**0.0**
C47	**Autonomic nervous system**	**0.9**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
C48–49	**Soft tissues**	**0.9**	**0.4**	**0.5**	**0.6**	**1.0**	**1.0**
C50	**Breast**	**0.0**	**0.0**	**0.0**	**0.4**	**2.0**	**10.6**
C51–58	**Female genital organs**	**0.3**	**0.0**	**0.5**	**1.5**	**4.6**	**16.9**
C53	Cervix uteri	0.0	0.0	0.0	0.1	2.6	13.8
C54	Corpus uteri	0.0	0.0	0.0	0.1	0.2	0.4
C55	Uterus, other	0.0	0.0	0.0	0.0	0.0	0.0
C56	Ovary	0.1	0.0	0.4	1.3	1.4	1.9
C51–52, C57	Other female genital	0.1	0.0	0.1	0.0	0.1	0.1
C58	Placenta	0.0	0.0	0.0	0.0	0.2	0.7
C64–68	**Urinary organs**	**1.7**	**0.4**	**0.1**	**0.4**	**0.4**	**0.6**
C64	Kidney excl. renal pelvis	1.7	0.4	0.1	0.3	0.2	0.4
C65	Renal pelvis	0.0	0.0	0.0	0.0	0.0	0.0
C66–68	Bladder, ureter, urethra	0.0	0.0	0.0	0.1	0.1	0.2
C69	**Eye**	**0.7**	**0.0**	**0.0**	**0.0**	**0.1**	**0.6**
C70–72, D32–33	**Central nervous system**	**4.9**	**4.2**	**4.0**	**4.4**	**5.7**	**6.3**
C73	**Thyroid gland**	**0.0**	**0.3**	**1.1**	**1.9**	**4.7**	**6.2**
C37, C74–75	**Other endocrine glands**	**0.9**	**0.3**	**0.4**	**2.3**	**2.7**	**4.1**
C39, C76, C80	**Other or unspecified**	**0.0**	**0.1**	**0.0**	**0.0**	**0.1**	**0.1**
C81–96	**Lymphoid and haematopoietic tissue**	**8.1**	**3.4**	**6.1**	**9.4**	**7.9**	**8.8**
C81	Hodgkin lymphoma	0.0	0.0	1.3	4.8	4.3	4.1
C82–86, C96	Non-Hodgkin lymphoma	1.5	0.7	1.2	1.1	1.0	2.0
C88	Malignant immunoproliferative diseases	0.0	0.0	0.0	0.0	0.0	0.0
C90	Multiple myeloma	0.0	0.0	0.0	0.1	0.0	0.0
C91–95, D45–47	Leukaemia	6.6	2.7	3.6	3.3	2.6	2.7

FEMALES

Age											
30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85+
116.1	**196.9**	**284.7**	**424.7**	**607.2**	**807.2**	**1093.1**	**1487.3**	**1684.4**	**2007.6**	**2271.9**	**2304.6**
0.9	**2.2**	**3.6**	**5.4**	**10.3**	**14.0**	**16.4**	**21.0**	**21.8**	**23.2**	**32.0**	**39.3**
0.1	0.4	0.7	0.8	1.1	2.3	3.1	3.9	6.2	6.6	11.9	15.2
0.4	0.5	0.3	1.4	2.6	2.8	4.5	4.4	3.7	4.9	7.2	6.5
0.0	0.0	0.8	0.6	1.6	2.4	2.7	5.2	6.4	5.2	7.8	10.6
0.4	0.9	0.4	0.6	1.4	1.2	1.7	2.4	2.0	2.2	3.5	3.6
0.0	0.5	1.4	2.0	3.5	5.4	4.5	5.0	3.5	4.4	1.6	3.4
9.1	**16.3**	**23.7**	**44.1**	**76.5**	**125.7**	**189.4**	**305.6**	**429.2**	**571.9**	**692.2**	**678.7**
0.0	0.0	0.6	0.8	1.4	2.9	4.6	9.9	8.8	12.0	10.7	17.6
0.2	2.5	1.3	3.7	6.3	6.0	9.4	17.2	21.1	34.2	44.9	51.9
0.4	0.1	0.9	1.6	1.9	3.6	5.1	6.6	7.3	10.7	12.6	10.3
4.8	5.8	8.9	18.5	32.0	52.9	79.8	142.4	210.8	288.6	365.1	333.1
1.7	3.8	6.5	10.7	18.0	31.5	42.4	59.0	83.5	95.9	103.3	98.6
0.1	0.7	1.1	2.2	2.6	3.8	4.6	5.5	5.1	7.4	8.2	7.0
0.4	0.7	0.2	1.6	2.0	3.4	5.6	7.3	10.8	13.7	19.8	20.4
0.2	0.7	0.6	1.0	2.5	4.4	7.0	11.2	15.9	17.8	22.9	20.4
1.1	1.8	3.1	2.9	8.3	15.2	26.3	39.7	55.7	76.8	88.2	91.9
0.0	0.2	0.6	0.9	1.5	2.0	4.5	6.8	10.4	15.0	16.6	27.4
1.9	**2.9**	**5.8**	**18.0**	**37.9**	**78.3**	**130.9**	**196.2**	**254.2**	**267.0**	**246.1**	**143.8**
0.1	0.4	0.1	0.5	0.6	1.6	1.8	1.1	3.1	1.9	3.8	3.1
0.1	0.4	0.3	0.2	0.8	1.9	1.1	2.5	2.2	4.1	3.1	1.5
1.6	2.2	5.4	17.2	35.9	74.7	127.6	191.9	248.2	260.7	238.0	137.4
0.0	0.0	0.0	0.1	0.6	0.1	0.4	0.6	0.7	0.3	1.3	1.8
1.2	**0.4**	**0.9**	**0.8**	**0.3**	**0.7**	**1.5**	**1.6**	**1.3**	**1.4**	**2.2**	**2.1**
14.5	**25.1**	**36.2**	**42.0**	**44.3**	**56.8**	**61.3**	**86.9**	**89.6**	**87.7**	**105.2**	**112.1**
1.2	**1.9**	**4.6**	**5.7**	**9.9**	**18.5**	**29.8**	**53.1**	**91.2**	**147.6**	**209.7**	**377.3**
0.0	**0.1**	**0.1**	**0.1**	**0.5**	**0.3**	**1.4**	**1.9**	**1.8**	**3.3**	**1.6**	**2.1**
0.2	**0.1**	**0.2**	**0.0**	**0.0**	**0.1**	**0.4**	**0.2**	**0.4**	**0.0**	**0.0**	**0.5**
1.0	**1.3**	**2.1**	**2.4**	**3.3**	**4.9**	**9.0**	**10.4**	**9.2**	**8.7**	**11.6**	**8.3**
23.7	**60.1**	**109.1**	**175.9**	**231.9**	**244.9**	**303.2**	**344.7**	**242.7**	**272.2**	**287.9**	**282.3**
25.2	**37.8**	**39.7**	**55.7**	**84.2**	**112.1**	**139.1**	**181.2**	**190.9**	**205.8**	**198.7**	**185.2**
20.0	27.9	22.7	22.6	15.1	13.4	13.8	14.2	13.9	13.7	14.4	12.4
2.1	3.4	7.1	15.6	34.0	57.0	73.1	99.7	106.2	118.3	104.5	75.9
0.0	0.0	0.0	0.1	0.5	0.1	0.1	0.6	1.3	0.3	3.5	2.6
2.4	5.2	7.6	13.5	28.3	33.0	40.0	50.5	51.8	55.5	53.4	56.8
0.4	1.1	2.3	3.8	6.2	8.6	12.1	16.2	17.8	18.0	22.9	37.4
0.4	0.2	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.0	**2.9**	**7.1**	**9.4**	**16.6**	**32.7**	**48.3**	**72.9**	**99.3**	**126.8**	**148.2**	**124.2**
0.6	2.4	5.2	4.9	9.4	12.3	21.5	30.1	37.9	43.2	40.8	30.0
0.0	0.0	0.1	0.1	0.4	2.4	2.7	4.3	5.9	10.9	12.2	4.9
0.4	0.6	1.8	4.4	6.8	18.0	24.2	38.5	55.5	72.7	95.1	89.4
0.6	**0.2**	**0.9**	**0.6**	**1.6**	**2.4**	**2.4**	**6.5**	**3.7**	**4.4**	**5.0**	**3.1**
10.9	**14.5**	**19.0**	**23.5**	**28.7**	**35.1**	**44.3**	**49.2**	**53.1**	**47.8**	**56.2**	**51.1**
8.9	**13.7**	**11.4**	**13.4**	**15.5**	**13.5**	**15.0**	**14.0**	**18.9**	**13.4**	**9.1**	**8.8**
3.5	**5.1**	**5.4**	**5.7**	**6.5**	**6.2**	**7.0**	**8.0**	**6.4**	**8.5**	**7.2**	**4.1**
0.5	**0.2**	**0.6**	**0.9**	**2.9**	**4.8**	**8.4**	**10.4**	**15.9**	**31.4**	**47.1**	**79.5**
11.8	**12.1**	**14.3**	**21.1**	**36.3**	**56.2**	**85.3**	**123.5**	**154.6**	**186.6**	**211.9**	**202.2**
4.2	2.9	2.0	2.0	1.1	0.9	1.5	3.0	2.9	3.6	4.1	1.3
3.4	4.9	5.5	7.8	16.9	26.4	38.1	49.2	60.6	70.8	73.5	62.2
0.0	0.0	0.0	0.6	0.5	1.1	3.8	3.8	5.3	6.3	5.7	3.9
0.1	0.6	1.2	2.0	4.8	8.9	12.4	19.6	21.8	38.5	39.2	36.9
4.1	3.7	5.6	8.7	13.0	18.9	29.5	47.9	64.1	67.5	89.5	97.9

Table 14a Average annual number of new cases by primary site and five-year period, 1955–2014

ICD10	Site	1955–59	1960–64	1965–69	1970–74
C00–96	**All sites**	**3841**	**4471**	**5226**	**6105**
C00–14	**Mouth, pharynx**	**182**	**192**	**194**	**244**
C00	Lip	100	95	99	124
C01–02	Tongue	16	21	20	25
C03–06	Mouth, other	21	24	29	29
C07–08	Salivary glands	11	12	13	16
C09–14	Pharynx	34	40	32	50
C15–26	**Digestive organs**	**1621**	**1702**	**1841**	**1931**
C15	Oesophagus	72	80	78	79
C16	Stomach	858	802	786	674
C17	Small intestine	12	10	15	15
C18	Colon	221	281	349	388
C19–20	Rectum, rectosigmoid	148	174	228	308
C21	Anus	3	8	6	5
C22	Liver	17	24	32	50
C23–24	Gallbladder, bile ducts	15	22	25	27
C25	Pancreas	138	159	214	249
C26	Other digestive organs	136	142	108	136
C30–34, C38	**Respiratory organs**	**296**	**430**	**587**	**754**
C30–31	Nose, sinuses	20	20	22	21
C32	Larynx, epiglottis	27	43	62	71
C33–34	Lung, trachea	238	356	489	646
C38	Mediastinum, pleura (non-mesothelioma)	11	11	14	15
C40–41	**Bone**	**15**	**14**	**18**	**18**
C43	**Melanoma of the skin**	**45**	**69**	**101**	**145**
C44	**Skin, non-melanoma**	**81**	**76**	**84**	**162**
C45	**Mesothelioma**	**0**	**2**	**1**	**8**
C47	**Autonomic nervous system**	**20**	**16**	**16**	**12**
C48–49	**Soft tissues**	**20**	**29**	**36**	**46**
C50	**Breast**	**8**	**7**	**9**	**8**
C60–63	**Male genital organs**	**707**	**887**	**1061**	**1295**
C61	Prostate	638	798	971	1186
C62	Testis	51	68	69	86
C60, C63	Other male genital	18	22	21	23
C64–68	**Urinary organs**	**293**	**378**	**490**	**602**
C64	Kidney excl. renal pelvis	88	119	149	166
C65	Renal pelvis	7	11	16	22
C66–68	Bladder, ureter, urethra	198	248	325	413
C69	**Eye**	**18**	**18**	**22**	**19**
C70–72, D32–33	**Central nervous system**	**115**	**131**	**148**	**153**
C73	**Thyroid gland**	**17**	**24**	**33**	**34**
C37, C74–75	**Other endocrine glands**	**6**	**9**	**13**	**24**
C39, C76, C80	**Other or unspecified**	**51**	**82**	**114**	**138**
C81–96	**Lymphoid and haematopoietic tissue**	**346**	**405**	**455**	**510**
C81	Hodgkin lymphoma	42	52	56	63
C82–86, C96	Non-Hodgkin lymphoma	87	96	121	122
C88	Malignant immunoproliferative diseases	0	0	2	5
C90	Multiple myeloma	66	79	84	113
C91–95, D45–47	Leukaemia	151	177	192	207

MALES

Period							
1975–79	1980–84	1985–89	1990–94	1995–99	2000–04	2005–09	2010–14
7243	**8281**	**9061**	**10124**	**11053**	**12264**	**14325**	**16398**
239	**248**	**256**	**255**	**260**	**258**	**286**	**350**
114	104	95	83	64	52	65	74
28	34	38	39	46	50	57	73
32	47	47	52	53	49	49	54
14	14	15	21	18	21	20	30
50	50	62	60	78	86	95	119
2110	**2318**	**2371**	**2456**	**2511**	**2669**	**2851**	**3306**
91	86	93	104	123	127	145	193
614	598	533	482	409	354	301	302
21	26	26	31	40	52	66	88
492	625	722	827	896	1004	1111	1305
399	493	521	567	573	642	670	757
9	10	13	14	19	18	19	24
52	61	63	61	65	79	92	141
38	42	48	54	56	59	68	80
258	287	306	275	279	296	339	355
136	90	47	40	50	37	39	61
969	**1166**	**1280**	**1354**	**1418**	**1520**	**1616**	**1741**
24	23	24	21	21	23	23	27
88	98	108	103	106	108	100	105
838	1029	1141	1216	1277	1374	1483	1601
19	17	7	14	14	15	11	9
24	**22**	**21**	**21**	**22**	**24**	**26**	**27**
192	**245**	**327**	**422**	**455**	**479**	**622**	**873**
205	**266**	**352**	**452**	**532**	**627**	**751**	**896**
17	**20**	**38**	**38**	**53**	**63**	**65**	**68**
9	**8**	**7**	**7**	**7**	**5**	**7**	**6**
57	**50**	**41**	**47**	**49**	**55**	**60**	**68**
11	**12**	**11**	**15**	**14**	**15**	**17**	**26**
1571	**1806**	**1996**	**2480**	**3007**	**3491**	**4502**	**5132**
1443	1647	1812	2250	2756	3208	4174	4780
101	134	157	199	219	247	283	305
27	25	26	31	32	36	45	46
768	**938**	**1025**	**1134**	**1129**	**1238**	**1396**	**1589**
200	246	260	285	281	331	394	532
27	30	27	35	36	39	47	56
540	663	737	814	813	869	955	1002
24	**27**	**23**	**26**	**28**	**32**	**32**	**35**
189	**207**	**245**	**262**	**314**	**387**	**465**	**473**
42	**48**	**47**	**44**	**47**	**53**	**69**	**94**
27	**42**	**45**	**47**	**61**	**84**	**124**	**115**
179	**206**	**267**	**289**	**297**	**237**	**187**	**149**
609	**650**	**708**	**775**	**850**	**1027**	**1249**	**1450**
67	56	49	52	56	66	71	75
163	193	250	301	340	375	455	540
7	8	9	14	20	28	33	36
145	151	161	157	168	169	205	214
227	241	238	251	266	389	485	585

Table 14b Average annual number of new cases by primary site and five-year period, 1955–2014

ICD10	Site	1955–59	1960–64	1965–69	1970–74
C00–96	**All sites**	**4083**	**4479**	**5140**	**5852**
C00–14	**Mouth, pharynx**	**61**	**60**	**77**	**79**
C00	Lip	8	7	12	10
C01–02	Tongue	12	12	17	17
C03–06	Mouth, other	12	11	16	17
C07–08	Salivary glands	8	11	15	15
C09–14	Pharynx	22	19	17	20
C15–26	**Digestive organs**	**1393**	**1422**	**1529**	**1676**
C15	Oesophagus	23	28	30	30
C16	Stomach	613	546	508	443
C17	Small intestine	10	9	12	18
C18	Colon	267	324	408	472
C19–20	Rectum, rectosigmoid	118	127	179	248
C21	Anus	3	10	11	13
C22	Liver	11	14	16	31
C23–24	Gallbladder, bile ducts	46	50	58	52
C25	Pancreas	92	117	142	181
C26	Other digestive organs	210	197	166	187
C30–34, C38	**Respiratory organs**	**87**	**106**	**140**	**185**
C30–31	Nose, sinuses	14	12	13	14
C32	Larynx, epiglottis	2	3	6	7
C33–34	Lung, trachea	68	83	115	158
C38	Mediastinum, pleura (non-mesothelioma)	4	7	6	6
C40–41	**Bone**	**10**	**10**	**11**	**14**
C43	**Melanoma of the skin**	**54**	**82**	**108**	**161**
C44	**Skin, non-melanoma**	**56**	**48**	**44**	**95**
C45	**Mesothelioma**	**0**	**1**	**1**	**2**
C47	**Autonomic nervous system**	**18**	**12**	**13**	**13**
C48–49	**Soft tissues**	**17**	**24**	**29**	**36**
C50	**Breast**	**901**	**1027**	**1172**	**1327**
C51–58	**Female genital organs**	**834**	**928**	**1067**	**1204**
C53	Cervix uteri	333	351	385	438
C54	Corpus uteri	167	207	250	303
C55	Uterus, other	23	22	15	11
C56	Ovary	249	278	349	339
C51–52, C57	Other female genital	61	66	65	111
C58	Placenta	2	3	4	4
C64–68	**Urinary organs**	**189**	**212**	**245**	**306**
C64	Kidney excl. renal pelvis	74	88	100	114
C65	Renal pelvis	6	5	10	13
C66–68	Bladder, ureter, urethra	109	119	135	179
C69	**Eye**	**13**	**19**	**16**	**17**
C70–72, D32–33	**Central nervous system**	**102**	**116**	**133**	**128**
C73	**Thyroid gland**	**52**	**59**	**79**	**99**
C37, C74–75	**Other endocrine glands**	**7**	**6**	**9**	**15**
C39, C76, C80	**Other or unspecified**	**46**	**63**	**91**	**98**
C81–96	**Lymphoid and haematopoietic tissue**	**241**	**283**	**378**	**397**
C81	Hodgkin lymphoma	30	35	48	40
C82–86, C96	Non-Hodgkin lymphoma	57	65	98	101
C88	Malignant immunoproliferative diseases	0	0	0	3
C90	Multiple myeloma	38	50	77	96
C91–95, D45–47	Leukaemia	116	132	154	157

FEMALES

Period							
1975–79	1980–84	1985–89	1990–94	1995–99	2000–04	2005–09	2010–14
6854	**7636**	**8320**	**9189**	**10187**	**11399**	**12600**	**13926**
82	**100**	**111**	**118**	**131**	**132**	**180**	**202**
13	20	24	30	27	26	44	48
18	20	25	22	25	27	32	42
18	25	29	33	36	33	45	43
12	14	12	17	19	19	23	24
21	20	20	17	24	27	37	44
1926	**2120**	**2199**	**2294**	**2434**	**2538**	**2721**	**2924**
32	33	36	42	44	53	55	66
407	401	358	313	267	229	221	181
20	26	26	32	36	50	54	60
626	745	861	947	1086	1169	1278	1397
318	397	405	444	470	487	516	540
18	22	26	35	36	41	44	51
30	39	44	47	41	46	58	81
65	81	81	72	80	76	82	97
213	253	287	300	312	336	359	374
197	122	75	61	64	50	56	76
232	**313**	**427**	**561**	**708**	**889**	**1127**	**1361**
12	13	16	16	16	16	19	19
8	13	11	17	19	18	18	19
204	283	395	523	666	847	1082	1317
7	5	4	5	7	7	7	6
13	**13**	**15**	**17**	**18**	**19**	**22**	**23**
240	**326**	**410**	**476**	**500**	**547**	**645**	**888**
143	**185**	**269**	**363**	**443**	**520**	**679**	**798**
3	**4**	**6**	**8**	**10**	**10**	**13**	**13**
7	**5**	**8**	**8**	**7**	**5**	**6**	**4**
44	**48**	**45**	**45**	**52**	**73**	**89**	**86**
1532	**1666**	**1813**	**1974**	**2357**	**2687**	**2766**	**3090**
1283	**1283**	**1270**	**1388**	**1403**	**1495**	**1566**	**1636**
422	369	327	363	328	292	299	309
361	384	395	444	488	611	689	729
6	7	6	7	8	11	7	8
372	405	437	466	460	464	445	439
120	114	101	102	114	114	125	148
2	4	4	6	4	3	2	3
363	**406**	**457**	**477**	**510**	**551**	**607**	**652**
135	152	179	194	192	200	241	245
17	15	17	18	27	28	27	39
211	239	261	265	291	324	340	368
22	**23**	**21**	**28**	**31**	**31**	**31**	**36**
182	**206**	**248**	**280**	**380**	**513**	**616**	**546**
123	**147**	**135**	**137**	**120**	**145**	**168**	**228**
25	**45**	**40**	**47**	**57**	**83**	**130**	**111**
153	**207**	**254**	**315**	**308**	**299**	**227**	**170**
480	**540**	**593**	**652**	**716**	**863**	**1008**	**1159**
44	38	36	33	36	48	47	60
137	176	225	269	302	342	376	434
3	6	7	12	11	17	22	30
123	127	138	137	146	153	160	172
173	192	187	200	222	303	403	464

Table 15a Age-standardised (Norway, 2014) incidence rates per 100 000 person-years by primary site and five-year period, 1955–2014

ICD10	Site	1955–59	1960–64	1965–69	1970–74
C00–96	**All sites**	**326.6**	**348.8**	**378.9**	**412.1**
C00–14	**Mouth, pharynx**	**15.7**	**15.1**	**14.4**	**16.3**
C00	Lip	8.8	7.7	7.7	8.4
C01–02	Tongue	1.3	1.6	1.5	1.7
C03–06	Mouth, other	1.8	2.0	2.1	2.0
C07–08	Salivary glands	0.9	0.9	0.9	1.0
C09–14	Pharynx	2.9	2.9	2.2	3.2
C15–26	**Digestive organs**	**140.9**	**137.0**	**136.2**	**133.1**
C15	Oesophagus	6.5	6.8	5.7	5.4
C16	Stomach	75.1	64.9	58.9	47.2
C17	Small intestine	1.0	0.7	1.0	1.0
C18	Colon	19.2	22.7	25.6	27.0
C19–20	Rectum, rectosigmoid	12.9	13.8	16.8	20.8
C21	Anus	0.2	0.6	0.4	0.4
C22	Liver	1.3	1.7	2.2	3.1
C23–24	Gallbladder, bile ducts	1.2	1.7	1.8	1.9
C25	Pancreas	11.3	11.9	15.2	16.3
C26	Other digestive organs	12.3	12.2	8.5	10.0
C30–34, C38	**Respiratory organs**	**22.4**	**29.9**	**38.0**	**46.1**
C30–31	Nose, sinuses	1.6	1.6	1.6	1.3
C32	Larynx, epiglottis	2.1	3.0	4.0	4.4
C33–34	Lung, trachea	17.8	24.5	31.5	39.4
C38	Mediastinum, pleura (non-mesothelioma)	0.9	0.8	0.9	0.9
C40–41	**Bone**	**0.9**	**0.8**	**1.0**	**0.9**
C43	**Melanoma of the skin**	**3.2**	**4.7**	**6.6**	**9.0**
C44	**Skin, non-melanoma**	**8.2**	**7.0**	**7.6**	**13.2**
C45	**Mesothelioma**	**0.0**	**0.2**	**0.1**	**0.5**
C47	**Autonomic nervous system**	**1.5**	**1.0**	**1.0**	**0.6**
C48–49	**Soft tissues**	**1.6**	**2.0**	**2.4**	**3.0**
C50	**Breast**	**0.7**	**0.6**	**0.7**	**0.6**
C60–63	**Male genital organs**	**68.0**	**77.2**	**85.4**	**94.6**
C61	Prostate	63.3	71.1	79.7	88.1
C62	Testis	3.1	4.2	4.1	4.8
C60, C63	Other male genital	1.6	1.9	1.6	1.7
C64–68	**Urinary organs**	**24.0**	**28.6**	**34.3**	**39.5**
C64	Kidney excl. renal pelvis	6.7	8.5	10.1	10.3
C65	Renal pelvis	0.5	0.8	1.1	1.5
C66–68	Bladder, ureter, urethra	16.8	19.3	23.1	27.7
C69	**Eye**	**1.3**	**1.2**	**1.3**	**1.1**
C70–72, D32–33	**Central nervous system**	**7.1**	**7.7**	**8.5**	**8.6**
C73	**Thyroid gland**	**1.3**	**1.7**	**2.2**	**2.1**
C37, C74–75	**Other endocrine glands**	**0.4**	**0.5**	**0.8**	**1.3**
C39, C76, C80	**Other or unspecified**	**4.3**	**6.0**	**8.4**	**9.6**
C81–96	**Lymphoid and haematopoietic tissue**	**25.3**	**27.7**	**30.2**	**32.0**
C81	Hodgkin lymphoma	2.8	3.3	3.4	3.6
C82–86, C96	Non-Hodgkin lymphoma	6.3	6.5	7.9	7.6
C88	Malignant immunoproliferative diseases	0.0	0.0	0.1	0.3
C90	Multiple myeloma	5.4	5.8	6.2	7.5
C91–95, D45–47	Leukaemia	10.8	12.0	12.6	12.9

MALES

Period							
1975–79	1980–84	1985–89	1990–94	1995–99	2000–04	2005–09	2010–14
461.7	**499.8**	**529.0**	**573.6**	**610.8**	**652.5**	**706.2**	**724.7**
15.1	**14.9**	**14.9**	**14.4**	**14.3**	**13.4**	**13.6**	**15.0**
7.4	6.4	5.7	4.7	3.6	2.8	3.3	3.4
1.7	2.0	2.1	2.1	2.5	2.5	2.7	3.1
2.1	2.8	2.8	3.0	3.0	2.6	2.3	2.4
1.0	0.8	0.8	1.2	1.1	1.1	1.0	1.3
3.0	2.9	3.5	3.5	4.2	4.4	4.4	4.9
137.7	**143.6**	**140.7**	**141.8**	**140.4**	**143.7**	**142.4**	**147.8**
5.9	5.2	5.5	6.0	6.8	6.9	7.1	8.5
40.1	37.1	31.9	28.0	23.0	19.2	15.3	13.5
1.3	1.7	1.5	1.7	2.1	2.8	3.1	3.8
32.3	38.5	43.0	47.8	50.1	54.2	55.9	59.2
25.9	30.1	30.4	32.5	31.9	34.3	33.1	33.3
0.5	0.6	0.7	0.8	1.1	0.9	0.9	1.0
3.2	3.6	3.7	3.4	3.5	4.1	4.5	6.1
2.4	2.6	2.8	3.1	3.2	3.2	3.5	3.6
16.3	17.8	18.0	15.9	15.6	15.9	17.0	15.9
9.7	6.3	3.2	2.5	3.1	2.1	2.0	2.8
57.0	**66.6**	**71.9**	**75.2**	**77.3**	**79.9**	**79.3**	**77.5**
1.4	1.4	1.4	1.2	1.1	1.2	1.1	1.2
5.1	5.6	6.1	5.8	5.8	5.7	4.8	4.6
49.3	58.6	64.0	67.5	69.6	72.3	72.9	71.4
1.1	1.0	0.4	0.8	0.8	0.8	0.5	0.4
1.3	**1.1**	**1.0**	**1.0**	**1.0**	**1.1**	**1.1**	**1.1**
11.3	**14.0**	**18.1**	**22.8**	**23.6**	**24.2**	**29.4**	**37.7**
15.4	**17.8**	**22.7**	**27.2**	**31.3**	**35.4**	**39.8**	**43.4**
1.0	**1.2**	**2.2**	**2.1**	**2.9**	**3.3**	**3.3**	**3.1**
0.5	**0.4**	**0.4**	**0.3**	**0.3**	**0.2**	**0.3**	**0.2**
3.5	**2.9**	**2.2**	**2.5**	**2.6**	**2.7**	**2.8**	**2.9**
0.7	**0.9**	**0.7**	**0.9**	**0.8**	**0.8**	**0.9**	**1.1**
106.2	**112.4**	**117.8**	**141.5**	**168.6**	**188.9**	**223.2**	**223.8**
99.1	104.3	109.0	131.0	157.4	176.4	209.1	209.8
5.3	6.5	7.2	8.8	9.4	10.5	11.9	12.0
1.8	1.6	1.6	1.8	1.8	2.0	2.2	2.0
47.6	**55.4**	**60.5**	**64.4**	**62.6**	**65.8**	**69.0**	**70.9**
11.9	14.3	15.0	15.8	15.2	17.1	18.8	22.6
1.6	1.8	1.5	2.0	1.9	2.0	2.3	2.5
34.1	39.3	44.0	46.6	45.5	46.7	47.8	45.7
1.4	**1.6**	**1.3**	**1.4**	**1.5**	**1.6**	**1.5**	**1.5**
10.2	**11.1**	**13.0**	**13.8**	**15.7**	**18.6**	**21.2**	**19.7**
2.5	**2.7**	**2.6**	**2.3**	**2.4**	**2.5**	**3.1**	**3.9**
1.4	**2.2**	**2.3**	**2.4**	**3.0**	**4.0**	**5.6**	**4.7**
11.4	**12.9**	**16.3**	**17.0**	**16.9**	**13.1**	**9.8**	**7.0**
37.5	**38.2**	**40.5**	**42.5**	**45.4**	**53.3**	**60.0**	**63.4**
3.7	2.9	2.4	2.4	2.5	3.0	3.1	3.0
9.9	11.2	14.1	16.2	18.1	19.2	21.7	23.5
0.5	0.5	0.6	0.8	1.1	1.6	1.6	1.6
9.4	9.3	9.7	9.1	9.3	9.0	10.1	9.5
14.0	14.3	13.6	13.9	14.3	20.5	23.5	25.8

Table 15b Age-standardised (Norway, 2014) incidence rates per 100 000 person-years by primary site and five-year period, 1955–2014

ICD10	Site	1955–59	1960–64	1965–69	1970–74
C00–96	**All sites**	**286.3**	**288.6**	**305.5**	**324.6**
C00–14	**Mouth, pharynx**	**4.7**	**4.0**	**4.8**	**4.5**
C00	Lip	0.6	0.5	0.8	0.6
C01–02	Tongue	0.9	0.8	1.1	1.0
C03–06	Mouth, other	1.0	0.8	1.1	0.9
C07–08	Salivary glands	0.6	0.7	0.9	0.8
C09–14	Pharynx	1.6	1.2	1.0	1.2
C15–26	**Digestive organs**	**107.1**	**99.0**	**95.4**	**93.8**
C15	Oesophagus	1.9	2.0	1.9	1.6
C16	Stomach	47.9	38.9	32.2	25.1
C17	Small intestine	0.7	0.6	0.7	1.0
C18	Colon	20.2	22.1	25.1	26.2
C19–20	Rectum, rectosigmoid	8.5	8.5	10.7	13.8
C21	Anus	0.3	0.6	0.7	0.7
C22	Liver	0.8	0.9	1.0	1.6
C23–24	Gallbladder, bile ducts	3.3	3.3	3.5	2.9
C25	Pancreas	6.6	7.6	8.5	10.0
C26	Other digestive organs	16.7	14.6	11.1	10.9
C30–34, C38	**Respiratory organs**	**6.3**	**6.8**	**8.2**	**10.0**
C30–31	Nose, sinuses	1.1	0.9	0.9	0.8
C32	Larynx, epiglottis	0.1	0.2	0.3	0.4
C33–34	Lung, trachea	4.8	5.2	6.6	8.5
C38	Mediastinum, pleura (non-mesothelioma)	0.2	0.5	0.3	0.4
C40–41	**Bone**	**0.6**	**0.6**	**0.6**	**0.7**
C43	**Melanoma of the skin**	**3.6**	**5.0**	**6.5**	**9.2**
C44	**Skin, non-melanoma**	**4.4**	**3.6**	**3.0**	**5.8**
C45	**Mesothelioma**	**0.0**	**0.1**	**0.0**	**0.1**
C47	**Autonomic nervous system**	**1.1**	**0.7**	**0.7**	**0.7**
C48–49	**Soft tissues**	**1.1**	**1.5**	**1.7**	**2.0**
C50	**Breast**	**60.2**	**64.3**	**68.6**	**74.0**
C51–58	**Female genital organs**	**53.9**	**56.0**	**61.3**	**66.3**
C53	Cervix uteri	20.2	20.8	22.3	25.0
C54	Corpus uteri	10.9	12.3	14.1	16.1
C55	Uterus, other	1.9	1.5	1.1	0.7
C56	Ovary	16.2	16.9	19.7	18.4
C51–52, C57	Other female genital	4.5	4.4	3.9	6.0
C58	Placenta	0.1	0.2	0.2	0.2
C64–68	**Urinary organs**	**13.4**	**13.9**	**14.6**	**16.6**
C64	Kidney excl. renal pelvis	5.0	5.5	5.8	6.0
C65	Renal pelvis	0.5	0.3	0.6	0.7
C66–68	Bladder, ureter, urethra	8.0	8.1	8.2	9.9
C69	**Eye**	**0.9**	**1.1**	**0.9**	**0.9**
C70–72, D32–33	**Central nervous system**	**6.2**	**6.6**	**7.3**	**6.8**
C73	**Thyroid gland**	**3.5**	**3.8**	**4.7**	**5.6**
C37, C74–75	**Other endocrine glands**	**0.4**	**0.4**	**0.5**	**0.8**
C39, C76, C80	**Other or unspecified**	**3.2**	**4.2**	**5.5**	**5.5**
C81–96	**Lymphoid and haematopoietic tissue**	**15.7**	**17.2**	**21.5**	**21.3**
C81	Hodgkin lymphoma	1.8	2.1	2.7	2.1
C82–86, C96	Non-Hodgkin lymphoma	3.7	4.1	5.7	5.5
C88	Malignant immunoproliferative diseases	0.0	0.0	0.0	0.1
C90	Multiple myeloma	2.7	3.2	4.5	5.1
C91–95, D45–47	Leukaemia	7.5	7.8	8.6	8.4

FEMALES

Period							
1975–79	1980–84	1985–89	1990–94	1995–99	2000–04	2005–09	2010–14
357.7	**374.9**	**388.7**	**414.3**	**446.9**	**483.4**	**508.6**	**528.3**
4.3	**4.9**	**5.2**	**5.4**	**5.8**	**5.6**	**7.3**	**7.6**
0.7	1.0	1.1	1.3	1.1	1.1	1.7	1.7
0.9	1.0	1.2	1.0	1.1	1.1	1.3	1.6
1.0	1.2	1.3	1.5	1.5	1.4	1.8	1.6
0.6	0.7	0.6	0.8	0.8	0.8	0.9	0.9
1.1	1.0	1.0	0.8	1.1	1.2	1.6	1.8
99.2	**100.5**	**97.8**	**97.9**	**100.4**	**102.2**	**105.3**	**107.6**
1.6	1.6	1.6	1.8	1.8	2.2	2.1	2.4
21.0	18.8	15.8	13.1	10.7	9.1	8.4	6.6
1.0	1.2	1.2	1.4	1.5	2.2	2.2	2.3
32.1	35.4	38.3	40.6	44.9	47.0	49.2	51.1
16.4	19.0	18.2	19.4	19.9	20.1	20.5	20.3
0.9	1.1	1.3	1.7	1.5	1.7	1.8	2.0
1.5	1.9	1.9	2.0	1.7	1.9	2.2	3.0
3.2	3.8	3.5	3.0	3.2	3.0	3.2	3.6
10.6	11.8	12.6	12.5	12.6	13.3	13.7	13.7
10.8	6.0	3.4	2.5	2.5	1.8	2.0	2.7
11.7	**15.2**	**20.1**	**26.2**	**32.3**	**39.2**	**46.5**	**52.1**
0.6	0.6	0.7	0.7	0.7	0.7	0.8	0.7
0.4	0.6	0.5	0.8	0.9	0.8	0.8	0.7
10.3	13.8	18.6	24.5	30.5	37.5	44.7	50.4
0.3	0.2	0.2	0.2	0.3	0.3	0.3	0.2
0.6	**0.7**	**0.7**	**0.8**	**0.8**	**0.8**	**0.9**	**0.9**
13.0	**16.8**	**20.3**	**22.5**	**22.7**	**23.8**	**26.6**	**34.3**
7.9	**9.1**	**12.0**	**15.2**	**17.6**	**19.7**	**24.6**	**27.5**
0.1	**0.2**	**0.3**	**0.3**	**0.5**	**0.4**	**0.5**	**0.5**
0.3	**0.3**	**0.4**	**0.4**	**0.3**	**0.2**	**0.2**	**0.2**
2.3	**2.3**	**2.1**	**2.1**	**2.3**	**3.1**	**3.7**	**3.3**
81.2	**84.3**	**87.8**	**92.4**	**109.1**	**120.3**	**116.1**	**121.0**
67.9	**65.3**	**62.1**	**65.8**	**64.2**	**64.9**	**64.7**	**63.3**
23.2	19.2	16.2	17.2	15.1	12.7	12.4	12.4
18.7	19.4	19.6	21.5	22.8	26.9	28.8	28.1
0.3	0.4	0.3	0.3	0.3	0.4	0.3	0.3
19.5	20.7	21.2	22.1	21.0	20.1	18.2	16.9
6.1	5.5	4.6	4.5	4.8	4.7	4.9	5.5
0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1
18.4	**19.1**	**20.4**	**20.5**	**21.3**	**22.4**	**24.1**	**24.2**
6.8	7.2	8.1	8.4	8.2	8.2	9.7	9.4
0.8	0.7	0.7	0.7	1.1	1.2	1.1	1.4
10.7	11.2	11.6	11.3	12.0	13.0	13.3	13.4
1.1	**1.1**	**1.0**	**1.3**	**1.4**	**1.3**	**1.3**	**1.4**
9.4	**10.3**	**12.2**	**13.1**	**17.2**	**22.5**	**25.6**	**21.3**
6.7	**7.4**	**6.5**	**6.4**	**5.3**	**6.3**	**7.1**	**9.1**
1.3	**2.3**	**1.9**	**2.3**	**2.6**	**3.7**	**5.6**	**4.4**
7.8	**9.8**	**11.2**	**13.3**	**12.5**	**11.3**	**8.3**	**5.9**
24.3	**25.4**	**26.9**	**28.4**	**30.6**	**35.6**	**40.3**	**43.7**
2.2	1.8	1.6	1.5	1.6	2.0	2.0	2.4
7.0	8.4	10.5	12.0	13.2	14.5	15.3	16.5
0.2	0.3	0.3	0.5	0.5	0.7	0.9	1.1
6.1	5.9	6.1	5.7	6.0	6.2	6.3	6.3
8.8	9.0	8.4	8.6	9.4	12.3	15.8	17.3

Table 16a Average annual number of new cases by primary site and county, 2010–2014

ICD10	Site	Norway	Østfold	Akershus	Oslo	Hedmark	Oppland	Buskerud
C00–96	**All sites**	**16398**	**1064**	**1704**	**1458**	**695**	**686**	**937**
C00–14	**Mouth, pharynx**	**350**	**23**	**34**	**43**	**14**	**14**	**22**
C00	Lip	74	6	6	5	3	4	6
C01–02	Tongue	73	4	7	10	2	3	3
C03–06	Mouth, other	54	3	6	6	2	3	3
C07–08	Salivary glands	30	3	3	4	2	1	1
C09–14	Pharynx	119	8	12	18	6	4	9
C15–26	**Digestive organs**	**3306**	**207**	**336**	**305**	**141**	**140**	**178**
C15	Oesophagus	193	11	19	16	10	11	10
C16	Stomach	302	16	24	26	13	12	16
C17	Small intestine	88	5	10	5	3	4	4
C18	Colon	1305	88	133	111	53	57	71
C19–20	Rectum, rectosigmoid	757	49	82	68	32	30	42
C21	Anus	24	1	3	4	1	1	1
C22	Liver	141	8	15	20	8	4	6
C23–24	Gallbladder, bile ducts	80	6	9	9	5	5	5
C25	Pancreas	355	18	33	37	15	14	20
C26	Other digestive organs	61	5	7	8	2	2	3
C30–34, C38	**Respiratory organs**	**1741**	**120**	**153**	**136**	**77**	**81**	**88**
C30–31	Nose, sinuses	27	1	2	2	1	1	2
C32	Larynx, epiglottis	105	6	9	10	5	6	5
C33–34	Lung, trachea	1601	112	142	124	70	73	81
C38	Mediastinum, pleura (non-mesothelioma)	9	1	1	0	1	0	0
C40–41	**Bone**	**27**	**2**	**2**	**3**	**1**	**2**	**0**
C43	**Melanoma of the skin**	**873**	**54**	**115**	**91**	**37**	**29**	**55**
C44	**Skin, non-melanoma**	**896**	**58**	**90**	**75**	**32**	**30**	**62**
C45	**Mesothelioma**	**68**	**4**	**7**	**7**	**3**	**3**	**5**
C47	**Autonomic nervous system**	**6**	**0**	**1**	**0**	**0**	**0**	**0**
C48–49	**Soft tissues**	**68**	**3**	**8**	**8**	**3**	**3**	**4**
C50	**Breast**	**26**	**1**	**3**	**3**	**1**	**1**	**1**
C60–63	**Male genital organs**	**5132**	**369**	**546**	**414**	**202**	**216**	**297**
C61	Prostate	4780	354	513	366	190	202	284
C62	Testis	305	14	29	41	10	12	11
C60, C63	Other male genital	46	2	3	6	1	2	2
C64–68	**Urinary organs**	**1589**	**99**	**160**	**140**	**77**	**68**	**97**
C64	Kidney excl. renal pelvis	532	30	55	48	25	22	36
C65	Renal pelvis	56	5	5	5	2	3	3
C66–68	Bladder, ureter, urethra	1002	64	100	87	49	43	59
C69	**Eye**	**35**	**3**	**2**	**4**	**1**	**1**	**2**
C70–72, D32–33	**Central nervous system**	**473**	**28**	**48**	**43**	**20**	**15**	**25**
C73	**Thyroid gland**	**94**	**5**	**10**	**14**	**3**	**3**	**6**
C37, C74–75	**Other endocrine glands**	**115**	**7**	**11**	**11**	**4**	**4**	**5**
C39, C76, C80	**Other or unspecified**	**149**	**9**	**11**	**13**	**7**	**8**	**11**
C81–96	**Lymphoid and haematopoietic tissue**	**1450**	**71**	**166**	**148**	**72**	**67**	**81**
C81	Hodgkin lymphoma	75	3	8	8	6	3	4
C82–86, C96	Non-Hodgkin lymphoma	540	28	58	54	25	29	24
C88	Malignant immunoproliferative diseases	36	1	6	3	1	1	3
C90	Multiple myeloma	214	10	24	23	12	10	12
C91–95, D45–47	Leukaemia	585	27	69	62	27	25	37

MALES

Vestfold	Telemark	Aust-Agder	Vest-Agder	Rogaland	Hordaland	Sogn og Fjordane	Møre og Romsdal	Sør-Trøn-delag	Nord-Trøn-delag	Nordland	Troms	Finnmark
923	**619**	**426**	**536**	**1382**	**1640**	**403**	**952**	**910**	**477**	**828**	**528**	**231**
20	**16**	**7**	**11**	**27**	**33**	**8**	**18**	**19**	**8**	**18**	**9**	**5**
3	4	2	2	9	7	1	5	4	2	4	2	0
6	3	1	2	6	8	1	5	5	1	4	2	2
3	2	2	1	5	6	2	2	3	1	3	0	1
2	2	0	1	2	3	0	2	1	1	2	1	0
7	5	2	5	5	9	3	5	7	3	5	5	2
176	**116**	**81**	**104**	**259**	**332**	**85**	**195**	**195**	**106**	**190**	**115**	**46**
12	7	5	6	14	19	5	10	10	5	13	6	3
12	12	8	10	25	33	9	18	18	10	20	12	7
5	3	1	4	11	11	2	4	7	3	3	3	1
71	45	31	39	105	132	35	84	77	44	73	41	15
42	22	18	25	57	76	20	46	43	24	40	32	9
1	1	0	0	1	2	1	1	2	1	1	0	1
7	7	3	3	11	12	3	6	9	3	9	6	1
2	3	3	2	5	6	2	4	6	2	4	2	1
17	15	10	12	28	37	7	19	21	11	22	12	6
6	2	1	3	3	3	2	3	3	1	5	2	1
104	**65**	**49**	**63**	**154**	**162**	**41**	**100**	**100**	**54**	**97**	**60**	**38**
1	2	0	0	3	3	1	2	1	1	2	1	1
5	4	1	2	11	10	2	9	5	3	7	4	1
97	58	48	61	139	149	38	88	94	49	87	54	36
0	1	0	0	1	1	0	1	0	0	1	0	0
1	**1**	**0**	**1**	**2**	**3**	**1**	**2**	**1**	**1**	**2**	**0**	**1**
68	**34**	**22**	**26**	**83**	**86**	**16**	**31**	**51**	**25**	**28**	**17**	**5**
58	**48**	**32**	**52**	**79**	**98**	**19**	**34**	**41**	**25**	**34**	**22**	**8**
5	**3**	**2**	**3**	**5**	**9**	**2**	**4**	**1**	**1**	**2**	**1**	**1**
0	**0**	**0**	**1**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**
5	**2**	**2**	**2**	**4**	**6**	**1**	**3**	**4**	**3**	**4**	**2**	**0**
2	**2**	**0**	**1**	**3**	**3**	**0**	**1**	**1**	**0**	**1**	**1**	**0**
273	**191**	**132**	**144**	**449**	**524**	**131**	**351**	**272**	**139**	**238**	**177**	**69**
255	180	125	132	412	487	124	331	246	130	218	166	63
14	8	6	11	33	32	6	18	23	7	15	9	5
3	2	1	1	3	5	1	2	2	1	5	1	1
90	**57**	**38**	**49**	**115**	**157**	**38**	**99**	**86**	**49**	**89**	**56**	**24**
31	21	11	21	40	48	13	31	33	17	24	16	8
2	4	2	1	3	5	1	3	3	2	2	3	1
57	32	25	27	72	104	24	66	50	29	62	37	14
2	**1**	**1**	**1**	**3**	**2**	**1**	**3**	**2**	**1**	**2**	**1**	**1**
25	**20**	**11**	**16**	**48**	**45**	**13**	**20**	**32**	**16**	**26**	**16**	**7**
3	**3**	**1**	**4**	**5**	**10**	**1**	**6**	**5**	**3**	**5**	**3**	**2**
5	**6**	**3**	**5**	**9**	**16**	**4**	**3**	**8**	**4**	**6**	**4**	**1**
7	**4**	**5**	**5**	**10**	**16**	**3**	**8**	**9**	**4**	**8**	**6**	**4**
78	**51**	**39**	**49**	**126**	**138**	**38**	**75**	**82**	**38**	**77**	**37**	**19**
3	1	2	3	6	8	1	5	4	2	4	3	1
25	19	15	18	46	49	14	35	34	14	31	15	8
4	1	0	1	2	5	1	1	1	0	2	1	0
11	8	5	5	17	19	8	11	11	6	15	4	3
34	22	17	23	54	57	14	22	32	17	25	13	7

Table 16b Average annual number of new cases by primary site and county, 2010–2014

ICD10	Site	Norway	Østfold	Akershus	Oslo	Hedmark	Oppland	Buskerud
C00–96	**All sites**	**13926**	**870**	**1491**	**1511**	**604**	**573**	**812**
C00–14	**Mouth, pharynx**	**202**	**12**	**21**	**26**	**11**	**10**	**9**
C00	Lip	48	3	5	4	3	2	3
C01–02	Tongue	42	3	5	6	3	2	1
C03–06	Mouth, other	43	2	5	5	2	3	2
C07–08	Salivary glands	24	2	3	3	1	2	0
C09–14	Pharynx	44	2	4	8	2	1	2
C15–26	**Digestive organs**	**2924**	**188**	**298**	**285**	**128**	**119**	**159**
C15	Oesophagus	66	3	7	11	3	3	4
C16	Stomach	181	8	12	16	8	7	9
C17	Small intestine	60	4	6	6	4	1	3
C18	Colon	1397	96	137	135	58	52	81
C19–20	Rectum, rectosigmoid	540	36	64	48	22	26	29
C21	Anus	51	2	8	6	2	3	3
C22	Liver	81	5	8	10	5	3	3
C23–24	Gallbladder, bile ducts	97	5	11	10	5	5	6
C25	Pancreas	374	24	41	35	17	16	18
C26	Other digestive organs	76	5	5	10	4	2	5
C30–34, C38	**Respiratory organs**	**1361**	**99**	**149**	**135**	**66**	**55**	**73**
C30–31	Nose, sinuses	19	1	2	1	1	2	2
C32	Larynx, epiglottis	19	2	1	2	1	1	1
C33–34	Lung, trachea	1317	96	146	130	64	52	70
C38	Mediastinum, pleura (non-mesothelioma)	6	1	0	1	0	0	0
C40–41	**Bone**	**23**	**1**	**2**	**4**	**1**	**1**	**0**
C43	**Melanoma of the skin**	**888**	**53**	**108**	**99**	**34**	**34**	**54**
C44	**Skin, non-melanoma**	**798**	**50**	**78**	**74**	**29**	**22**	**65**
C45	**Mesothelioma**	**13**	**1**	**2**	**1**	**1**	**0**	**1**
C47	**Autonomic nervous system**	**4**	**0**	**1**	**0**	**0**	**0**	**0**
C48–49	**Soft tissues**	**86**	**4**	**9**	**9**	**5**	**4**	**5**
C50	**Breast**	**3090**	**187**	**355**	**380**	**122**	**125**	**176**
C51–58	**Female genital organs**	**1636**	**107**	**171**	**186**	**78**	**81**	**97**
C53	Cervix uteri	309	19	34	42	15	13	16
C54	Corpus uteri	729	45	73	79	37	37	45
C55	Uterus, other	8	0	1	1	0	0	1
C56	Ovary	439	34	49	49	19	23	26
C51–52, C57	Other female genital	148	9	14	15	7	8	10
C58	Placenta	3	0	0	1	0	0	0
C64–68	**Urinary organs**	**652**	**44**	**63**	**67**	**27**	**33**	**39**
C64	Kidney excl. renal pelvis	245	18	26	21	10	13	18
C65	Renal pelvis	39	2	4	6	1	1	2
C66–68	Bladder, ureter, urethra	368	24	33	40	17	19	19
C69	**Eye**	**36**	**3**	**2**	**4**	**2**	**2**	**2**
C70–72, D32–33	**Central nervous system**	**546**	**29**	**56**	**48**	**24**	**21**	**32**
C73	**Thyroid gland**	**228**	**10**	**22**	**39**	**9**	**7**	**11**
C37, C74–75	**Other endocrine glands**	**111**	**6**	**10**	**10**	**4**	**2**	**7**
C39, C76, C80	**Other or unspecified**	**170**	**10**	**17**	**20**	**8**	**8**	**9**
C81–96	**Lymphoid and haematopoietic tissue**	**1159**	**67**	**128**	**124**	**55**	**48**	**72**
C81	Hodgkin lymphoma	60	4	6	8	3	1	5
C82–86, C96	Non-Hodgkin lymphoma	434	26	45	46	21	17	22
C88	Malignant immunoproliferative diseases	30	1	4	2	2	1	3
C90	Multiple myeloma	172	10	20	17	10	9	11
C91–95, D45–47	Leukaemia	464	26	54	51	19	20	31

FEMALES

Vestfold	Telemark	Aust-Agder	Vest-Agder	Rogaland	Hordaland	Sogn og Fjordane	Møre og Romsdal	Sør-Trøn-delag	Nord-Trøn-delag	Nordland	Troms	Finnmark
732	**523**	**332**	**503**	**1152**	**1357**	**304**	**701**	**801**	**379**	**690**	**414**	**176**
12	**9**	**4**	**6**	**17**	**17**	**5**	**10**	**9**	**5**	**12**	**6**	**2**
3	1	1	1	7	4	2	2	2	1	3	1	0
3	2	1	1	3	3	1	2	2	1	2	1	1
2	3	1	1	2	5	1	3	2	0	2	1	0
1	0	0	1	2	3	0	1	2	1	1	1	0
3	2	1	2	3	3	0	2	2	1	4	1	1
146	**100**	**62**	**100**	**241**	**291**	**77**	**173**	**175**	**83**	**159**	**98**	**41**
4	3	1	1	4	5	1	2	3	1	5	2	1
9	7	2	5	16	23	7	14	11	5	12	7	4
1	2	1	2	4	7	2	2	8	2	2	2	1
65	46	31	51	124	142	37	86	80	38	77	46	16
34	19	10	19	40	58	14	31	28	16	26	14	6
2	1	1	2	4	5	1	2	2	2	3	2	1
4	2	1	2	5	7	1	4	8	2	4	5	2
4	4	2	3	8	8	4	5	6	3	4	2	1
18	13	9	13	30	30	8	22	24	11	21	16	7
3	4	3	3	5	6	2	4	4	3	4	2	0
76	**50**	**37**	**59**	**109**	**121**	**22**	**67**	**74**	**36**	**70**	**41**	**23**
1	1	0	1	2	1	0	1	1	0	1	1	0
1	1	0	0	2	2	0	1	1	0	1	1	0
74	47	36	58	105	117	21	65	71	36	68	39	22
0	0	0	0	1	0	0	0	0	0	1	0	1
1	**1**	**1**	**1**	**3**	**3**	**0**	**1**	**1**	**1**	**2**	**0**	**0**
61	**34**	**24**	**32**	**91**	**85**	**16**	**33**	**60**	**22**	**24**	**17**	**5**
42	**41**	**31**	**52**	**77**	**82**	**14**	**31**	**35**	**19**	**33**	**18**	**6**
1	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**1**	**0**	**0**	**1**	**0**
0	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
4	**4**	**2**	**2**	**5**	**6**	**2**	**4**	**6**	**2**	**5**	**5**	**1**
154	**108**	**71**	**104**	**255**	**293**	**64**	**164**	**177**	**89**	**143**	**85**	**37**
84	**65**	**37**	**52**	**125**	**162**	**32**	**73**	**90**	**42**	**81**	**53**	**18**
18	12	6	8	19	30	6	15	15	8	18	11	5
37	27	17	25	58	75	14	33	42	20	35	25	6
0	0	0	0	0	1	0	0	0	1	0	1	0
20	18	10	16	39	41	9	17	24	8	21	11	6
8	7	4	4	8	15	3	9	9	4	8	5	1
1	0	0	0	0	0	0	0	0	0	0	0	0
29	**22**	**15**	**18**	**48**	**67**	**15**	**37**	**42**	**17**	**37**	**22**	**10**
10	8	5	6	15	22	6	13	17	8	16	10	4
3	1	1	1	2	5	1	2	3	1	2	1	0
17	13	9	12	32	39	8	22	22	8	19	11	6
2	**1**	**1**	**1**	**4**	**5**	**1**	**2**	**2**	**0**	**2**	**2**	**0**
34	**21**	**12**	**17**	**52**	**56**	**15**	**22**	**30**	**19**	**30**	**17**	**9**
13	**10**	**4**	**9**	**11**	**20**	**4**	**11**	**16**	**3**	**16**	**12**	**3**
6	**3**	**2**	**4**	**6**	**18**	**5**	**5**	**7**	**4**	**6**	**3**	**1**
8	**9**	**3**	**6**	**12**	**13**	**4**	**8**	**9**	**7**	**11**	**4**	**4**
59	**46**	**26**	**38**	**93**	**117**	**27**	**60**	**67**	**31**	**57**	**30**	**15**
2	3	2	2	4	5	1	4	4	2	2	2	0
20	15	9	16	34	47	8	24	27	12	26	13	7
1	1	1	1	2	5	1	1	2	1	1	0	1
9	7	5	5	10	16	4	9	10	5	9	4	2
26	21	10	15	42	46	12	22	23	11	19	11	5

Table 17a Age-standardised (Norway, 2014) incidence rates per 100 000 person-years by primary site and county, 2010–2014

ICD10	Site	Norway	Østfold	Akershus	Oslo	Hedmark	Oppland	Buskerud
C00–96	**All sites**	**724.7**	**780.8**	**713.8**	**669.4**	**656.8**	**682.2**	**742.6**
C00–14	**Mouth, pharynx**	**15.0**	**16.5**	**13.8**	**18.7**	**13.1**	**14.3**	**16.5**
C00	Lip	3.4	4.1	2.7	2.5	2.9	3.8	4.5
C01–02	Tongue	3.1	2.6	3.0	4.0	1.5	2.8	2.4
C03–06	Mouth, other	2.4	2.3	2.4	2.9	1.7	3.0	2.2
C07–08	Salivary glands	1.3	1.9	1.1	1.8	1.7	1.0	0.8
C09–14	Pharynx	4.9	5.6	4.6	7.5	5.4	3.6	6.6
C15–26	**Digestive organs**	**147.8**	**153.3**	**141.5**	**143.5**	**133.0**	**138.5**	**142.0**
C15	Oesophagus	8.5	8.1	8.0	7.6	9.2	11.3	7.8
C16	Stomach	13.5	12.2	9.7	12.1	12.4	12.2	12.8
C17	Small intestine	3.8	3.6	4.1	2.1	2.8	3.6	3.1
C18	Colon	59.2	65.9	57.1	53.3	49.9	56.4	57.4
C19–20	Rectum, rectosigmoid	33.3	35.3	34.2	31.6	29.9	29.6	33.1
C21	Anus	1.0	1.0	1.0	2.1	0.7	0.6	1.2
C22	Liver	6.1	5.9	6.3	9.0	7.2	4.3	4.3
C23–24	Gallbladder, bile ducts	3.6	4.2	3.8	4.0	4.4	4.8	3.6
C25	Pancreas	15.9	13.2	14.1	18.0	14.4	13.6	16.3
C26	Other digestive organs	2.8	3.9	3.3	3.7	2.1	2.1	2.2
C30–34, C38	**Respiratory organs**	**77.5**	**87.6**	**66.1**	**65.4**	**71.0**	**80.0**	**70.3**
C30–31	Nose, sinuses	1.2	0.5	0.8	0.8	1.3	1.4	1.2
C32	Larynx, epiglottis	4.6	4.6	3.5	4.9	4.6	5.8	4.0
C33–34	Lung, trachea	71.4	81.8	61.4	59.6	64.6	72.4	64.9
C38	Mediastinum, pleura (non-mesothelioma)	0.4	0.7	0.4	0.1	0.6	0.5	0.2
C40–41	**Bone**	**1.1**	**1.7**	**0.9**	**1.1**	**0.9**	**1.7**	**0.3**
C43	**Melanoma of the skin**	**37.7**	**38.8**	**46.1**	**39.7**	**35.2**	**28.2**	**42.5**
C44	**Skin, non-melanoma**	**43.4**	**47.8**	**43.2**	**39.2**	**31.8**	**31.6**	**54.3**
C45	**Mesothelioma**	**3.1**	**3.0**	**2.7**	**3.6**	**2.7**	**3.1**	**3.8**
C47	**Autonomic nervous system**	**0.2**	**0.0**	**0.2**	**0.0**	**0.4**	**0.0**	**0.3**
C48–49	**Soft tissues**	**2.9**	**2.0**	**3.2**	**3.3**	**2.9**	**2.6**	**2.9**
C50	**Breast**	**1.1**	**0.9**	**1.3**	**1.3**	**1.4**	**1.0**	**0.7**
C60–63	**Male genital organs**	**223.8**	**267.3**	**226.1**	**187.3**	**188.5**	**214.0**	**231.4**
C61	Prostate	209.8	256.2	214.3	173.2	175.9	198.4	221.2
C62	Testis	12.0	10.0	10.3	11.2	11.5	13.9	8.4
C60, C63	Other male genital	2.0	1.1	1.5	2.9	1.1	1.6	1.9
C64–68	**Urinary organs**	**70.9**	**73.8**	**67.8**	**66.6**	**72.4**	**67.6**	**77.1**
C64	Kidney excl. renal pelvis	22.6	21.7	21.9	21.1	24.0	21.5	26.9
C65	Renal pelvis	2.5	3.4	2.1	2.3	2.1	3.0	2.1
C66–68	Bladder, ureter, urethra	45.7	48.6	43.8	43.2	46.3	43.2	48.1
C69	**Eye**	**1.5**	**2.0**	**0.9**	**1.7**	**1.3**	**1.1**	**1.2**
C70–72, D32–33	**Central nervous system**	**19.7**	**20.1**	**18.6**	**16.1**	**20.1**	**15.6**	**18.9**
C73	**Thyroid gland**	**3.9**	**3.5**	**3.7**	**5.1**	**3.3**	**2.6**	**4.4**
C37, C74–75	**Other endocrine glands**	**4.7**	**4.9**	**4.2**	**4.3**	**3.8**	**4.0**	**3.5**
C39, C76, C80	**Other or unspecified**	**7.0**	**6.8**	**5.4**	**6.4**	**6.6**	**8.6**	**8.9**
C81–96	**Lymphoid and haematopoietic tissue**	**63.4**	**50.9**	**68.2**	**66.0**	**68.3**	**67.6**	**63.8**
C81	Hodgkin lymphoma	3.0	2.3	2.8	2.6	6.1	3.2	2.9
C82–86, C96	Non-Hodgkin lymphoma	23.5	20.1	23.6	23.3	23.8	28.6	19.0
C88	Malignant immunoproliferative diseases	1.6	0.9	2.6	1.2	1.0	0.8	2.6
C90	Multiple myeloma	9.5	7.5	10.3	10.9	11.7	9.6	9.5
C91–95, D45–47	Leukaemia	25.8	20.1	29.0	28.1	25.7	25.4	29.9

MALES

Vestfold	Telemark	Aust-Agder	Vest-Agder	Rogaland	Hordaland	Sogn og Fjordane	Møre og Romsdal	Sør-Trøn-delag	Nord-Trøn-delag	Nordland	Troms	Finnmark
808.1	**717.9**	**804.6**	**703.4**	**788.0**	**769.1**	**720.5**	**741.2**	**689.2**	**695.3**	**670.9**	**708.7**	**653.6**
17.1	**18.4**	**13.2**	**13.9**	**15.1**	**15.1**	**13.4**	**14.2**	**13.9**	**11.3**	**14.6**	**12.0**	**12.1**
2.8	4.8	3.6	3.2	5.3	3.4	2.2	3.7	3.0	2.6	3.1	2.4	0.4
4.8	3.1	1.4	2.2	3.1	3.5	2.1	3.5	3.4	1.7	3.3	2.5	5.8
2.3	2.5	3.5	1.6	2.7	2.8	3.2	1.9	1.9	1.4	2.6	0.5	2.1
1.3	2.0	0.9	1.3	1.4	1.3	0.8	1.4	0.8	1.4	1.7	1.0	0.0
5.9	5.9	3.9	5.7	2.6	4.0	5.2	3.6	4.8	4.2	3.9	5.6	3.8
155.7	**135.3**	**152.8**	**138.2**	**150.9**	**157.9**	**153.0**	**153.1**	**150.7**	**154.4**	**153.1**	**156.8**	**131.1**
10.0	8.0	8.7	8.3	7.8	9.1	9.7	7.4	7.9	7.8	10.7	7.9	8.4
10.9	13.8	15.9	12.7	14.7	16.0	16.9	14.3	14.4	14.2	16.3	16.5	18.1
4.5	3.2	2.0	5.1	6.3	5.2	3.2	2.9	5.2	5.0	2.0	4.0	3.0
64.1	52.7	59.0	53.2	62.2	63.5	63.3	66.2	60.7	65.7	59.3	57.8	44.6
36.7	24.8	34.4	31.9	32.7	35.6	36.1	36.2	32.0	34.7	31.4	40.5	26.8
0.6	1.2	0.4	0.2	0.7	1.0	1.0	0.9	1.5	0.8	0.7	0.5	2.5
6.4	8.1	4.8	4.7	6.0	5.4	4.6	4.5	6.8	4.5	7.6	7.2	3.2
2.0	3.8	5.5	2.9	2.6	2.9	3.5	3.4	4.4	3.5	3.2	3.5	1.6
15.6	17.7	19.3	15.8	16.1	17.7	11.7	14.7	15.7	16.6	17.9	16.4	18.5
5.0	1.9	3.0	3.4	1.8	1.5	3.0	2.6	2.0	1.6	4.0	2.4	4.3
90.3	**74.7**	**92.6**	**83.2**	**89.5**	**76.8**	**72.6**	**78.0**	**76.9**	**79.4**	**77.3**	**81.3**	**107.4**
1.3	2.0	0.4	0.0	1.7	1.4	1.4	1.3	0.7	2.0	1.7	1.7	2.1
4.4	4.7	2.6	2.5	6.0	4.4	3.1	7.1	3.4	4.8	5.2	5.5	1.8
84.3	66.9	89.6	80.2	81.4	70.5	68.1	69.1	72.7	72.3	69.8	73.6	102.4
0.4	1.2	0.0	0.5	0.3	0.4	0.0	0.4	0.1	0.3	0.5	0.5	1.1
1.1	**1.7**	**0.9**	**0.7**	**0.7**	**1.4**	**1.0**	**1.2**	**0.8**	**0.8**	**1.6**	**0.5**	**1.5**
58.8	**39.1**	**42.5**	**33.2**	**45.8**	**39.4**	**29.3**	**23.9**	**37.1**	**37.0**	**23.5**	**22.0**	**13.1**
54.6	**58.4**	**64.8**	**73.8**	**50.2**	**49.6**	**34.8**	**28.0**	**33.9**	**38.8**	**30.1**	**32.1**	**24.9**
4.8	**3.5**	**3.6**	**4.2**	**2.9**	**4.6**	**3.4**	**3.1**	**1.1**	**2.2**	**1.6**	**1.3**	**2.1**
0.4	**0.6**	**0.4**	**0.7**	**0.3**	**0.2**	**0.0**	**0.4**	**0.0**	**0.3**	**0.3**	**0.3**	**0.0**
4.3	**2.6**	**3.5**	**3.0**	**2.0**	**2.5**	**2.1**	**2.2**	**2.6**	**4.5**	**3.6**	**3.4**	**0.6**
1.9	**2.2**	**0.8**	**1.0**	**1.5**	**1.3**	**0.3**	**0.6**	**0.9**	**0.3**	**0.6**	**1.0**	**0.9**
236.1	**218.1**	**242.0**	**185.4**	**251.7**	**242.6**	**234.4**	**270.0**	**202.7**	**198.4**	**191.1**	**231.1**	**194.9**
221.1	204.7	229.4	171.1	235.9	227.8	220.5	254.4	186.4	184.7	173.4	217.9	179.0
12.2	10.6	11.2	12.5	14.1	12.5	12.5	14.0	14.7	11.5	13.5	11.5	13.5
2.9	2.9	1.5	1.8	1.8	2.4	1.4	1.6	1.7	2.2	4.3	1.7	2.3
78.6	**65.9**	**74.1**	**65.3**	**67.4**	**74.0**	**68.4**	**77.0**	**65.8**	**71.0**	**72.8**	**78.9**	**72.0**
26.4	23.3	19.9	27.4	21.8	22.0	23.2	23.3	23.9	24.4	19.2	21.3	22.6
1.9	4.6	4.3	1.9	1.7	2.3	2.5	2.0	2.6	3.5	1.6	4.5	3.3
50.3	38.0	50.0	36.1	44.0	49.8	42.7	51.7	39.3	43.1	52.0	53.1	46.1
1.7	**1.2**	**2.6**	**1.0**	**1.9**	**0.9**	**1.4**	**2.0**	**1.8**	**2.1**	**1.9**	**0.8**	**2.8**
21.2	**23.1**	**20.4**	**19.4**	**24.5**	**19.5**	**22.9**	**15.5**	**23.1**	**22.8**	**20.7**	**19.5**	**17.2**
3.0	**3.6**	**1.5**	**5.3**	**2.8**	**4.5**	**2.5**	**4.8**	**3.6**	**3.8**	**4.2**	**4.7**	**6.1**
3.9	**6.4**	**5.3**	**5.4**	**4.6**	**6.8**	**7.0**	**2.2**	**5.9**	**5.7**	**5.1**	**5.2**	**2.6**
6.8	**4.8**	**9.8**	**6.4**	**6.6**	**8.2**	**6.0**	**6.3**	**7.5**	**6.0**	**6.9**	**9.1**	**11.7**
67.8	**58.4**	**73.9**	**63.3**	**69.6**	**63.9**	**68.1**	**58.8**	**60.7**	**56.6**	**62.0**	**48.9**	**52.4**
2.9	1.6	3.0	2.8	3.0	3.2	1.8	4.1	2.7	2.6	2.9	4.5	3.7
21.8	21.6	28.2	22.9	25.2	22.7	25.6	27.0	25.4	20.5	24.6	19.0	21.3
3.3	1.4	0.9	0.8	1.4	2.6	1.8	1.1	1.0	0.3	1.5	1.6	0.0
9.6	8.7	9.7	6.9	9.8	9.0	14.0	8.8	8.2	8.1	12.2	5.9	7.2
30.1	25.0	32.0	29.9	30.2	26.4	25.0	17.7	23.5	25.1	20.7	18.0	20.2

Table 17b Age-standardised (Norway, 2014) incidence rates per 100 000 person-years by primary site and county, 2010–2014

ICD10	Site	Norway	Østfold	Akershus	Oslo	Hedmark	Oppland	Buskerud
C00–96	**All sites**	**528.3**	**545.7**	**530.0**	**540.9**	**502.2**	**504.7**	**554.8**
C00–14	**Mouth, pharynx**	**7.6**	**7.6**	**7.5**	**9.5**	**9.4**	**8.0**	**6.1**
C00	Lip	1.7	1.9	1.6	1.3	2.3	1.8	1.9
C01–02	Tongue	1.6	1.6	1.8	2.2	2.1	1.5	1.0
C03–06	Mouth, other	1.6	1.5	1.7	2.0	1.9	2.1	1.6
C07–08	Salivary glands	0.9	1.3	1.0	1.1	1.1	1.9	0.0
C09–14	Pharynx	1.8	1.3	1.4	2.9	2.0	0.8	1.6
C15–26	**Digestive organs**	**107.6**	**113.4**	**106.0**	**101.5**	**99.1**	**98.4**	**105.7**
C15	Oesophagus	2.4	1.8	2.3	3.9	2.7	2.9	2.3
C16	Stomach	6.6	4.7	4.4	5.5	6.4	5.3	5.9
C17	Small intestine	2.3	2.3	2.2	2.1	2.7	1.3	2.1
C18	Colon	51.1	57.9	48.6	47.5	44.5	42.4	53.1
C19–20	Rectum, rectosigmoid	20.3	22.2	22.7	17.1	18.2	22.1	19.5
C21	Anus	2.0	1.3	2.7	2.1	1.5	2.6	1.8
C22	Liver	3.0	3.2	3.0	3.6	3.8	2.3	1.9
C23–24	Gallbladder, bile ducts	3.6	2.8	3.9	3.7	3.9	4.6	4.1
C25	Pancreas	13.7	13.9	14.4	12.5	12.6	13.1	11.7
C26	Other digestive organs	2.7	3.2	1.7	3.5	2.9	1.9	3.4
C30–34, C38	**Respiratory organs**	**52.1**	**61.6**	**53.6**	**50.7**	**53.2**	**47.5**	**49.5**
C30–31	Nose, sinuses	0.7	0.3	0.8	0.5	0.7	1.6	1.4
C32	Larynx, epiglottis	0.7	1.0	0.4	0.9	0.9	0.7	0.4
C33–34	Lung, trachea	50.4	59.9	52.3	49.1	51.6	44.9	47.7
C38	Mediastinum, pleura (non-mesothelioma)	0.2	0.3	0.1	0.3	0.1	0.3	0.0
C40–41	**Bone**	**0.9**	**0.5**	**0.8**	**1.2**	**1.0**	**0.7**	**0.3**
C43	**Melanoma of the skin**	**34.3**	**34.2**	**38.6**	**34.8**	**29.5**	**31.7**	**37.7**
C44	**Skin, non-melanoma**	**27.5**	**28.2**	**27.0**	**23.8**	**20.6**	**16.7**	**41.3**
C45	**Mesothelioma**	**0.5**	**0.6**	**0.7**	**0.5**	**0.5**	**0.3**	**1.0**
C47	**Autonomic nervous system**	**0.2**	**0.2**	**0.2**	**0.1**	**0.0**	**0.0**	**0.3**
C48–49	**Soft tissues**	**3.3**	**2.7**	**3.3**	**3.3**	**4.6**	**3.7**	**3.5**
C50	**Breast**	**121.0**	**121.2**	**125.4**	**140.3**	**106.6**	**116.8**	**123.6**
C51–58	**Female genital organs**	**63.3**	**69.5**	**61.0**	**66.4**	**67.7**	**73.9**	**67.5**
C53	Cervix uteri	12.4	13.1	12.1	13.3	15.6	14.4	11.9
C54	Corpus uteri	28.1	28.6	26.3	29.7	31.0	31.1	30.9
C55	Uterus, other	0.3	0.1	0.3	0.2	0.2	0.3	0.7
C56	Ovary	16.9	21.9	17.3	17.9	15.4	20.9	17.6
C51–52, C57	Other female genital	5.5	5.7	4.8	5.1	5.5	6.8	6.4
C58	Placenta	0.1	0.0	0.1	0.2	0.0	0.3	0.1
C64–68	**Urinary organs**	**24.2**	**26.8**	**22.3**	**23.8**	**22.3**	**28.0**	**26.4**
C64	Kidney excl. renal pelvis	9.4	10.7	9.2	7.8	8.1	11.1	12.2
C65	Renal pelvis	1.4	1.4	1.4	2.1	0.6	1.2	1.4
C66–68	Bladder, ureter, urethra	13.4	14.7	11.8	13.9	13.6	15.7	12.8
C69	**Eye**	**1.4**	**1.7**	**0.8**	**1.5**	**1.5**	**1.5**	**1.3**
C70–72, D32–33	**Central nervous system**	**21.3**	**19.4**	**19.8**	**16.8**	**21.4**	**19.8**	**22.5**
C73	**Thyroid gland**	**9.1**	**6.7**	**7.7**	**13.1**	**8.3**	**7.6**	**8.1**
C37, C74–75	**Other endocrine glands**	**4.4**	**4.1**	**3.8**	**3.3**	**4.5**	**2.2**	**4.6**
C39, C76, C80	**Other or unspecified**	**5.9**	**5.9**	**5.8**	**6.7**	**6.1**	**5.9**	**5.7**
C81–96	**Lymphoid and haematopoietic tissue**	**43.7**	**41.5**	**45.6**	**43.8**	**45.9**	**42.0**	**49.7**
C81	Hodgkin lymphoma	2.4	2.4	2.2	2.4	3.1	1.6	3.9
C82–86, C96	Non-Hodgkin lymphoma	16.5	16.0	15.9	16.6	17.5	15.3	15.5
C88	Malignant immunoproliferative diseases	1.1	0.9	1.4	0.8	1.5	0.8	1.7
C90	Multiple myeloma	6.3	5.7	7.0	5.9	8.1	7.3	7.6
C91–95, D45–47	Leukaemia	17.3	16.6	19.1	18.2	15.7	17.0	21.0

FEMALES

Vestfold	Telemark	Aust-Agder	Vest-Agder	Rogaland	Hordaland	Sogn og Fjordane	Møre og Romsdal	Sør-Trøn-delag	Nord-Trøn-delag	Nordland	Troms	Finnmark
542.2	**518.4**	**556.6**	**555.0**	**562.3**	**540.3**	**501.3**	**485.7**	**526.1**	**499.7**	**502.5**	**496.6**	**466.4**
8.5	**9.1**	**7.2**	**6.4**	**8.3**	**6.7**	**7.9**	**6.8**	**6.2**	**5.8**	**8.7**	**7.3**	**4.8**
2.1	0.9	1.9	1.4	3.2	1.6	4.0	1.4	1.1	1.5	1.8	0.9	0.0
2.0	2.3	1.6	1.0	1.5	1.0	1.8	1.5	1.3	1.0	1.6	1.7	2.2
1.6	3.0	1.5	1.4	1.2	1.8	0.8	1.7	1.1	0.5	1.2	1.7	0.0
0.7	0.4	0.7	0.6	0.8	1.1	0.7	0.6	1.1	1.0	0.9	1.5	1.1
2.2	2.5	1.4	1.9	1.5	1.3	0.6	1.5	1.7	1.7	3.1	1.5	1.5
103.6	**93.5**	**101.2**	**107.4**	**117.6**	**111.3**	**118.3**	**112.7**	**112.4**	**103.9**	**109.7**	**113.9**	**106.8**
3.1	2.7	1.6	0.8	2.2	1.7	2.0	1.6	2.2	1.5	3.7	2.1	3.2
6.0	6.4	3.3	5.1	7.5	8.5	10.4	9.3	7.2	6.6	8.5	7.7	11.3
1.0	1.7	2.3	1.8	1.9	2.6	3.6	1.7	5.1	2.2	1.8	2.1	3.6
45.8	42.1	50.8	54.4	60.1	54.2	57.2	55.1	51.5	46.4	52.6	53.3	41.8
24.7	17.6	16.5	21.1	19.8	22.8	21.2	20.2	18.3	21.2	19.0	17.2	15.5
1.4	1.3	1.9	1.7	2.1	2.0	2.5	1.6	1.6	2.3	1.9	2.3	3.2
3.0	1.6	1.9	1.8	2.3	2.8	1.6	2.6	4.8	2.5	2.8	5.7	6.1
3.1	3.9	2.9	3.2	4.1	3.1	4.9	3.5	4.0	4.0	2.9	2.1	1.6
13.1	13.0	15.2	14.7	15.0	11.5	11.8	14.7	14.9	13.5	14.1	18.7	19.5
2.5	3.2	4.8	2.9	2.5	2.1	3.2	2.4	2.8	3.7	2.5	2.7	1.0
56.1	**48.8**	**61.6**	**65.9**	**55.0**	**48.7**	**37.7**	**46.8**	**49.2**	**46.7**	**49.8**	**48.9**	**60.9**
0.8	1.2	0.4	0.7	0.7	0.4	0.6	0.5	0.7	0.6	0.6	0.9	0.0
0.6	1.0	0.7	0.5	0.9	0.9	0.8	0.9	0.6	0.3	0.5	1.0	1.1
54.7	46.3	60.6	64.5	53.0	47.2	36.1	45.2	47.7	45.8	48.2	47.0	58.3
0.0	0.2	0.0	0.2	0.3	0.2	0.2	0.3	0.1	0.0	0.4	0.0	1.5
0.8	**0.8**	**1.8**	**0.7**	**1.2**	**1.1**	**0.8**	**0.9**	**0.6**	**1.0**	**1.8**	**0.5**	**0.0**
47.1	**35.8**	**41.1**	**36.2**	**44.0**	**34.8**	**29.1**	**23.5**	**40.5**	**31.4**	**18.4**	**21.0**	**13.3**
28.1	**35.1**	**47.7**	**52.7**	**35.8**	**29.0**	**19.4**	**18.5**	**21.4**	**22.0**	**21.4**	**20.4**	**16.1**
0.4	**0.2**	**0.4**	**0.2**	**0.6**	**0.5**	**0.6**	**0.1**	**0.4**	**0.0**	**0.3**	**1.0**	**0.5**
0.2	**0.3**	**0.0**	**0.2**	**0.3**	**0.2**	**0.7**	**0.2**	**0.1**	**0.0**	**0.0**	**0.0**	**0.5**
3.3	**3.6**	**3.5**	**2.6**	**2.5**	**2.4**	**3.2**	**2.6**	**4.2**	**2.8**	**4.1**	**6.3**	**3.3**
118.2	**112.9**	**123.1**	**119.5**	**125.4**	**121.4**	**113.0**	**120.2**	**119.0**	**123.2**	**109.7**	**104.2**	**98.8**
63.6	**67.8**	**63.1**	**58.9**	**61.6**	**66.5**	**57.0**	**52.6**	**59.8**	**56.2**	**61.6**	**64.9**	**47.9**
15.0	14.5	11.1	9.1	8.7	12.6	12.4	11.5	10.0	11.8	15.2	13.5	13.4
27.2	27.4	27.9	28.0	29.2	30.6	24.7	22.8	28.1	27.4	25.4	30.3	15.2
0.3	0.4	0.3	0.0	0.2	0.4	0.0	0.0	0.3	0.6	0.1	0.7	0.6
15.0	18.6	17.7	17.8	19.6	16.7	14.7	11.9	15.6	10.6	15.5	13.8	16.0
5.6	6.9	6.0	4.0	3.8	6.3	5.2	6.4	5.7	5.0	5.4	6.3	2.7
0.6	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.7	0.0	0.3	0.0
20.9	**21.1**	**25.4**	**19.7**	**24.0**	**25.9**	**22.0**	**24.6**	**26.9**	**22.0**	**25.4**	**25.8**	**27.2**
7.6	8.0	9.4	6.8	7.3	9.0	9.6	9.2	11.4	11.0	11.1	11.6	11.7
1.8	0.9	1.6	0.8	1.1	2.0	0.8	1.6	1.7	0.9	1.6	1.7	0.5
11.5	12.2	14.4	12.1	15.6	14.9	11.6	13.8	13.8	10.1	12.7	12.5	14.9
1.9	**0.6**	**1.0**	**1.3**	**2.0**	**2.0**	**1.2**	**1.1**	**1.2**	**0.5**	**1.6**	**2.1**	**0.6**
26.1	**21.9**	**20.6**	**19.7**	**25.1**	**22.9**	**26.2**	**16.5**	**20.4**	**26.7**	**23.8**	**21.2**	**24.9**
10.2	**11.3**	**6.3**	**10.7**	**5.4**	**8.5**	**7.3**	**8.0**	**10.6**	**4.4**	**12.8**	**14.6**	**7.5**
5.1	**3.9**	**3.2**	**5.1**	**3.1**	**7.4**	**9.2**	**4.2**	**4.9**	**6.4**	**4.8**	**3.8**	**3.9**
5.2	**7.6**	**5.2**	**6.1**	**5.7**	**4.8**	**4.6**	**4.9**	**5.2**	**7.4**	**7.0**	**4.9**	**9.6**
42.9	**44.2**	**44.2**	**41.6**	**44.9**	**46.1**	**43.2**	**41.5**	**43.2**	**39.3**	**41.9**	**35.9**	**39.9**
1.9	3.2	4.3	2.0	1.9	2.0	2.4	3.4	2.8	2.3	1.6	2.8	1.1
14.8	14.2	14.5	17.8	16.6	18.6	13.9	16.8	17.3	15.8	19.1	15.5	17.8
0.8	0.6	1.0	1.1	1.0	1.9	1.4	0.5	1.3	0.8	1.0	0.5	1.6
6.4	6.3	7.8	4.7	4.8	6.2	6.5	5.7	6.7	6.9	6.4	4.9	5.4
19.1	19.9	16.6	15.9	20.5	17.5	19.0	15.1	15.1	13.4	13.9	12.3	14.0

Table 18a Average annual number of new cases for selected primary sites, stage and period of diagnosis, 1955–2014

ICD10	Site	Stage	1955–59	1960–64	1965–69
C00–14	Mouth, pharynx	Total	182	192	194
		Localized	126	132	131
		Regional	44	46	44
		Distant	2	7	8
		Unknown	11	7	11
C15	Oesophagus	Total	72	80	78
		Localized	44	49	45
		Regional	9	12	10
		Distant	14	15	19
		Unknown	6	4	4
C16	Stomach	Total	858	802	786
		Localized	242	218	211
		Regional	189	174	155
		Distant	336	352	342
		Unknown	91	58	78
C18	Colon	Total	221	281	349
		Localized	87	114	139
		Regional	57	72	80
		Distant	66	81	113
		Unknown	12	14	17
C19–20	Rectum, rectosigmoid	Total	148	174	228
		Localized	72	84	106
		Regional	37	43	63
		Distant	26	38	50
		Unknown	13	8	9
C22	Liver	Total	17	24	32
		Localized	8	11	17
		Regional	1	1	1
		Distant	6	11	12
		Unknown	2	1	1
C23–24	Gallbladder, bile ducts	Total	15	22	25
		Localized	8	8	8
		Regional	2	3	5
		Distant	5	9	11
		Unknown	1	1	1
C25	Pancreas	Total	138	159	214
		Localized	41	47	58
		Regional	13	18	27
		Distant	72	85	117
		Unknown	13	9	12
C33–34	Lung, trachea	Total	238	356	489
		Localized	71	115	168
		Regional	48	77	93
		Distant	98	140	205
		Unknown	21	23	23
C43	Melanoma of the skin	Total	45	69	101
		Localized	27	43	64
		Regional	9	10	13
		Distant	6	14	17
		Unknown	3	1	7
C61	Prostate	Total	638	798	971
		Localized	378	497	644
		Regional	30	33	31
		Distant	167	207	219
		Unknown	63	61	77
C62	Testis	Total	51	68	69
		Localized	35	44	48
		Regional	2	3	4
		Distant	12	18	16
		Unknown	1	2	1
C64	Kidney except renal pelvis	Total	88	119	149
		Localized	48	62	75
		Regional	6	16	19
		Distant	30	37	51
		Unknown	4	4	4
C66–68	Bladder, ureter, urethra	Total	198	248	325
		Localized	153	207	271
		Regional	15	19	30
		Distant	19	14	15
		Unknown	11	7	9
C70–72, D32–33	Central nervous system	Total	115	131	148
		Non-malignant	25	40	39
		Malignant	90	90	110
C73	Thyroid gland	Total	17	24	33
		Localized	7	5	10
		Regional	7	12	14
		Distant	3	7	8
		Unknown		1	1

MALES

Period									
1970–74	1975–79	1980–84	1985–89	1990–94	1995–99	2000–04	2005–09	2010–14	% 2010–14
244	239	248	256	255	260	258	286	350	*100.0*
160	153	153	161	149	116	84	104	161	*45.9*
59	70	86	83	88	94	113	134	169	*48.2*
10	9	5	8	11	11	13	14	15	*4.3*
15	7	4	4	7	39	48	34	6	*1.6*
79	91	86	93	104	123	127	145	193	*100.0*
36	43	43	40	44	37	24	36	82	*42.4*
17	18	19	24	24	25	31	41	51	*26.3*
20	24	20	27	28	34	41	44	55	*28.7*
6	5	4	2	8	26	31	23	5	*2.5*
674	614	598	533	482	409	354	301	302	*100.0*
164	178	186	178	168	93	62	68	111	*36.7*
152	141	166	148	136	122	107	85	89	*29.3*
303	257	218	185	153	138	126	102	96	*31.7*
54	39	29	22	25	57	58	47	7	*2.3*
388	492	625	722	827	896	1004	1111	1305	*100.0*
132	156	183	222	273	186	176	187	256	*19.7*
112	170	257	282	302	428	489	578	681	*52.2*
127	148	163	194	217	236	263	287	337	*25.8*
17	17	22	24	35	45	76	59	30	*2.3*
308	399	493	521	567	573	642	670	757	*100.0*
144	182	226	221	250	198	167	155	214	*28.3*
84	129	163	198	204	227	267	327	390	*51.5*
69	80	91	94	99	110	133	138	146	*19.2*
12	8	13	8	15	38	75	51	8	*1.1*
50	52	61	63	61	65	79	92	141	*100.0*
23	24	32	34	38	26	27	34	69	*48.8*
3	5	5	5	3	4	5	11	16	*11.5*
19	20	16	15	10	14	20	22	34	*23.9*
5	3	8	9	10	21	26	26	22	*15.8*
27	38	42	48	54	56	59	68	80	*100.0*
8	11	14	19	17	9	12	14	13	*16.4*
5	9	10	10	10	11	17	22	38	*47.0*
12	17	15	14	16	16	16	20	22	*27.4*
2	1	4	5	11	20	15	12	7	*9.2*
249	258	287	306	275	279	296	339	355	*100.0*
50	43	53	68	53	28	22	30	45	*12.7*
34	34	38	36	27	35	59	76	76	*21.4*
141	154	163	159	137	129	157	186	191	*53.7*
24	28	34	42	58	87	58	47	43	*12.2*
646	838	1029	1141	1216	1277	1374	1483	1601	*100.0*
205	278	339	379	406	270	189	210	357	*22.3*
127	143	193	241	228	308	374	435	456	*28.5*
266	359	425	448	469	531	645	698	706	*44.1*
48	58	72	73	113	167	165	140	82	*5.1*
145	192	245	327	422	455	479	622	873	*100.0*
108	157	203	280	360	337	281	336	761	*87.2*
16	16	17	16	18	13	20	28	54	*6.2*
14	16	15	20	26	26	34	31	29	*3.4*
7	3	9	11	18	79	145	227	28	*3.2*
1186	1443	1647	1812	2250	2756	3208	4174	4780	*100.0*
771	965	1111	1207	1564	1227	1273	2053	3058	*64.0*
59	75	63	56	85	114	177	525	1235	*25.8*
255	307	385	487	411	419	400	403	383	*8.0*
101	96	88	61	191	997	1357	1193	105	*2.2*
86	101	134	157	199	219	247	283	305	*100.0*
45	59	69	102	136	135	138	179	254	*83.3*
14	21	38	31	36	34	44	42	28	*9.3*
25	21	24	23	23	29	27	30	22	*7.1*
3	1	3	2	4	21	38	32	1	*0.3*
166	200	246	260	285	281	331	394	532	*100.0*
71	81	109	121	150	115	144	190	387	*72.6*
32	50	46	51	38	44	42	38	45	*8.4*
59	65	81	78	75	74	75	88	83	*15.7*
5	4	10	10	22	48	69	78	17	*3.3*
413	540	663	737	814	813	869	955	1002	*100.0*
324	449	558	642	730	541	470	580	845	*84.4*
47	51	61	54	40	40	60	74	62	*6.2*
25	30	29	28	26	29	36	36	34	*3.4*
17	10	15	14	18	202	302	265	60	*6.0*
153	189	207	245	262	314	387	465	473	*100.0*
44	56	65	72	105	135	195	243	236	*49.9*
108	133	142	173	157	178	192	221	237	*50.1*
34	42	48	47	44	47	53	69	94	*100.0*
14	20	21	26	22	20	19	20	50	*53.0*
13	16	18	13	12	15	21	33	37	*39.6*
6	5	8	8	8	8	7	9	5	*5.5*
1	0	1	1	2	4	6	7	2	*1.9*

Table 18b Average annual number of new cases for selected primary sites, stage and period of diagnosis, 1955–2014

ICD10	Site	Stage	1955–59	1960–64	1965–69
C00–14	Mouth, pharynx	Total	61	60	77
		Localized	38	35	44
		Regional	18	19	29
		Distant	2	3	2
		Unknown	2	3	2
C15	Oesophagus	Total	23	28	30
		Localized	15	19	18
		Regional	3	4	3
		Distant	3	3	6
		Unknown	3	2	2
C16	Stomach	Total	613	546	508
		Localized	176	152	128
		Regional	107	98	94
		Distant	232	229	221
		Unknown	97	67	64
C18	Colon	Total	267	324	408
		Localized	107	130	166
		Regional	64	79	96
		Distant	73	97	125
		Unknown	22	18	20
C19–20	Rectum, rectosigmoid	Total	118	127	179
		Localized	57	58	84
		Regional	29	32	47
		Distant	24	30	39
		Unknown	8	7	9
C22	Liver	Total	11	14	16
		Localized	5	6	7
		Regional	0	0	1
		Distant	4	6	8
		Unknown	2	1	0
C23–24	Gallbladder, bile ducts	Total	46	50	58
		Localized	12	16	14
		Regional	8	8	9
		Distant	23	24	34
		Unknown	3	2	1
C25	Pancreas	Total	92	117	142
		Localized	29	36	42
		Regional	8	12	14
		Distant	45	61	75
		Unknown	9	9	11
C33–34	Lung, trachea	Total	68	83	115
		Localized	17	25	35
		Regional	7	11	17
		Distant	34	41	57
		Unknown	10	6	6
C43	Melanoma of the skin	Total	54	82	108
		Localized	42	67	81
		Regional	6	6	7
		Distant	5	6	12
		Unknown	1	3	8
C50	Breast	Total	901	1027	1172
		Pagets stage 0		1	0
		I	396	467	569
		II	340	355	369
		III	43	80	83
		IV	93	96	115
		Unknown	29	27	36
C53	Cervix uteri	Total	333	351	385
		I	139	147	185
		II	106	119	134
		III	57	54	40
		IV	23	24	20
		Unknown	8	7	6
C54	Corpus uteri	Total	167	207	250
		Localized	133	171	199
		Regional	10	11	13
		Distant	17	21	35
		Unknown	7	4	3
C56	Ovary	Total	249	278	349
		Localized	79	89	110
		Regional	23	17	18
		Distant	137	160	215
		Unknown	10	13	6
C64	Kidney except renal pelvis	Total	74	88	100
		Localized	43	52	54
		Regional	7	10	11
		Distant	20	25	32
		Unknown	4	2	3
C66–68	Bladder, ureter, urethra	Total	109	119	135
		Localized	68	73	93
		Regional	12	17	19
		Distant	19	19	17
		Unknown	11	9	6
C70–72, D32–33	Central nervous system	Total	102	116	133
		Non-malignant	38	51	62
		Malignant	63	65	71
C73	Thyroid gland	Total	52	59	79
		Localized	23	25	44
		Regional	15	22	24
		Distant	10	11	9
		Unknown	3	2	2

FEMALES

Period									
1970–74	1975–79	1980–84	1985–89	1990–94	1995–99	2000–04	2005–09	2010–14	% 2010–14
79	82	100	111	118	131	132	180	202	*100.0*
43	47	55	70	78	70	48	75	115	*57.0*
26	28	38	35	33	39	48	71	79	*38.9*
6	3	3	4	4	6	5	6	5	*2.7*
4	5	3	2	4	16	32	28	3	*1.4*
30	32	33	36	42	44	53	55	66	*100.0*
15	18	16	20	24	14	13	14	35	*53.4*
5	6	8	8	7	8	12	12	14	*21.6*
7	6	6	6	8	9	12	12	14	*20.7*
3	2	3	1	3	13	16	16	3	*4.3*
443	407	401	358	313	267	229	221	181	*100.0*
102	109	128	138	112	69	44	55	75	*41.3*
86	96	104	92	78	66	64	51	42	*22.9*
212	167	135	112	106	85	77	80	57	*31.4*
43	36	34	16	18	47	44	35	8	*4.3*
472	626	745	861	947	1086	1169	1278	1397	*100.0*
159	193	223	251	314	225	210	226	266	*19.1*
145	228	301	360	364	523	577	674	766	*54.8*
144	182	186	215	216	255	282	306	319	*22.8*
24	23	35	36	52	82	101	73	46	*3.3*
248	318	397	405	444	470	487	516	540	*100.0*
113	141	187	178	213	167	135	130	177	*32.8*
69	100	129	142	139	180	203	243	257	*47.6*
58	68	68	72	77	86	89	98	98	*18.1*
8	10	13	13	15	37	61	45	8	*1.5*
31	30	39	44	47	41	46	58	81	*100.0*
15	14	18	22	24	12	11	19	38	*46.9*
1	1	2	2	3	3	5	8	9	*11.6*
12	13	15	11	10	9	8	13	19	*23.5*
3	2	5	8	11	16	20	17	15	*18.0*
52	65	81	81	72	80	76	82	97	*100.0*
14	17	26	28	22	14	11	18	14	*14.8*
9	11	16	15	13	15	16	20	36	*37.5*
26	34	33	25	24	24	26	30	37	*37.7*
3	4	6	12	14	27	23	14	10	*9.9*
181	213	253	287	300	312	336	359	374	*100.0*
43	45	50	72	72	27	28	44	63	*16.7*
23	27	33	36	27	36	57	75	76	*20.2*
95	120	134	138	121	139	163	176	181	*48.3*
21	21	36	41	80	111	88	65	55	*14.8*
158	204	283	395	523	666	847	1082	1317	*100.0*
50	62	77	124	157	125	122	190	329	*25.0*
25	29	46	71	103	148	208	287	341	*25.9*
71	96	134	173	211	279	422	504	576	*43.7*
11	17	25	27	52	114	96	102	72	*5.5*
161	240	326	410	476	500	547	645	888	*100.0*
132	216	288	380	435	382	341	373	813	*91.6*
10	8	16	10	12	11	13	20	38	*4.3*
10	13	12	11	15	20	22	19	16	*1.8*
10	3	10	9	14	87	171	233	20	*2.3*
1327	1532	1666	1813	1974	2357	2687	2766	3090	*100.0*
16	23	33	37	25	18	20	21	14	*0.5*
640	794	885	449	343	662	928	1117	1216	*39.4*
411	435	474	644	742	869	1079	1071	1022	*33.1*
94	109	90	118	110	135	168	219	354	*11.5*
111	117	105	118	135	124	135	110	103	*3.3*
55	54	78	447	620	549	356	229	380	*12.3*
438	422	369	327	363	328	292	299	309	*100.0*
231	238	213	180	223	195	171	164	187	*60.3*
117	98	73	71	65	65	53	66	63	*20.4*
63	56	52	49	41	36	34	26	21	*6.7*
23	23	23	23	29	27	25	32	27	*8.7*
4	7	8	5	5	5	9	11	12	*3.9*
303	361	384	395	444	488	611	689	729	*100.0*
251	289	284	304	333	343	381	464	583	*80.0*
19	37	49	41	50	56	66	74	44	*6.0*
28	31	37	44	53	65	79	94	91	*12.5*
5	3	13	6	8	24	84	56	11	*1.5*
339	372	405	437	466	460	464	445	439	*100.0*
139	116	108	117	131	97	85	83	99	*22.5*
23	25	40	25	16	13	13	13	14	*3.2*
171	226	246	283	299	307	308	307	294	*66.9*
6	5	11	12	20	43	59	42	33	*7.4*
114	135	152	179	194	192	200	241	245	*100.0*
58	67	69	88	107	85	83	123	179	*73.0*
23	25	34	29	22	22	21	21	17	*6.9*
29	40	43	51	45	47	47	38	36	*14.6*
4	3	7	11	19	38	48	59	13	*5.5*
179	211	239	261	265	291	324	340	368	*100.0*
117	152	184	219	223	170	159	191	296	*80.5*
27	26	24	21	16	19	28	32	24	*6.6*
22	21	18	14	15	20	23	23	18	*4.9*
12	12	12	8	11	83	114	95	29	*7.9*
128	182	206	248	280	380	513	616	546	*100.0*
52	80	90	124	159	234	360	450	378	*69.2*
75	102	116	125	121	146	153	166	168	*30.8*
99	123	147	135	137	120	145	168	228	*100.0*
55	77	98	91	89	61	71	81	144	*63.3*
29	30	34	31	34	38	44	53	73	*31.9*
12	14	11	10	11	9	10	8	8	*3.7*
4	2	4	4	4	12	21	27	3	*1.1*

Table 19a Age-standardised (Norway, 2014) incidence rates per 100 000 person-years for selected primary sites, stage and period of diagnosis, 1955–2014

ICD10	Site	Stage	1955–59	1960–64	1965–69
C00–14	Mouth, pharynx	Total	15.7	15.1	14.4
		Localized	10.6	10.5	9.9
		Regional	3.7	3.4	3.2
		Distant	0.2	0.6	0.5
		Unknown	1.2	0.6	0.8
C15	Oesophagus	Total	6.5	6.8	5.7
		Localized	4.1	4.4	3.4
		Regional	0.7	0.8	0.6
		Distant	1.0	1.0	1.3
		Unknown	0.6	0.5	0.4
C16	Stomach	Total	75.1	64.9	58.9
		Localized	22.5	18.7	17.0
		Regional	14.7	12.5	10.5
		Distant	28.0	27.4	24.1
		Unknown	9.9	6.3	7.3
C18	Colon	Total	19.2	22.7	25.6
		Localized	7.7	9.6	10.3
		Regional	4.6	5.3	5.6
		Distant	5.6	6.3	8.1
		Unknown	1.3	1.5	1.6
C19–20	Rectum, rectosigmoid	Total	12.9	13.8	16.8
		Localized	6.5	6.8	8.0
		Regional	2.9	3.3	4.3
		Distant	2.3	2.8	3.6
		Unknown	1.2	0.9	0.9
C22	Liver	Total	1.3	1.7	2.2
		Localized	0.6	0.8	1.2
		Regional	0.1	0.1	0.1
		Distant	0.5	0.7	0.8
		Unknown	0.1	0.1	0.1
C23–24	Gallbladder, bile ducts	Total	1.2	1.7	1.8
		Localized	0.6	0.6	0.6
		Regional	0.1	0.3	0.3
		Distant	0.4	0.7	0.8
		Unknown	0.1	0.1	0.1
C25	Pancreas	Total	11.3	11.9	15.2
		Localized	3.3	3.6	4.3
		Regional	1.0	1.3	1.9
		Distant	5.8	6.2	8.1
		Unknown	1.1	0.7	0.9
C33–34	Lung, trachea	Total	17.8	24.5	31.5
		Localized	5.4	7.9	11.1
		Regional	3.4	5.1	5.7
		Distant	7.2	9.7	13.1
		Unknown	1.7	1.8	1.6
C43	Melanoma of the skin	Total	3.2	4.7	6.6
		Localized	2.0	3.0	4.2
		Regional	0.6	0.6	0.8
		Distant	0.4	1.0	1.1
		Unknown	0.2	0.1	0.5
C61	Prostate	Total	63.3	71.1	79.7
		Localized	37.8	44.1	52.6
		Regional	2.9	3.1	2.7
		Distant	15.8	18.0	17.4
		Unknown	6.7	5.9	7.1
C62	Testis	Total	3.1	4.2	4.1
		Localized	2.1	2.7	2.8
		Regional	0.1	0.2	0.2
		Distant	0.8	1.1	1.0
		Unknown	0.1	0.1	0.1
C64	Kidney except renal pelvis	Total	6.7	8.5	10.1
		Localized	3.5	4.4	5.3
		Regional	0.5	1.1	1.2
		Distant	2.3	2.7	3.4
		Unknown	0.3	0.3	0.3
C66–68	Bladder, ureter, urethra	Total	16.8	19.3	23.1
		Localized	12.9	16.1	19.1
		Regional	1.3	1.5	2.2
		Distant	1.6	1.1	1.1
		Unknown	1.0	0.6	0.7
C70–72, D32–33	Central nervous system	Total	7.1	7.7	8.5
		Non-malignant	1.6	2.4	2.3
		Malignant	5.5	5.2	6.2
C73	Thyroid gland	Total	1.3	1.7	2.2
		Localized	0.5	0.4	0.6
		Regional	0.5	0.8	0.9
		Distant	0.2	0.5	0.6
		Unknown	0.0	0.0	0.1

MALES

Period								
1970–74	1975–79	1980–84	1985–89	1990–94	1995–99	2000–04	2005–09	2010–14
16.3	15.1	14.9	14.9	14.4	14.3	13.4	13.6	15.0
10.7	9.8	9.3	9.5	8.5	6.5	4.4	5.1	7.0
3.9	4.3	5.0	4.8	4.9	5.0	5.8	6.2	7.1
0.7	0.6	0.3	0.4	0.6	0.6	0.6	0.6	0.7
1.0	0.5	0.3	0.2	0.5	2.2	2.6	1.7	0.2
5.4	5.9	5.2	5.5	6.0	6.8	6.9	7.1	8.5
2.5	3.0	2.7	2.5	2.6	2.1	1.3	1.8	3.7
1.1	1.1	1.1	1.4	1.4	1.4	1.7	2.0	2.2
1.4	1.5	1.1	1.5	1.6	1.8	2.2	2.1	2.4
0.4	0.4	0.3	0.1	0.6	1.5	1.7	1.2	0.2
47.2	40.1	37.1	31.9	28.0	23.0	19.2	15.3	13.5
12.3	12.2	12.4	11.4	10.3	5.3	3.4	3.5	5.1
9.9	8.8	9.6	8.4	7.4	6.7	5.7	4.2	3.9
20.0	16.0	12.9	10.7	8.6	7.6	6.7	5.0	4.2
4.9	3.1	2.1	1.5	1.6	3.5	3.4	2.5	0.4
27.0	32.3	38.5	43.0	47.8	50.1	54.2	55.9	59.2
9.4	10.4	11.5	13.2	15.7	10.2	9.6	9.4	11.7
7.3	11.0	15.4	16.6	17.3	24.0	26.0	29.2	30.8
8.8	9.6	9.9	11.4	12.3	13.0	14.1	14.2	15.1
1.5	1.4	1.7	1.8	2.4	2.8	4.4	3.1	1.6
20.8	25.9	30.1	30.4	32.5	31.9	34.3	33.1	33.3
9.9	12.0	14.2	13.2	14.5	11.0	9.0	7.7	9.5
5.5	8.0	9.4	11.2	11.4	12.5	14.1	16.0	17.1
4.4	5.1	5.4	5.4	5.6	6.1	7.1	6.8	6.3
1.0	0.7	1.1	0.6	1.0	2.3	4.2	2.6	0.4
3.1	3.2	3.6	3.7	3.4	3.5	4.1	4.5	6.1
1.5	1.5	1.8	2.0	2.1	1.4	1.4	1.6	3.0
0.2	0.3	0.3	0.3	0.2	0.2	0.3	0.5	0.7
1.2	1.2	1.0	0.9	0.6	0.7	1.0	1.0	1.4
0.3	0.2	0.5	0.5	0.6	1.1	1.4	1.3	1.0
1.9	2.4	2.6	2.8	3.1	3.2	3.2	3.5	3.6
0.5	0.7	0.9	1.2	1.0	0.5	0.6	0.7	0.6
0.3	0.5	0.5	0.5	0.6	0.6	0.9	1.1	1.6
0.9	1.1	0.9	0.8	0.9	0.9	0.9	1.0	1.0
0.2	0.1	0.2	0.3	0.6	1.2	0.8	0.6	0.4
16.3	16.3	17.8	18.0	15.9	15.6	15.9	17.0	15.9
3.4	2.9	3.6	4.2	3.2	1.5	1.2	1.6	2.0
2.2	2.1	2.2	2.1	1.5	1.9	3.2	3.8	3.4
9.1	9.5	9.6	9.1	7.6	7.1	8.3	9.2	8.4
1.6	1.8	2.3	2.7	3.6	5.1	3.3	2.5	2.1
39.4	49.3	58.6	64.0	67.5	69.6	72.3	72.9	71.4
12.5	16.4	19.4	21.2	22.3	14.5	9.9	10.4	15.9
7.4	8.1	10.8	13.3	12.5	16.5	19.4	21.3	20.1
16.3	20.9	24.0	25.1	26.0	28.9	33.8	34.1	31.3
3.1	3.8	4.5	4.4	6.8	9.6	9.2	7.1	4.1
9.0	11.3	14.0	18.1	22.8	23.6	24.2	29.4	37.7
6.7	9.2	11.6	15.4	19.4	17.5	14.1	15.8	32.7
0.9	1.0	1.0	0.9	1.0	0.7	1.0	1.4	2.4
0.9	1.0	0.9	1.1	1.4	1.4	1.7	1.5	1.3
0.5	0.2	0.5	0.6	1.0	4.1	7.3	10.8	1.2
88.1	99.1	104.3	109.0	131.0	157.4	176.4	209.1	209.8
56.6	65.5	69.3	72.2	89.6	68.7	69.1	101.2	131.3
4.6	5.1	3.9	3.3	4.9	6.7	9.8	26.3	54.7
18.6	20.9	24.8	29.2	24.0	23.9	22.3	20.9	18.0
8.4	7.5	6.3	4.4	12.5	58.1	75.2	60.7	5.7
4.8	5.3	6.5	7.2	8.8	9.4	10.5	11.9	12.0
2.5	3.1	3.4	4.6	6.0	5.7	5.8	7.5	10.0
0.8	1.1	1.8	1.4	1.6	1.5	1.9	1.8	1.1
1.3	1.1	1.1	1.0	1.0	1.3	1.2	1.3	0.9
0.2	0.0	0.2	0.1	0.2	0.9	1.7	1.4	0.0
10.3	11.9	14.3	15.0	15.8	15.2	17.1	18.8	22.6
4.5	4.9	6.4	6.9	8.3	6.1	7.3	8.9	16.3
1.9	2.9	2.7	2.9	2.1	2.3	2.1	1.8	1.9
3.6	3.9	4.6	4.5	4.1	4.0	3.9	4.3	3.6
0.3	0.3	0.6	0.6	1.2	2.8	3.7	3.8	0.9
27.7	34.1	39.3	44.0	46.6	45.5	46.7	47.8	45.7
21.6	28.2	33.0	38.3	41.7	30.1	25.1	28.9	38.6
3.1	3.1	3.5	3.1	2.3	2.2	3.2	3.6	2.8
1.7	2.0	1.7	1.6	1.5	1.6	1.9	1.9	1.6
1.2	0.7	1.1	0.9	1.1	11.5	16.5	13.5	2.8
8.6	10.2	11.1	13.0	13.8	15.7	18.6	21.2	19.7
2.6	3.1	3.6	3.9	5.6	6.8	9.3	11.0	9.8
6.0	7.1	7.5	9.1	8.2	9.0	9.3	10.2	9.9
2.1	2.5	2.7	2.6	2.3	2.4	2.5	3.1	3.9
0.9	1.2	1.2	1.4	1.1	1.0	0.9	0.9	2.0
0.8	0.9	1.0	0.7	0.6	0.7	1.0	1.5	1.6
0.4	0.4	0.5	0.5	0.4	0.4	0.4	0.4	0.2
0.1	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.1

Table 19b Age-standardised (Norway, 2014) incidence rates per 100 000 person-years for selected primary sites, stage and period of diagnosis, 1955–2014

ICD10	Site	Stage	1955–59	1960–64	1965–69
C00–14	Mouth, pharynx	Total	4.7	4.0	4.8
		Localized	2.8	2.2	2.8
		Regional	1.5	1.4	1.8
		Distant	0.2	0.2	0.1
		Unknown	0.2	0.2	0.1
C15	Oesophagus	Total	1.9	2.0	1.9
		Localized	1.2	1.4	1.1
		Regional	0.2	0.2	0.2
		Distant	0.3	0.2	0.4
		Unknown	0.2	0.2	0.2
C16	Stomach	Total	47.9	38.9	32.2
		Localized	14.3	11.2	8.5
		Regional	7.3	6.1	5.4
		Distant	17.1	15.6	13.4
		Unknown	9.3	6.0	4.9
C18	Colon	Total	20.2	22.1	25.1
		Localized	8.2	9.0	10.4
		Regional	4.5	5.0	5.6
		Distant	5.4	6.4	7.5
		Unknown	2.1	1.6	1.6
C19–20	Rectum, rectosigmoid	Total	8.5	8.5	10.7
		Localized	4.2	3.9	5.1
		Regional	2.1	2.1	2.7
		Distant	1.6	2.0	2.2
		Unknown	0.7	0.6	0.6
C22	Liver	Total	0.8	0.9	1.0
		Localized	0.3	0.4	0.4
		Regional	0.0	0.0	0.0
		Distant	0.3	0.4	0.5
		Unknown	0.1	0.1	0.0
C23–24	Gallbladder, bile ducts	Total	3.3	3.3	3.5
		Localized	0.8	1.1	0.9
		Regional	0.6	0.5	0.6
		Distant	1.6	1.6	2.0
		Unknown	0.2	0.1	0.1
C25	Pancreas	Total	6.6	7.6	8.5
		Localized	2.1	2.4	2.5
		Regional	0.6	0.7	0.8
		Distant	3.2	3.9	4.4
		Unknown	0.7	0.6	0.7
C33–34	Lung, trachea	Total	4.8	5.2	6.6
		Localized	1.2	1.6	2.1
		Regional	0.5	0.6	0.9
		Distant	2.4	2.6	3.2
		Unknown	0.7	0.4	0.4
C43	Melanoma of the skin	Total	3.6	5.0	6.5
		Localized	2.8	4.0	4.9
		Regional	0.4	0.4	0.4
		Distant	0.4	0.4	0.7
		Unknown	0.1	0.2	0.5
C50	Breast	Total	60.2	64.3	68.6
		Pagets stage 0	0.0	0.0	0.0
		I	26.3	29.2	33.3
		II	21.9	21.4	20.9
		III	3.2	5.4	5.0
		IV	6.6	6.3	6.9
		Unknown	2.2	1.9	2.3
C53	Cervix uteri	Total	20.2	20.8	22.3
		I	8.2	8.6	10.8
		II	6.5	7.0	7.7
		III	3.6	3.3	2.3
		IV	1.5	1.4	1.1
		Unknown	0.5	0.5	0.4
C54	Corpus uteri	Total	10.9	12.3	14.1
		Localized	8.5	10.1	11.1
		Regional	0.7	0.7	0.8
		Distant	1.1	1.3	2.0
		Unknown	0.5	0.3	0.2
C56	Ovary	Total	16.2	16.9	19.7
		Localized	5.1	5.3	6.2
		Regional	1.5	1.0	1.0
		Distant	8.9	9.7	12.1
		Unknown	0.7	0.8	0.4
C64	Kidney except renal pelvis	Total	5.0	5.5	5.8
		Localized	3.0	3.2	3.2
		Regional	0.4	0.6	0.6
		Distant	1.3	1.5	1.8
		Unknown	0.3	0.1	0.2
C66–68	Bladder, ureter, urethra	Total	8.0	8.1	8.2
		Localized	4.9	5.0	5.5
		Regional	0.9	1.1	1.1
		Distant	1.3	1.2	1.1
		Unknown	0.9	0.7	0.4
C70–72, D32–33	Central nervous system	Total	6.2	6.6	7.3
		Non-malignant	2.5	3.0	3.5
		Malignant	3.7	3.6	3.9
C73	Thyroid gland	Total	3.5	3.8	4.7
		Localized	1.6	1.6	2.6
		Regional	1.0	1.4	1.4
		Distant	0.7	0.7	0.5
		Unknown	0.2	0.1	0.1

FEMALES

Period								
1970–74	1975–79	1980–84	1985–89	1990–94	1995–99	2000–04	2005–09	2010–14
4.5	4.3	4.9	5.2	5.4	5.8	5.6	7.3	7.6
2.5	2.4	2.7	3.3	3.5	3.0	2.0	3.0	4.3
1.4	1.5	1.9	1.6	1.5	1.7	2.1	2.9	3.0
0.3	0.2	0.1	0.2	0.2	0.3	0.2	0.2	0.2
0.3	0.3	0.2	0.1	0.2	0.7	1.3	1.1	0.1
1.6	1.6	1.6	1.6	1.8	1.8	2.2	2.1	2.4
0.8	1.0	0.8	0.9	1.0	0.6	0.5	0.5	1.3
0.3	0.3	0.4	0.4	0.3	0.4	0.5	0.5	0.5
0.4	0.3	0.3	0.3	0.3	0.4	0.5	0.5	0.5
0.2	0.1	0.2	0.1	0.1	0.5	0.6	0.6	0.1
25.1	21.0	18.8	15.8	13.1	10.7	9.1	8.4	6.6
6.0	5.9	6.1	6.0	4.7	2.7	1.7	2.1	2.7
4.6	4.7	4.7	4.1	3.3	2.7	2.6	1.9	1.5
11.7	8.4	6.2	4.9	4.4	3.6	3.1	3.1	2.1
2.8	2.0	1.8	0.7	0.7	1.8	1.6	1.2	0.3
26.2	32.1	35.4	38.3	40.6	44.9	47.0	49.2	51.1
9.0	10.0	10.6	11.1	13.4	9.3	8.4	8.7	9.7
7.7	11.5	14.2	15.9	15.6	21.7	23.2	26.0	28.1
7.8	9.2	8.8	9.7	9.4	10.7	11.5	12.0	11.8
1.7	1.4	1.8	1.6	2.2	3.2	3.8	2.5	1.4
13.8	16.4	19.0	18.2	19.4	19.9	20.1	20.5	20.3
6.4	7.3	9.1	8.1	9.2	7.0	5.6	5.2	6.6
3.7	5.0	6.0	6.4	6.2	7.8	8.4	9.7	9.7
3.2	3.5	3.2	3.2	3.4	3.6	3.7	4.0	3.7
0.5	0.6	0.6	0.6	0.6	1.5	2.4	1.7	0.3
1.6	1.5	1.9	1.9	2.0	1.7	1.9	2.2	3.0
0.8	0.7	0.9	1.0	1.0	0.5	0.5	0.7	1.4
0.1	0.0	0.1	0.1	0.1	0.1	0.2	0.3	0.4
0.6	0.7	0.7	0.5	0.4	0.4	0.3	0.5	0.7
0.1	0.1	0.2	0.3	0.5	0.7	0.8	0.6	0.5
2.9	3.2	3.8	3.5	3.0	3.2	3.0	3.2	3.6
0.8	0.9	1.2	1.2	0.9	0.5	0.4	0.7	0.5
0.5	0.5	0.7	0.7	0.6	0.7	0.7	0.8	1.4
1.4	1.7	1.5	1.1	1.0	1.0	1.1	1.2	1.4
0.2	0.2	0.3	0.5	0.5	1.0	0.8	0.5	0.3
10.0	10.6	11.8	12.6	12.5	12.6	13.3	13.7	13.7
2.3	2.3	2.3	3.1	2.9	1.1	1.1	1.6	2.3
1.2	1.3	1.5	1.6	1.2	1.5	2.3	3.0	2.8
5.2	5.9	6.2	6.1	5.2	5.8	6.7	6.9	6.7
1.3	1.1	1.7	1.8	3.1	4.2	3.2	2.2	1.8
8.5	10.3	13.8	18.6	24.5	30.5	37.5	44.7	50.4
2.7	3.1	3.7	5.7	7.2	5.7	5.4	7.9	12.7
1.3	1.5	2.3	3.5	5.0	6.9	9.2	12.0	13.1
3.8	4.9	6.6	8.3	10.2	13.0	19.0	20.8	22.1
0.7	0.9	1.2	1.2	2.2	4.8	4.0	4.0	2.4
9.2	13.0	16.8	20.3	22.5	22.7	23.8	26.6	34.3
7.5	11.8	14.9	18.9	20.6	17.4	14.9	15.5	31.6
0.6	0.4	0.8	0.4	0.5	0.5	0.5	0.7	1.4
0.6	0.7	0.6	0.5	0.7	0.8	1.0	0.8	0.6
0.6	0.1	0.5	0.4	0.6	4.0	7.3	9.7	0.7
74.0	81.2	84.3	87.8	92.4	109.1	120.3	116.1	121.0
0.9	1.2	1.6	1.8	1.2	0.8	0.8	0.8	0.5
35.8	41.9	44.4	21.6	16.5	31.8	44.0	48.6	48.8
22.6	23.1	24.2	31.7	35.1	40.3	48.4	45.0	40.1
5.2	5.7	4.5	5.6	4.9	5.9	7.0	8.9	13.8
6.2	6.0	5.2	5.6	6.3	5.6	5.7	4.5	4.0
3.4	3.2	4.3	21.5	28.3	24.7	14.3	8.3	13.8
25.0	23.2	19.2	16.2	17.2	15.1	12.7	12.4	12.4
13.6	13.4	11.2	8.9	10.6	9.0	7.5	6.9	7.5
6.5	5.2	3.8	3.6	3.1	3.0	2.3	2.8	2.5
3.4	2.9	2.6	2.4	1.9	1.7	1.4	1.1	0.8
1.2	1.2	1.1	1.1	1.4	1.2	1.1	1.3	1.1
0.2	0.4	0.4	0.2	0.2	0.2	0.4	0.4	0.5
16.1	18.7	19.4	19.6	21.5	22.8	26.9	28.8	28.1
13.3	15.1	14.6	15.2	16.3	16.2	16.9	19.5	22.5
1.0	1.9	2.4	2.0	2.4	2.6	2.9	3.1	1.7
1.5	1.6	1.7	2.1	2.5	3.0	3.5	3.9	3.5
0.2	0.2	0.6	0.3	0.4	1.0	3.6	2.3	0.4
18.4	19.5	20.7	21.2	22.1	21.0	20.1	18.2	16.9
7.5	6.2	5.6	5.8	6.3	4.6	3.8	3.5	3.9
1.2	1.3	2.1	1.2	0.8	0.6	0.5	0.5	0.5
9.2	11.7	12.5	13.7	14.2	14.0	13.4	12.7	11.4
0.4	0.2	0.6	0.5	0.9	1.8	2.4	1.6	1.1
6.0	6.8	7.2	8.1	8.4	8.2	8.2	9.7	9.4
3.1	3.4	3.3	4.0	4.7	3.8	3.6	5.1	7.0
1.2	1.2	1.6	1.3	1.0	1.0	0.9	0.9	0.6
1.5	2.0	2.0	2.3	1.9	2.0	1.9	1.5	1.3
0.2	0.2	0.3	0.5	0.7	1.5	1.9	2.3	0.4
9.9	10.7	11.2	11.6	11.3	12.0	13.0	13.3	13.4
6.4	7.8	8.6	9.7	9.5	7.1	6.5	7.5	10.9
1.5	1.3	1.1	0.9	0.7	0.8	1.1	1.3	0.9
1.3	1.0	0.9	0.6	0.7	0.8	0.9	0.9	0.7
0.8	0.6	0.6	0.3	0.5	3.3	4.5	3.6	1.0
6.8	9.4	10.3	12.2	13.1	17.2	22.5	25.6	21.3
2.8	4.2	4.5	6.1	7.5	10.5	15.9	18.7	14.8
3.9	5.2	5.7	6.1	5.7	6.6	6.7	6.9	6.5
5.6	6.7	7.4	6.5	6.4	5.3	6.3	7.1	9.1
3.1	4.3	5.0	4.5	4.3	2.8	3.1	3.4	5.8
1.6	1.5	1.7	1.4	1.6	1.7	1.9	2.2	2.9
0.6	0.7	0.5	0.4	0.5	0.4	0.4	0.3	0.3
0.3	0.1	0.2	0.2	0.2	0.5	0.9	1.1	0.1

Prevalence

As of December 31st 2014, more than 242 000 persons were alive and previously diagnosed with cancer in Norway. The cancer prevalence in Table 20 provides the numbers of cancer survivors a given number of years after diagnosis (<1, 1–4, 5–9 and ≥10 years), and approximates the number of patients in Norway (of both sexes) potentially requiring some form of cancer care. The highest 10-year prevalence occurs for breast cancer (18 769) followed by melanoma of the skin (10 372), prostate (7 851) and colon cancer (6 221).

In terms of new cases, there are almost twice as many lung cancers as melanoma in Norway, but the prevalence of lung cancer survivors ten years after the diagnosis is less than 10% of the prevalence of melanoma patients. This reflects the vast difference in survival between the two cancers. Differences in prognosis, rather than incidence, and median age at diagnosis explain much of the site-specific variability in prevalence.

Table 20 Prevalence of cancer 31.12.2004 and 31.12.2014, both sexes

		Total no. of persons alive		Years after diagnosis			
ICD10	Site	31.12.04	31.12.14	<1	1–4	5–9	10+
C00–96	**All sites**	**165474**	**242398**	**22933**	**68777**	**58132**	**92556**
C00–14	**Mouth, pharynx**	**3245**	**4590**	**554**	**1429**	**1073**	**1534**
C00	Lip	1194	1360	117	384	333	526
C01–02	Tongue	516	880	123	315	187	255
C03–06	Mouth, other	571	740	91	217	189	243
C07–08	Salivary glands	423	558	66	134	111	247
C09–14	Pharynx	570	1122	169	417	268	268
C15–26	**Digestive organs**	**26184**	**36106**	**4783**	**11621**	**8466**	**11236**
C15	Oesophagus	273	552	196	216	78	62
C16	Stomach	2059	1982	327	539	393	723
C17	Small intestine	532	992	125	356	266	245
C18	Colon	14284	19783	2354	6419	4789	6221
C19–20	Rectum, rectosigmoid	8126	11089	1245	3481	2701	3662
C21	Anus	506	675	75	198	165	237
C22	Liver	172	448	119	185	70	74
C23–24	Gallbladder, bile ducts	274	439	107	164	77	91
C25	Pancreas	506	841	327	317	110	87
C26	Other digestive organs	105	177	52	53	23	49
C30–34, C38	**Respiratory organs**	**5275**	**8111**	**1976**	**3019**	**1569**	**1547**
C30–31	Nose, sinuses	272	343	39	112	89	103
C32	Larynx, epiglottis	1085	1142	119	328	277	418
C33–34	Lung, trachea	3889	6619	1830	2595	1197	997
C38	Mediastinum, pleura (non-mesothelioma)	59	62	5	12	11	34
C40–41	**Bone**	**551**	**753**	**49**	**136**	**138**	**430**
C43	**Melanoma of the skin**	**14775**	**22261**	**1931**	**5721**	**4237**	**10372**
C44	**Skin, non-melanoma**	**9315**	**14131**	**1823**	**4893**	**3529**	**3886**
C45	**Mesothelioma**	**104**	**121**	**48**	**56**	**7**	**10**
C47	**Autonomic nervous system**	**228**	**252**	**11**	**21**	**36**	**184**
C48–49	**Soft tissues**	**1101**	**1511**	**127**	**404**	**306**	**674**
C50	**Breast**	**30519**	**42786**	**3248**	**10752**	**10017**	**18769**
C51–58	**Female genital organs**	**19034**	**22031**	**1491**	**4594**	**4255**	**11691**
C53	Cervix uteri	6731	6972	317	1000	1011	4644
C54	Corpus uteri	7561	9804	688	2356	2317	4443
C55	Uterus, other	42	46	6	9	6	25
C56	Ovary	3978	4203	345	971	705	2182
C51–52, C57	Other female genital	894	1200	159	327	276	438
C58	Placenta	137	153	2	13	11	127
C60–63	**Male genital organs**	**25499**	**49199**	**5016**	**17501**	**14452**	**12230**
C61	Prostate	20387	41841	4673	16268	13049	7851
C62	Testis	4846	7049	319	1176	1328	4226
C60, C63	Other male genital	326	479	56	121	131	171
C64–68	**Urinary organs**	**13296**	**18357**	**2018**	**5750**	**4534**	**6055**
C64	Kidney excl. renal pelvis	3580	6006	689	2056	1498	1763
C65	Renal pelvis	467	622	93	205	136	188
C66–68	Bladder, ureter, urethra	9483	12042	1284	3606	2978	4174
C69	**Eye**	**849**	**1040**	**90**	**232**	**176**	**542**
C70–72, D32–33	**Central nervous system**	**7433**	**11940**	**782**	**2693**	**3119**	**5346**
C73	**Thyroid gland**	**3721**	**5202**	**312**	**1076**	**912**	**2902**
C37, C74–75	**Other endocrine glands**	**2038**	**3642**	**188**	**838**	**1015**	**1601**
C39, C76, C80	**Other or unspecified**	**505**	**585**	**108**	**176**	**110**	**191**
C81–96	**Lymphoid and haematopoietic tissue**	**12330**	**21056**	**2103**	**6803**	**5196**	**6954**
C81	Hodgkin lymphoma	1824	2547	126	477	473	1471
C82–86, C96	Non-Hodgkin lymphoma	5149	8770	848	2778	2221	2923
C88	Malignant immunoproliferative diseases	303	555	58	231	161	105
C90	Multiple myeloma	1245	1845	294	839	437	275
C91–95, D45–47	Leukaemia	3851	7528	813	2581	1943	2191

Table 21 shows the number of patients with metastasis or local recurrence, alive at specific time points. Only patients with metastasis confirmed histologically are included. Patients with metastatic disease now live longer than before and they more often have diagnostic work-up and surgery for metastatic lesions. They are also given more chemotherapy than before. This patient group represents an increasing demand of personnel and costs in the health care system.

Table 21 Prevalence of patients diagnosed with a metastasis during lifetime, by health region, both sexes

	Alive by 31st of december					
Health region	**Alive by 31st of december 1989**	**Alive by 31st of december 1994**	**Alive by 31st of december 1999**	**Alive by 31st of december 2004**	**Alive by 31st of december2009**	**Alive by 31st of december 2014**
South East	3 802	4 622	5 746	7 239	9 165	10 762
West	1 275	1 608	2 004	2 517	3 048	3 729
Middle	1 003	1 164	1 411	1 807	2 164	2 484
North	0 630	0 742	0 924	1 168	1 425	1 749
Total	**6 710**	**8 136**	**10 085**	**12 731**	**15 802**	**18 724**

Mortality

Mortality data is obtained from the Cause of Death Registry

There were 10 971 deaths from cancer in Norway in 2014, of which 5 833 were among men and 5 138 among women (Table 22). Cancers of the lung, colon, rectum, prostate and female breast account for half of the total cancer mortality. In 2014, we see that mortality numbers for prostate cancer and lung cancer are almost equal: Lung cancer is responsible for 1 198 deaths and the corresponding number for prostate cancer is 1 093 deaths. Colon cancer (543 deaths) and pancreas cancer (349 deaths) represent the third and fourth most frequent cause of cancer deaths among men.

Lung cancer mortality also ranks highest among women (960 deaths). Breast cancer (663 deaths) and colon cancer (595 deaths), respectively, represent the second and third most frequent cause of cancer deaths among women. Figure 9 shows the distribution of age-standardised mortality rates for selected cancer sites. There is at least a 200-fold difference in rates across these cancers. Given the very poor prognosis for pancreatic cancer, it ranks among the top four causes of cancer death among both men and women, even though pancreatic cancer is a relatively rare cancer.

The trends section in this report examines the mortality, incidence and survival for 23 selected cancer sites.

Figure 9. Age-standardised (Norway, 2014) mortality rates per 100 000 person-years for selected cancers in Norway, 2014

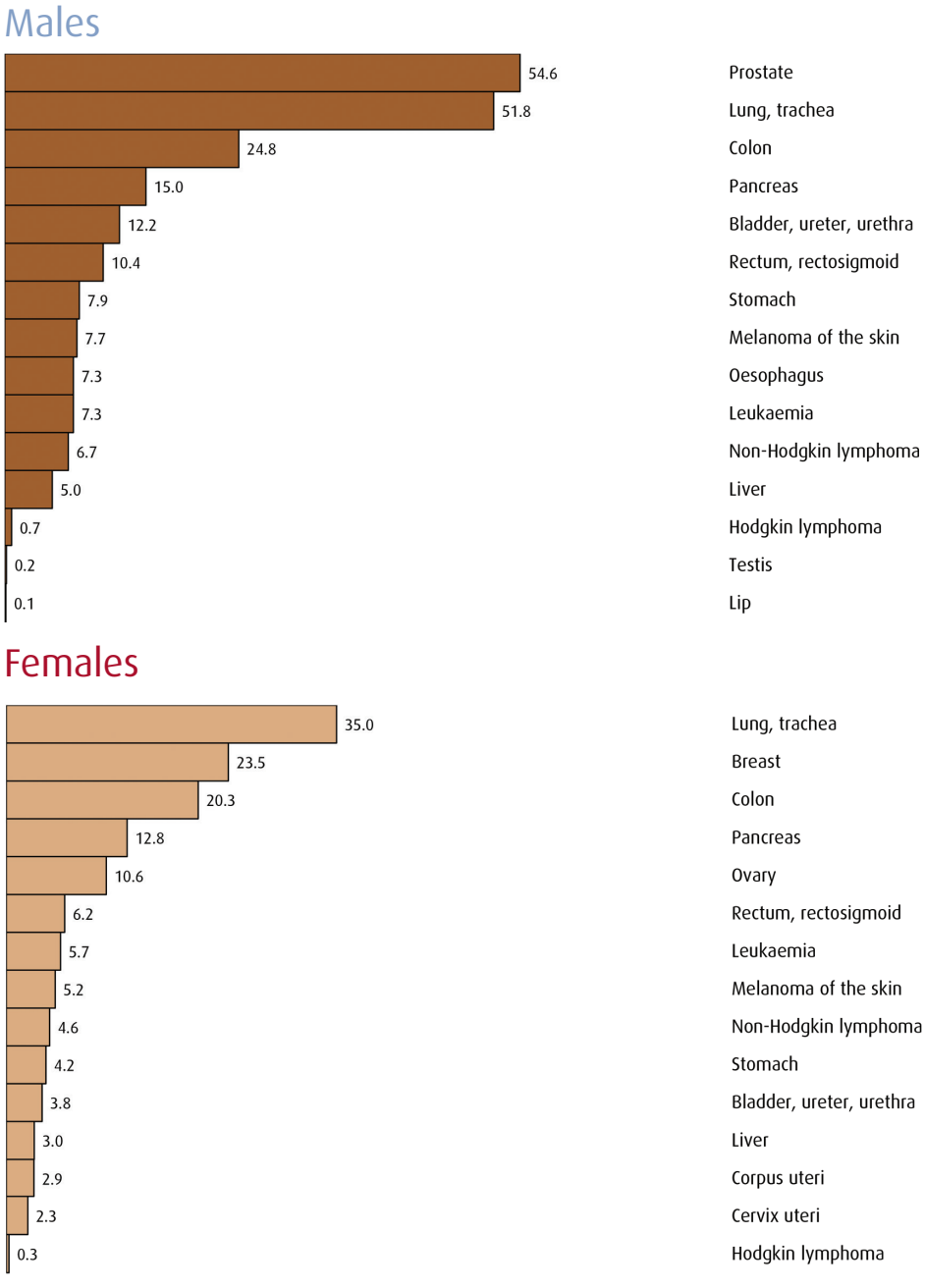


Table 22 Number of cancer deaths in Norway by primary site and sex, 2014 (Source: Cause of Death Registry)

ICD10	Site	Males	Females	Total
C00–96	**All sites**	**5833**	**5138**	**10971**
C00–14	**Mouth, pharynx**	**69**	**41**	**110**
C00	Lip	2		2
C01–02	Tongue	18	5	23
C03–06	Mouth, other	16	15	31
C07–08	Salivary glands	4	8	12
C09–14	Pharynx	29	13	42
C15–26	**Digestive organs**	**1691**	**1530**	**3221**
C15	Oesophagus	170	56	226
C16	Stomach	179	122	301
C17	Small intestine	29	30	59
C18	Colon	543	595	1138
C19–20	Rectum, rectosigmoid	231	177	408
C21	Anus	9	8	17
C22	Liver	120	84	204
C23–24	Gallbladder, bile ducts	25	53	78
C25	Pancreas	349	364	713
C26	Other digestive organs	36	41	77
C30–34, C38	**Respiratory organs**	**1247**	**977**	**2224**
C30–31	Nose, sinuses	9	4	13
C32	Larynx, epiglottis	32	7	39
C33–34	Lung, trachea	1198	960	2158
C38	Mediastinum, pleura (non-mesothelioma)	8	6	14
C40–41	**Bone**	**16**	**9**	**25**
C43	**Melanoma of the skin**	**178**	**144**	**322**
C44	**Skin, non-melanoma**	**28**	**24**	**52**
C45	**Mesothelioma**	**51**	**5**	**56**
C47	**Autonomic nervous system**	**3**	**3**	**6**
C48–49	**Soft tissues**	**40**	**37**	**77**
C50	**Breast**	**6**	**663**	**669**
C51–58	**Female genital organs**		**579**	**579**
C53	Cervix uteri		63	63
C54	Corpus uteri		81	81
C55	Uterus, other		85	85
C56	Ovary		292	292
C51–52, C57	Other female genital		58	58
C58	Placenta			
C60–63	**Male genital organs**	**1107**		**1107**
C61	Prostate	1093		1093
C62	Testis	4		4
C60, C63	Other male genital	10		10
C64–68	**Urinary organs**	**446**	**213**	**659**
C64	Kidney excl. renal pelvis	195	91	286
C65	Renal pelvis	5	7	12
C66–68	Bladder, ureter, urethra	246	115	361
C69	**Eye**	**3**	**5**	**8**
C70–72, D32–33	**Central nervous system**	**231**	**159**	**390**
C73	**Thyroid gland**	**14**	**35**	**49**
C37, C74–75	**Other endocrine glands**	**11**	**11**	**22**
C39, C76, C80	**Other or unspecified**	**186**	**257**	**443**
C81–96	**Lymphoid and haematopoietic tissue**	**506**	**445**	**951**
C81	Hodgkin lymphoma	16	8	24
C82–86, C96	Non-Hodgkin lymphoma	151	134	285
C88	Malignant immunoproliferative diseases	7	3	10
C90	Multiple myeloma	122	130	252
C91–95, D45–47	Leukaemia	210	170	380

Survival

Long-term estimates of survival are becoming increasingly relevant as life expectancy amongst cancer patients increases and cancer care continues to advance (Brenner & Hakulinen, 2002). Table 23 gives the 1-, 5-, 10- and 15-year relative survival estimates (with 95% confidence intervals) for the follow-up period 2012–2014 by cancer site and sex. Less frequent cancer diagnoses and groups with low survival will have few cases left especially at 10 and 15 years after diagnosis, and the 95% confidence intervals should be taken into consideration in any interpretation of the relative survival estimates.

Given that cancer patients survive longer, there is a need to communicate information about prognosis not only at the time of diagnosis, but also later because prognosis tends to improve for those surviving the first year(s) after diagnosis. (Janssen-Heijnen & al, 2007). Figures 10-A to 10-X depict these two aspects of cancer survival in Norway for all cancers combined and for 23 specific cancer types. Relative survival estimates are presented by sex and age, 1 to 15 years after diagnosis, with age strata determined specifically according to relevant biological and/or clinical criteria.

For some sites, the cumulative survival curves tend to level off a certain number of years after diagnosis, indicating that from this point forward, the cancer patient group has similar mortality to the group without cancer, or in other words, statistically, these patients appear to be "cured" (Lambert, 2007). This concept of "statistical cure" involves attributes of survival observed among patients as a group, and should be distinguished from clinical cure, as is determined on the basis of a lack of specific symptoms in an individual.

Estimates of five-year relative survival conditional on being alive 1 to 10 years after diagnosis are included in the sex-specific figures, and better quantify the prognosis of cancer patients at time points beyond the initial diagnosis (Figure 10-A to 10-X, dashed lines). When conditional five-year relative survival reaches 90-95% we usually say that there is little or no excess mortality - analogous to the notion of statistical cure that may be observed in the long-term relative survival estimates.

The overall profile of the sex- and age-specific survival of all cancer patients 1 to 15 years after diagnosis in Norway is presented in Figure 10-A. As mentioned in the trends section, the combined cancer group is an aggregate of many different cancer types with different diagnostic and treatment possibilities. Survival estimates will be particularly influenced by PSA testing for prostate cancer and mammographic screening for female breast cancer.

The cumulative five-year relative survival described by cancer site, sex and age, and five-year conditional relative survival by site and age (Figures 10-B to 10-X) are fairly self-explanatory and highlight the wide variations in patient survival according to these three variables. The 90 percentage-point difference in five-year survival among patients with testicular cancer (Figure 10-Q) compared to patients with pancreatic cancer (Figure 10-I) strikingly illustrates the wide differential in prognosis according to type of cancer. Long-term survival following diagnosis of melanoma and cancers of the oral cavity, central nervous system and thyroid gland clearly varies between men and women. This may be due to biological or anatomical differences or may relate to sex-specific differences in stage at presentation, subsite or histological type, as well as levels of co-morbidity.

The overall cancer survival tends to diminish with increasing age at diagnosis, yet the age-specific differences are rather narrow for colon cancer (Figure 10-E) relative to, for example, cervix cancer (Figure 10-M) or non-Hodgkin lymphoma (Figure 10-W). For certain cancers, including breast and corpus uteri cancer, long-term survival among patients diagnosed under the age of 50 are slightly lower than for patients diagnosed at the age 50-59. This in part represents the diagnosis of more aggressive tumours in the younger age group, and, for breast cancer, the impact of screening in the older group.

The figures also illustrate a positive aspect of cancer survival; cancer patients who are alive a certain time after diagnosis show good prospects of surviving their cancer and being cured. In fact, for more than two-thirds of the cancer groups, the five-year conditional relative survival reaches 90% 2–5 years after diagnosis. In general terms, this means that survivors of these cancers will, within a few years of diagnosis, have mortality rates similar to that of the general population, and would be considered (statistically) cured. The extent to which survivors may be considered cured does however vary; five-year conditional survival from breast cancer reaches 90% 1 year after diagnosis (Figure 10-L) and slowly increases to about 93% 10 years from diagnosis. As is evident from the continual decline in long-term breast cancer cumulative survival, there remains a persistent excess mortality for women with this disease.

Table 23 provides the five-year relative survival estimates over the last four decades by stage, cancer site and sex. While the stage-specific count of cases by five-year period of diagnosis in Tables 18 a and b are not equivalent to the size of the patient groups used in the survival calculations, the numbers do provide a reasonable indication of the absolute number of patients involved in the survival analyses at different time periods and their relative distribution.

In general, caution is required in interpreting cancer-specific incidence and survival according to stage, particularly given the time-varying proportion of staging recorded as unknown. Due to changes in coding practice described in the *Data sources and methods* section, any observed reduction in relative survival for localised disease between the last two periods in Table 23 are most probably due to those coding changes and do not reflect a real change in survival for patients with localised cancer.

A visual description of survival trends in colon, breast and prostate cancer by stage was provided in the Special Issue in Cancer in Norway 2007.

Table 23a Five-year relative survival by primary site, stage and period of diagnosis, 1975–2014

MALES

ICD10	Site	Stage*	Relative survival (%)							
			1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14**
C00-96	All sites	Total	38.3	42.1	44.3	49.8	54.7	60.1	66.5	68.9
C00-14	Mouth, pharynx	Total	61.2	59.4	56.7	55.4	56.0	55.0	60.4	64.8
		Localized	80.7	79.9	75.1	75.6	76.9	79.5	79.6	78.0
		Regional	27.1	27.4	27.6	27.1	35.5	42.7	46.9	56.8
		Distant	-	-	-	10.9	9.6	9.7	11.8	11.3
		Unknown	-	-	-	-	56.9	55.2	78.7	51.2
C15	Oesophagus	Total	3.4	4.7	4.0	4.3	7.9	7.3	10.6	13.8
		Localized	3.9	6.0	5.8	8.1	16.8	15.2	24.3	23.1
		Regional	-	6.0	4.6	2.6	7.9	11.4	11.7	14.3
		Distant	-	-	-	-	-	-	-	-
		Unknown	-	-	-	-	-	3.4	3.6	-
C16	Stomach	Total	16.3	16.4	18.8	18.1	17.6	19.7	23.3	23.4
		Localized	37.6	35.5	38.7	36.8	45.5	54.8	49.4	38.5
		Regional	19.3	18.2	20.8	18.7	18.2	21.4	23.4	26.8
		Distant	1.6	1.7	1.1	0.4	1.7	1.5	3.2	3.4
		Unknown	-	-	-	-	14.2	16.6	29.6	0.1
C18	Colon	Total	40.2	46.5	46.1	49.2	53.6	55.0	58.7	58.9
		Localized	66.3	76.5	72.6	77.6	87.6	86.2	86.5	77.9
		Regional	47.6	54.0	56.3	59.0	67.0	69.7	74.5	76.8
		Distant	7.0	4.2	4.8	3.5	5.8	7.8	9.6	11.8
		Unknown	8.6	8.2	4.8	6.8	17.1	32.2	49.7	16.7
C19-20	Rectum, rectosigmoid	Total	36.6	42.9	44.9	49.8	55.9	58.1	63.5	66.2
		Localized	55.7	62.8	64.1	71.4	79.3	83.5	84.5	77.1
		Regional	31.8	39.5	44.2	47.3	61.8	67.6	76.2	79.5
		Distant	2.6	3.4	2.5	3.1	9.1	9.8	14.4	18.1
		Unknown	-	13.4	-	18.9	22.4	53.1	31.2	14.7
C22	Liver	Total	5.4	-	3.8	7.2	5.4	7.6	14.1	14.4
		Localized	8.0	-	6.2	9.9	12.3	16.7	24.4	23.8
		Regional	-	-	-	-	-	-	-	-
		Distant	-	-	-	-	-	-	-	-
		Unknown	-	-	-	-	-	-	15.1	16.5
C23-24	Gallbladder, bile ducts	Total	8.0	9.7	13.3	8.1	15.6	14.6	16.7	19.7
		Localized	-	13.1	14.5	14.7	-	31.6	24.5	25.8
		Regional	-	-	-	8.4	27.6	15.6	22.8	30.0
		Distant	-	-	-	-	-	-	-	-
		Unknown	-	-	-	-	8.6	-	-	-
C25	Pancreas	Total	1.6	1.5	1.7	2.3	3.0	3.8	4.4	5.5
		Localized	3.8	2.2	4.7	3.0	5.0	18.4	18.3	23.2
		Regional	3.2	3.6	-	10.7	5.5	5.2	7.1	7.8
		Distant	-	-	0.8	0.6	1.9	1.9	1.4	2.0
		Unknown	20.1	-	-	-	1.5	-	-	-
C33-34	Lung, trachea	Total	5.7	7.0	7.2	7.6	8.4	9.1	11.8	13.2
		Localized	11.5	15.7	14.6	14.1	24.7	34.2	39.2	38.3
		Regional	6.0	6.2	9.3	9.9	8.4	10.1	14.7	15.9
		Distant	0.7	0.7	0.6	0.6	0.5	0.9	1.7	1.9
		Unknown	2.9	1.7	1.5	5.9	4.3	7.7	10.8	8.7
C43	Melanoma of the skin	Total	59.5	66.7	68.0	73.6	75.7	75.3	75.6	79.0
		Localized	68.6	75.2	75.9	81.4	83.5	87.2	82.4	85.7
		Regional	15.9	29.3	26.5	38.9	28.8	44.4	37.0	41.5
		Distant	12.5	-	5.3	11.1	8.6	9.9	10.1	12.0
		Unknown	-	-	44.4	46.8	70.9	71.7	77.8	53.2
C61	Prostate	Total	54.6	57.7	56.4	64.4	75.3	82.9	88.9	90.8
		Localized	69.6	73.9	71.7	76.0	88.5	96.4	97.9	98.9
		Regional	41.0	39.0	45.5	61.2	67.0	74.9	88.0	90.4
		Distant	18.7	18.4	24.5	22.2	23.2	27.5	32.4	33.8
		Unknown	28.0	39.1	46.6	50.8	70.0	76.3	79.7	71.0
C62	Testis	Total	80.6	91.1	92.9	96.0	95.8	97.1	97.5	98.2
		Localized	93.4	98.4	98.3	99.1	98.9	98.9	99.9	99.5
		Regional	80.1	93.5	95.1	96.0	97.0	96.3	94.9	96.0
		Distant	43.2	64.8	69.1	78.9	77.6	87.1	84.8	89.5
		Unknown	-	-	-	-	-	-	-	-
C64	Kidney except renal pelvis	Total	38.6	39.9	41.7	51.4	48.5	57.7	63.3	67.6
		Localized	71.9	69.3	67.3	74.6	75.0	84.6	84.1	85.3
		Regional	41.0	44.1	44.5	54.8	52.1	51.6	57.6	55.0
		Distant	4.7	5.0	5.8	6.2	6.8	6.1	10.7	8.2
		Unknown	-	-	-	26.5	43.7	56.1	67.6	73.9
C66-68	Bladder, ureter, urethra	Total	59.9	60.4	66.6	69.1	69.5	71.5	72.4	73.1
		Localized	68.4	68.3	72.6	74.2	77.9	83.6	81.8	79.9
		Regional	24.7	22.7	27.2	25.6	22.3	25.3	27.6	26.9
		Distant	-	-	7.0	4.5	8.6	6.1	5.0	5.0
		Unknown	-	30.3	53.9	47.7	66.5	69.7	74.2	79.2
C70-72, D32-33	Central nervous system	Total	29.0	31.5	37.2	42.2	48.2	55.3	59.3	58.4
		Non-malignant	56.5	67.3	76.1	75.8	87.0	91.3	91.4	92.2
		Malignant	16.2	16.4	22.3	22.5	20.1	19.6	25.6	24.3
C73	Thyroid gland	Total	74.5	81.9	73.3	74.4	81.6	82.1	84.6	89.2
		Localized	90.1	97.7	88.7	93.9	101.8	95.9	99.7	95.8
		Regional	76.7	84.8	84.1	84.4	84.2	87.3	89.0	93.8
		Distant	-	-	-	-	-	-	-	20.0
		Unknown	-	-	-	-	-	-	-	92.6
C81	Hodgkin lymphoma	Total	55.6	69.4	72.2	77.3	85.8	88.3	85.5	85.3
C82-86, C96	Non-Hodgkin lymphoma	Total	37.9	40.4	44.4	45.1	48.2	56.1	63.7	68.5
C91-95	Leukaemia	Total	21.7	25.2	29.8	38.3	44.2	51.3	58.7	59.8

'-': Not estimated due to few patients in the group (<50 patients at start of interval 0-1, or <5 at start of later intervals).

* Caution is advised when interpreting survival trends according to stage due to changes in coding practices. From 1993 there was a large increase in the number of patients with unknown stage, corresponding to an increase in survival for patients with localized or unknown stage for several sites. From 2009, this coding practice was reversed, corresponding to a decrease in survival for patients with localized or unknown stage for several sites.

** For 2010-2014 the 5-year relative survial estimates are based on the period approach (observation window 2010-2014).

Table 23b Five-year relative survival by primary site, stage and period of diagnosis, 1975–2014

FEMALES

ICD10	Site	Stage*	Relative survival (%)							
			1975-79	1980-84	1985-89	1990-94	1995-99	2000-04	2005-09	2010-14**
C00-96	All sites	Total	48.7	51.4	54.0	57.4	60.4	63.5	67.1	68.5
C00-14	Mouth, pharynx	Total	61.4	56.0	56.3	67.0	60.6	61.9	68.4	70.5
		Localized	75.8	72.1	66.5	79.0	81.5	78.5	85.1	82.3
		Regional	41.8	35.6	40.8	46.5	36.0	50.8	54.2	58.1
		Unknown	-	-	-	-	-	61.9	60.2	52.4
C15	Oesophagus	Total	6.9	13.1	6.0	10.5	8.9	10.1	10.2	15.8
		Localized	9.1	14.9	10.4	14.1	15.9	22.1	20.9	24.1
		Regional	-	-	-	-	-	10.1	13.9	22.1
		Distant	-	-	-	-	-	-	-	-
		Unknown	-	-	-	-	-	-	-	-
C16	Stomach	Total	14.4	17.8	21.6	20.8	24.0	22.3	23.2	22.1
		Localized	35.5	40.6	38.6	39.0	52.1	56.4	49.2	38.6
		Regional	17.7	15.0	24.1	26.2	33.7	22.8	22.6	22.6
		Distant	2.0	0.8	1.0	1.2	2.1	4.6	3.7	2.8
		Unknown	2.0	6.1	-	5.2	6.0	11.3	17.7	0.7
C18	Colon	Total	40.3	44.7	49.9	51.9	55.9	58.1	61.5	62.8
		Localized	65.1	70.9	79.3	78.8	87.5	91.7	89.6	83.5
		Regional	50.4	53.7	59.9	59.7	69.2	70.9	75.7	78.4
		Distant	4.0	4.2	4.1	4.8	8.1	8.4	13.3	13.6
		Unknown	8.4	10.4	8.1	13.9	18.5	42.6	26.9	3.9
C19-20	Rectum, rectosigmoid	Total	42.0	45.6	49.5	53.7	58.0	63.7	64.6	66.0
		Localized	62.8	66.3	69.1	72.3	82.9	91.2	88.2	79.9
		Regional	35.9	37.3	49.1	53.4	63.2	71.5	72.8	77.2
		Distant	6.8	3.8	2.7	4.9	6.8	9.6	14.9	18.7
		Unknown	-	-	-	-	20.0	32.3	56.7	19.4
C22	Liver	Total	-	3.4	7.7	6.8	9.7	12.4	14.5	19.5
		Localized	-	7.3	11.5	10.7	17.6	25.7	23.7	30.1
		Regional	-	-	-	-	-	-	-	-
		Distant	-	-	-	-	-	-	-	-
		Unknown	-	-	-	-	-	8.4	13.6	-
C23-24	Gallbladder, bile ducts	Total	8.1	11.2	11.8	8.5	12.2	10.2	14.8	14.2
		Localized	30.3	22.6	15.3	15.8	22.4	20.3	25.3	24.1
		Regional	-	8.9	21.8	-	23.4	20.0	26.0	22.4
		Distant	-	-	-	-	-	-	-	-
		Unknown	-	-	-	-	4.3	5.7	-	-
C25	Pancreas	Total	1.8	1.7	2.2	3.1	2.8	3.8	5.6	6.8
		Localized	4.4	3.7	5.3	9.2	9.6	21.0	20.5	21.7
		Regional	4.1	4.8	4.3	4.3	3.6	5.2	5.5	9.1
		Distant	-	1.1	-	-	-	1.3	2.2	2.1
		Unknown	-	-	-	-	7.3	3.3	5.9	0.7
C33-34	Lung, trachea	Total	11.4	7.3	7.8	11.0	11.7	12.9	16.8	19.2
		Localized	26.9	19.1	18.0	24.2	35.2	49.0	49.5	51.7
		Regional	12.0	6.7	8.5	13.0	12.8	12.8	19.6	21.5
		Distant	1.3	-	1.1	1.2	1.2	1.8	2.7	2.6
		Unknown	13.9	6.6	5.8	5.5	8.1	16.6	15.6	18.0
C43	Melanoma of the skin	Total	78.9	80.3	86.0	87.5	87.8	87.2	87.0	87.5
		Localized	85.4	87.3	90.2	92.2	93.6	94.1	92.5	91.9
		Regional	-	34.9	47.0	40.0	56.2	51.9	46.2	53.0
		Distant	18.2	-	13.4	15.1	15.3	23.0	29.8	24.7
		Unknown	-	-	-	74.2	82.0	83.8	82.3	53.1
C50	Breast	Total	69.8	73.6	74.8	77.1	83.1	85.9	87.8	88.0
		Pagets stage 0	75.7	75.3	75.3	87.4	96.9	94.5	97.5	102.5
		I	85.7	86.4	91.2	94.4	97.2	98.6	99.3	99.4
		II	60.0	65.0	72.0	76.3	82.9	86.9	90.0	91.1
		III	45.9	47.7	48.4	51.4	58.5	63.8	71.1	73.8
		IV	13.4	16.6	16.6	21.3	15.1	19.5	22.6	24.2
		Unknown	64.8	70.6	76.2	81.2	82.2	81.7	65.8	64.3
C53	Cervix uteri	Total	74.8	70.6	68.8	71.4	73.5	77.3	77.1	80.4
		I	90.8	86.1	86.5	86.2	90.5	93.1	93.5	92.3
		II	64.5	59.9	54.9	59.4	59.9	72.1	72.0	77.8
		III	35.5	33.9	28.2	33.4	38.1	41.5	51.6	56.1
		IV	7.4	4.8	14.8	24.4	13.3	17.1	16.1	27.9
		Unknown	-	-	-	-	-	-	68.2	75.8
C54	Corpus uteri	Total	72.4	69.6	71.6	75.2	78.0	81.4	81.6	82.2
		Localized	81.2	82.3	81.6	85.4	89.4	92.4	92.3	92.6
		Regional	60.9	52.1	58.4	63.5	69.9	72.7	70.5	66.5
		Distant	16.7	21.7	22.8	28.2	33.0	36.1	39.5	35.5
		Unknown	-	31.2	-	-	51.8	83.6	78.4	64.3
C56	Ovary	Total	36.4	35.6	34.5	37.6	40.0	43.1	43.0	44.5
		Localized	78.3	79.5	80.4	82.4	90.6	89.4	88.5	88.9
		Regional	39.5	41.8	44.1	49.3	54.7	66.5	65.4	58.8
		Distant	15.8	16.4	15.8	18.9	24.1	27.1	29.4	30.7
		Unknown	-	41.9	19.4	24.9	37.9	52.0	39.4	34.3
C64	Kidney except renal pelvis	Total	38.4	44.5	48.4	53.7	54.0	57.2	69.8	69.9
		Localized	67.7	73.0	76.3	75.9	80.0	84.2	88.7	87.7
		Regional	37.6	45.6	46.5	51.1	46.4	45.3	44.1	45.7
		Distant	3.2	4.4	6.5	5.4	9.6	9.3	12.3	8.8
		Unknown	-	-	-	20.8	30.8	47.2	66.1	35.1
C66-68	Bladder, ureter, urethra	Total	47.4	52.8	59.8	60.1	59.0	60.1	63.2	65.1
		Localized	61.4	64.6	67.9	68.1	71.8	79.8	74.6	72.6
		Regional	9.3	14.8	13.6	15.0	24.6	19.7	23.5	23.9
		Distant	8.3	-	-	-	-	-	8.6	6.5
		Unknown	-	22.7	-	-	55.7	59.4	67.0	62.5
C70-72, D32-33	Central nervous system	Total	41.8	45.4	52.0	60.4	63.4	73.2	76.3	75.1
		Non-malignant	75.3	80.4	81.8	85.0	88.6	92.2	94.0	94.3
		Malignant	14.9	19.4	24.1	29.0	24.3	27.9	27.5	28.8
C73	Thyroid gland	Total	85.5	86.3	87.8	89.8	87.5	90.1	91.5	92.9
		Localized	95.0	94.3	95.8	97.6	97.9	103.9	100.9	99.0
		Regional	87.3	84.5	87.4	88.8	84.2	88.1	92.7	92.2
		Distant	21.1	19.3	-	23.2	-	-	-	25.2
		Unknown	-	-	-	-	57.2	79.8	53.3	9.6
C81	Hodgkin lymphoma	Total	70.7	69.9	70.5	83.4	84.0	85.0	86.2	87.6
C82-86, C96	Non-Hodgkin lymphoma	Total	38.8	48.0	49.4	52.7	53.9	58.7	70.6	72.6
C91-95	Leukaemia	Total	22.2	26.2	28.2	41.4	46.0	54.3	62.7	63.2

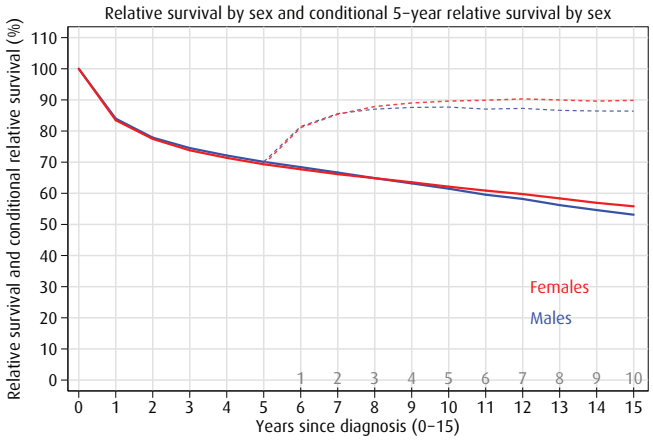
Table 24 1-, 5-, 10,- and 15-year relative survival proportion (95% confidence interval) by cancer site and sex, period approach follow-up, 2012–2014

ICD10	Site	Sex	1-year		5-year		10-year		15-year	
C00-14	Mouth, pharynx	M	85.2	(83.3, 87.0)	64.8	(61.8, 67.6)	51.2	(47.3, 54.9)	43.1	(37.9, 48.3)
		F	87.2	(84.7, 89.4)	70.5	(66.8, 74.0)	59.6	(54.4, 64.3)	47.2	(41.3, 52.8)
C15	Oesophagus	M	42.0	(38.9, 45.1)	13.8	(11.4, 16.4)	11.8	(9.2, 14.8)	10.7	(7.2, 15.0)
		F	44.6	(39.3, 49.8)	15.8	(11.5, 20.8)	12.2	(7.7, 17.8)	-	-
C16	Stomach	M	51.2	(48.7, 53.7)	23.4	(21.1, 25.8)	19.6	(17.0, 22.3)	16.3	(13.5, 19.3)
		F	45.9	(42.7, 49.2)	22.1	(19.3, 25.0)	19.9	(16.9, 23.2)	18.1	(14.0, 22.6)
C18	Colon	M	78.3	(77.2, 79.4)	58.9	(57.3, 60.5)	52.6	(50.2, 55.0)	44.6	(40.7, 48.5)
		F	79.4	(78.4, 80.4)	62.8	(61.3, 64.3)	56.4	(54.1, 58.5)	48.6	(44.6, 52.4)
C19-20	Rectum, rectosigmoid	M	86.9	(85.7, 88.1)	66.2	(64.2, 68.2)	54.7	(51.9, 57.4)	50.7	(46.5, 54.7)
		F	86.0	(84.5, 87.3)	66.0	(63.7, 68.1)	59.8	(56.8, 62.6)	54.7	(50.3, 58.9)
C22	Liver	M	35.1	(31.3, 39.0)	14.4	(11.3, 17.8)	11.4	(8.3, 14.9)	8.8	(4.9, 14.5)
		F	38.3	(33.5, 43.0)	19.5	(15.0, 24.3)	15.7	(10.6, 21.7)	10.4	(5.7, 16.9)
C23-24	Gallbladder, bile ducts	M	53.3	(47.9, 58.3)	19.7	(15.0, 25.0)	16.2	(11.1, 22.1)	11.9	(6.3, 19.5)
		F	40.1	(35.9, 44.3)	14.2	(11.0, 17.9)	12.0	(8.8, 15.8)	9.4	(6.1, 13.7)
C25	Pancreas	M	24.8	(22.9, 26.8)	5.5	(4.4, 6.7)	3.9	(2.9, 5.2)	2.7	(1.7, 4.2)
		F	23.6	(21.8, 25.5)	6.8	(5.6, 8.2)	4.8	(3.6, 6.3)	3.2	(2.0, 4.7)
C33-34	Lung, trachea	M	37.8	(36.7, 38.9)	13.2	(12.4, 14.0)	7.9	(7.1, 8.7)	5.5	(4.6, 6.4)
		F	45.9	(44.7, 47.1)	19.2	(18.1, 20.3)	12.9	(11.8, 14.1)	9.9	(8.4, 11.6)
C43	Melanoma of the skin	M	94.5	(93.6, 95.3)	79.0	(77.2, 80.8)	72.0	(69.1, 74.7)	64.1	(59.4, 68.3)
		F	97.3	(96.6, 97.9)	87.5	(86.0, 88.9)	82.8	(80.4, 84.9)	80.7	(77.1, 83.8)
C50	Breast	F	97.4	(97.1, 97.7)	88.0	(87.3, 88.7)	79.3	(78.3, 80.3)	72.4	(71.1, 73.7)
C53	Cervix uteri	F	92.3	(90.9, 93.5)	80.4	(78.2, 82.3)	75.7	(73.3, 77.9)	70.9	(68.3, 73.3)
C54	Corpus uteri	F	93.0	(92.0, 93.9)	82.2	(80.5, 83.8)	76.8	(74.4, 79.0)	69.9	(66.2, 73.2)
C56	Ovary	F	76.4	(74.6, 78.1)	44.5	(42.4, 46.7)	35.1	(32.8, 37.3)	31.1	(28.6, 33.6)
C61	Prostate	M	98.6	(98.3, 98.8)	90.8	(90.1, 91.4)	78.5	(77.3, 79.5)	65.1	(63.3, 66.8)
C62	Testis	M	98.9	(98.1, 99.3)	98.2	(97.1, 98.9)	97.5	(95.8, 98.4)	96.8	(94.6, 98.1)
C64	Kidney except renal pelvis	M	83.9	(82.3, 85.4)	67.6	(65.2, 69.9)	55.5	(52.3, 58.7)	49.3	(44.4, 54.0)
		F	82.8	(80.4, 84.9)	69.9	(66.8, 72.8)	61.3	(57.5, 64.9)	51.9	(46.4, 57.1)
C66-68	Bladder, ureter, urethra	M	88.1	(87.0, 89.1)	73.1	(71.2, 74.9)	62.0	(59.3, 64.6)	54.5	(49.3, 59.5)
		F	81.0	(78.9, 82.9)	65.1	(62.1, 67.9)	59.9	(55.3, 64.2)	46.9	(38.9, 54.5)
C70-72, D32-33	Central nervous system	M	76.4	(74.7, 78.1)	58.4	(56.3, 60.5)	53.6	(51.1, 56.0)	48.6	(45.4, 51.8)
		F	85.8	(84.3, 87.0)	75.1	(73.3, 76.9)	71.4	(69.2, 73.5)	67.0	(64.0, 69.7)
C73	Thyroid gland	M	93.5	(90.4, 95.7)	89.2	(84.1, 92.7)	85.0	(77.2, 90.3)	81.4	(68.7, 89.3)
		F	95.5	(94.0, 96.7)	92.9	(90.6, 94.7)	88.9	(85.4, 91.6)	84.4	(79.5, 88.2)
C81	Hodgkin lymphoma	M	91.2	(87.9, 93.6)	85.3	(81.2, 88.6)	82.1	(77.5, 85.9)	80.2	(74.5, 84.7)
		F	95.8	(92.7, 97.6)	87.6	(83.0, 91.0)	84.7	(79.0, 88.9)	83.6	(76.7, 88.5)
C82-86, C96	Non-Hodgkin lymphoma	M	82.1	(80.5, 83.6)	68.5	(66.3, 70.6)	55.9	(52.7, 59.0)	47.1	(42.1, 52.0)
		F	83.2	(81.5, 84.7)	72.6	(70.4, 74.8)	62.2	(59.3, 65.1)	53.8	(48.9, 58.4)
C91-95	Leukaemia	M	79.8	(78.2, 81.3)	59.8	(57.6, 61.9)	46.4	(43.6, 49.1)	39.5	(34.2, 44.8)
		F	77.9	(76.1, 79.7)	63.2	(60.8, 65.4)	48.9	(46.0, 51.8)	41.8	(37.5, 46.1)

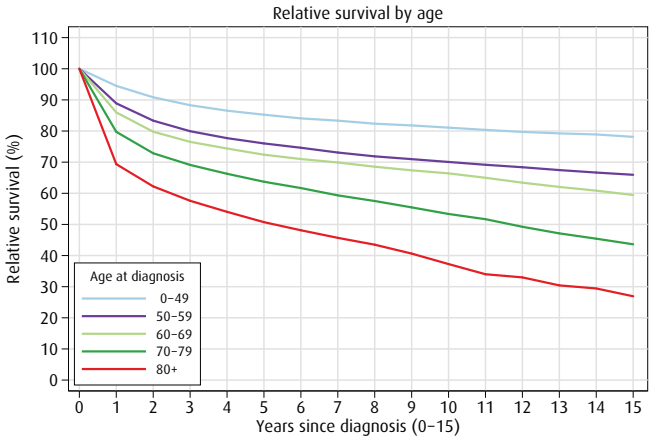
'-': Not estimated due to few patients in the group (<50 patients at start of interval 0-1, or <5 at start of later intervals).

Figure 10. Relative survival (RS) up to 15 years after diagnosis by sex and age (2012–14)

Figure 10A: All sites (ICD10 C00–96, D32–33, D35.2–35.4, D42–43, D44.3–44.5, D45–47)

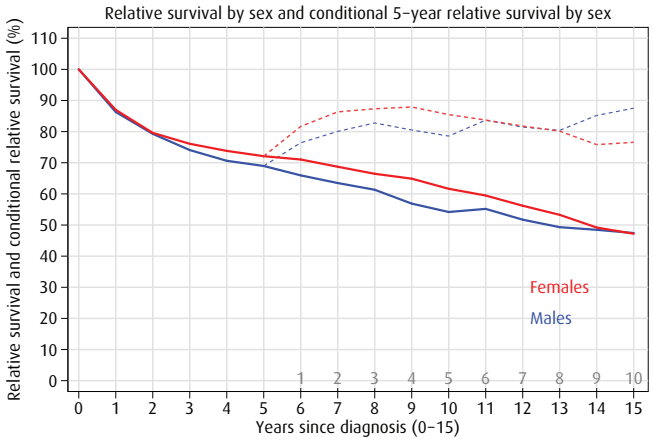


Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis

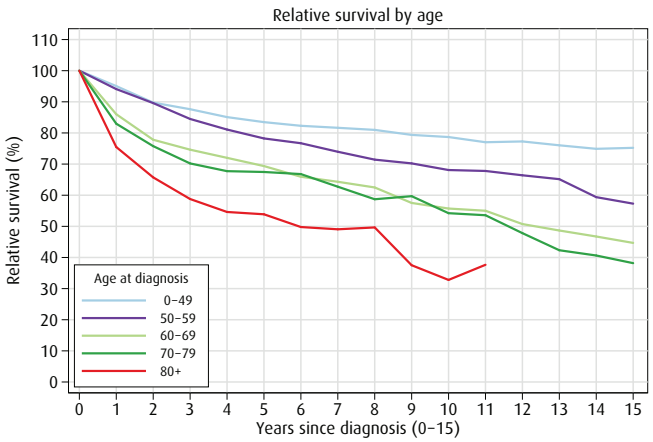


Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10B: Mouth, pharynx (ICD-10 C00–14)

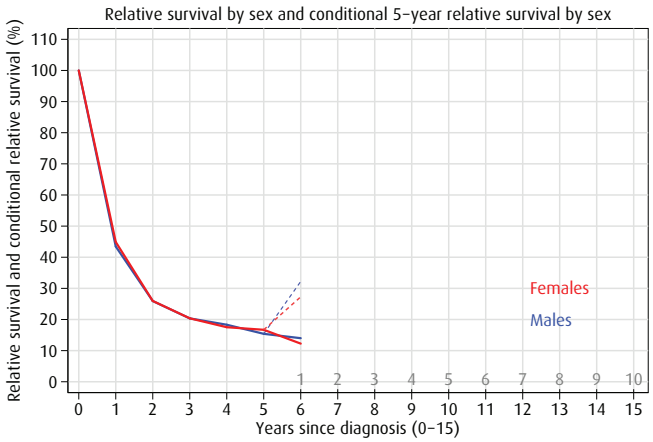


Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis

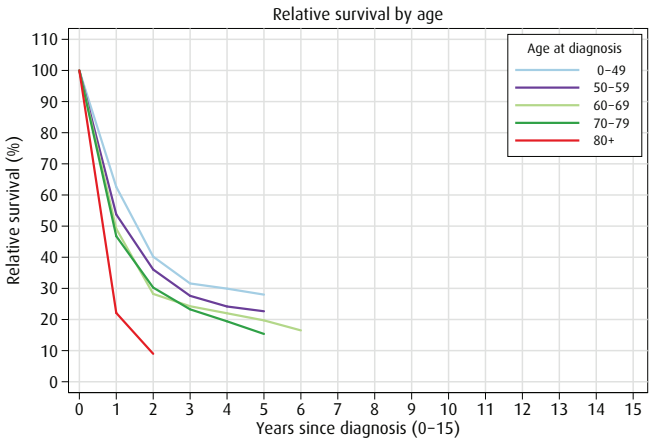


Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10C: Oesophagus (ICD-10 C15)



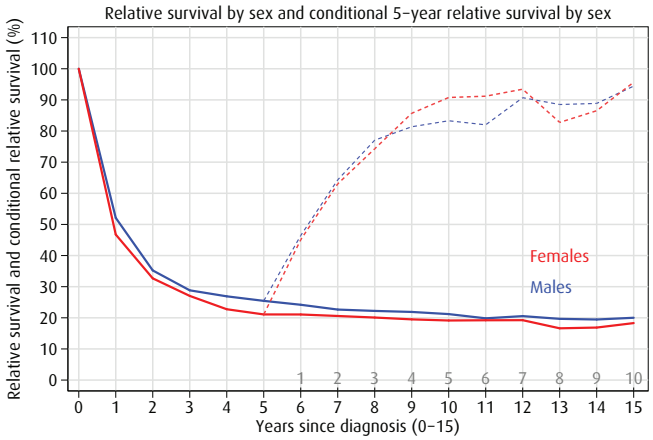
Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis



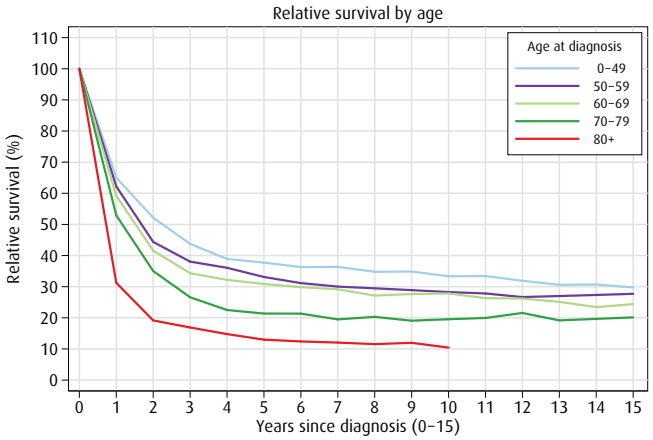
Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10. Relative survival (RS) up to 15 years after diagnosis by sex and age (2012–14)

Figure 10D: Stomach (ICD-10 C16)

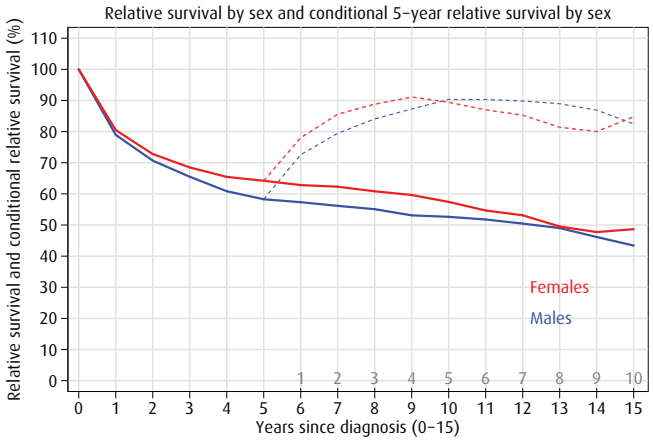


Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis

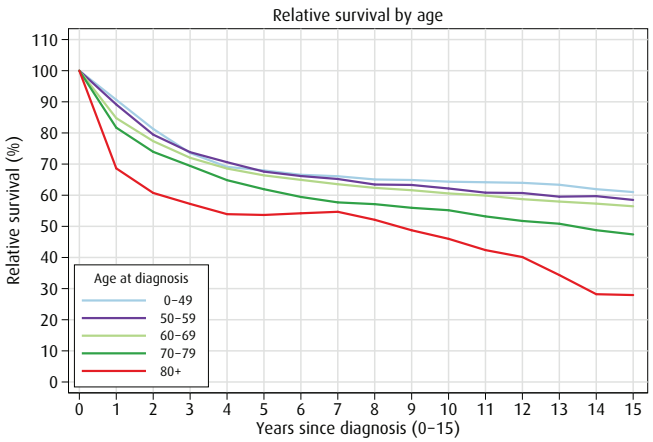


Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10E: Colon (ICD-10 C18)

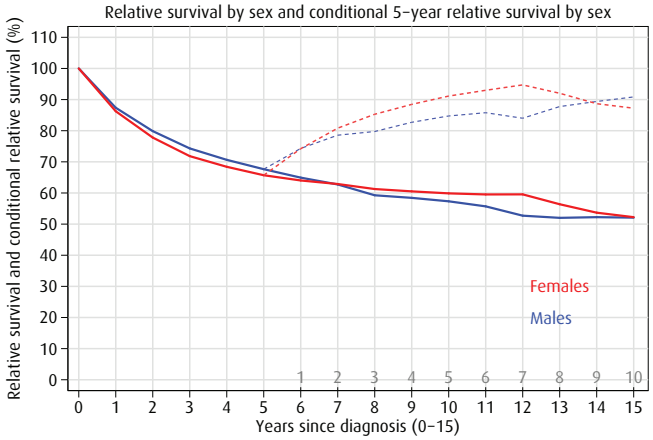


Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis

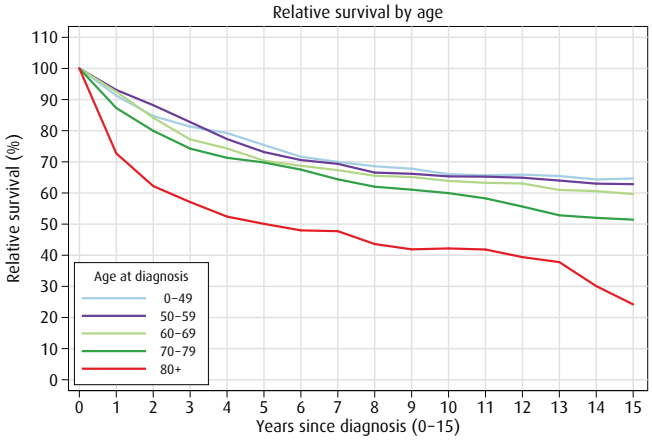


Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10F: Rectum, rectosigmoid (ICD-10 C19–20)



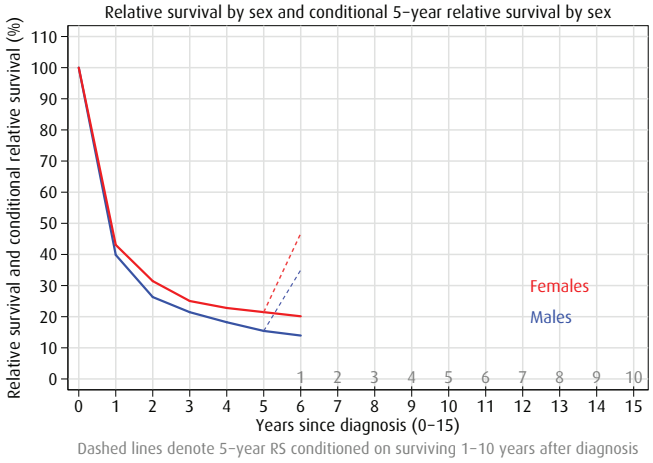
Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis



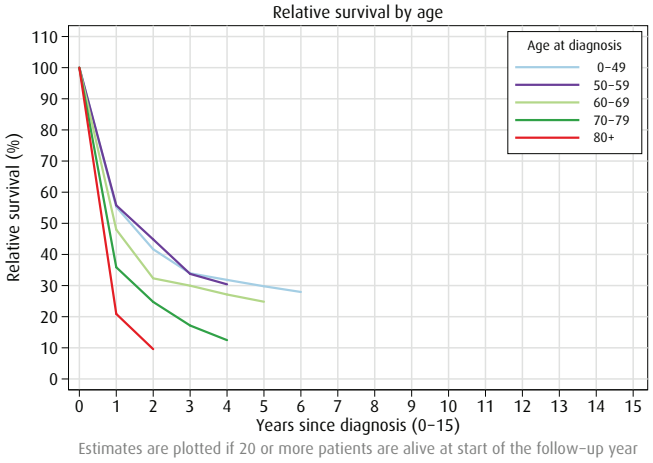
Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10. Relative survival (RS) up to 15 years after diagnosis by sex and age (2012–14)

Figure 10G: Liver (ICD-10 C22)

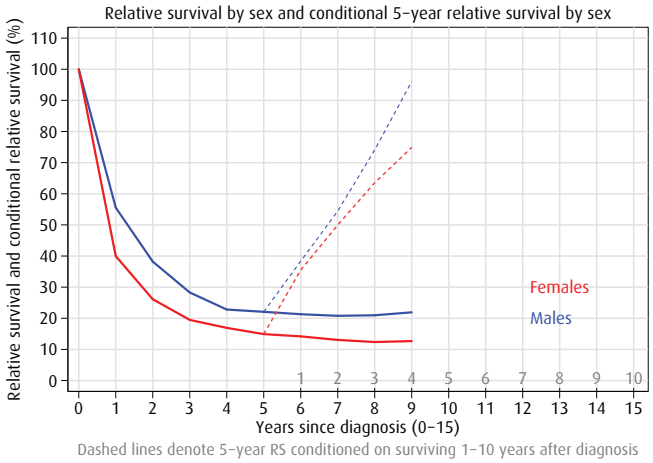


Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis

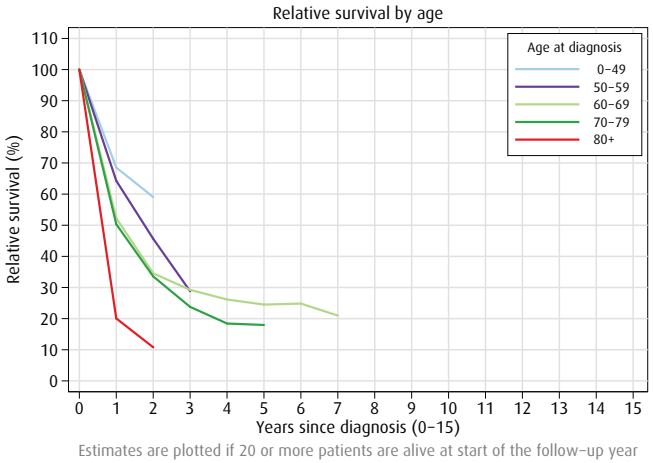


Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10H: Gallbladder, bile ducts (ICD-10 C23–24)

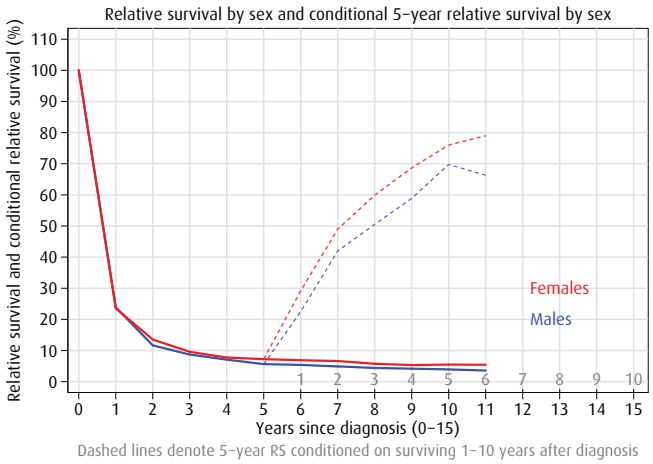


Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis

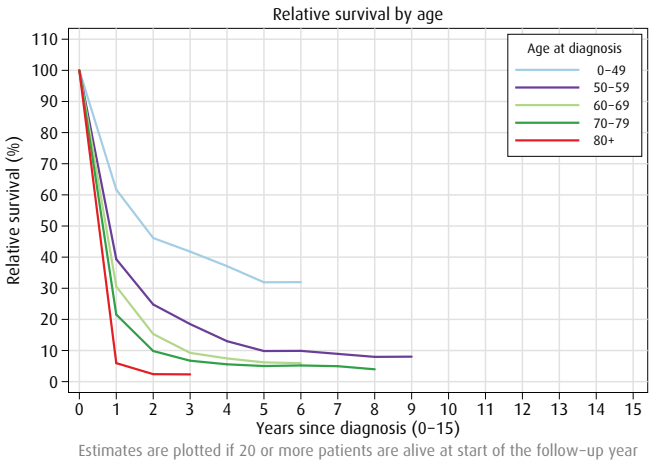


Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10I: Pancreas (ICD-10 C25)



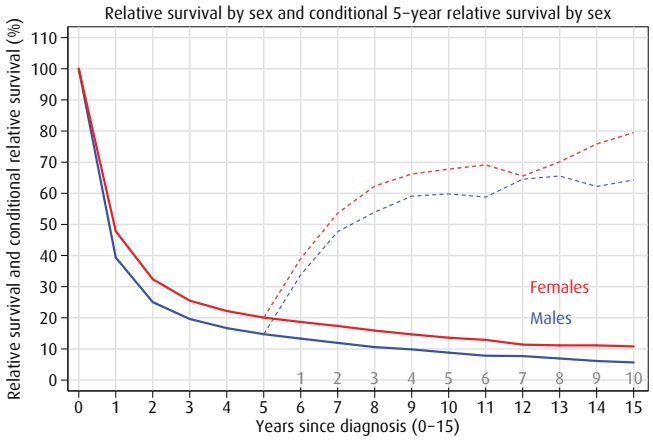
Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis



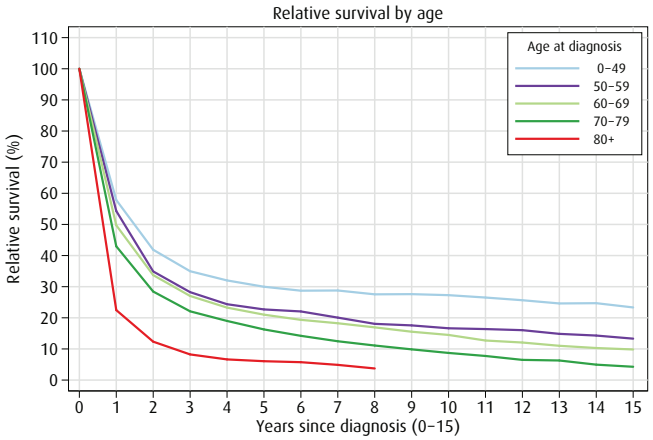
Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10. Relative survival (RS) up to 15 years after diagnosis by sex and age (2012–14)

Figure 10J: Lung, trachea (ICD-10 C33–34)

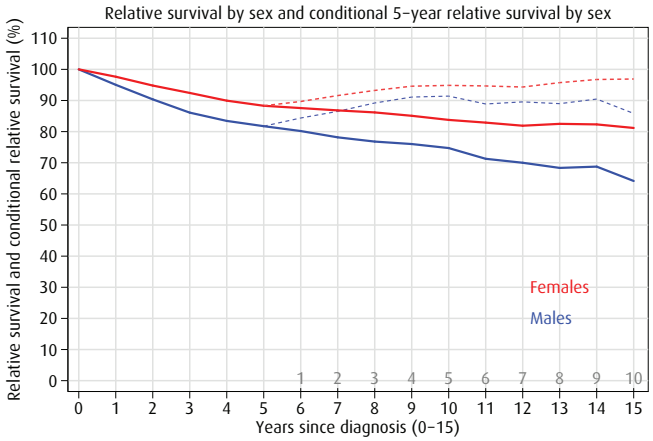


Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis

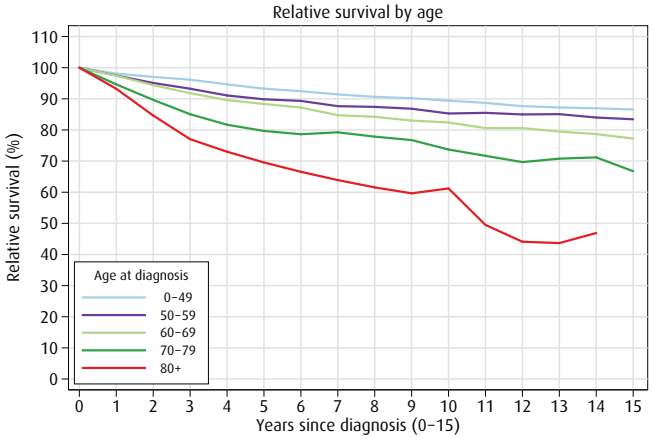


Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10K: Melanoma of the skin (ICD-10 C43)

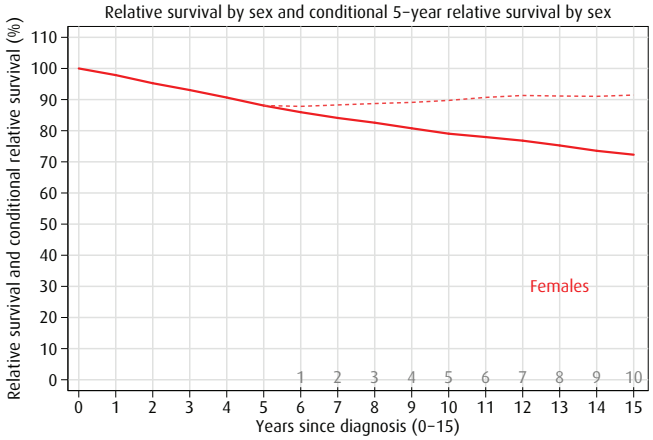


Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis

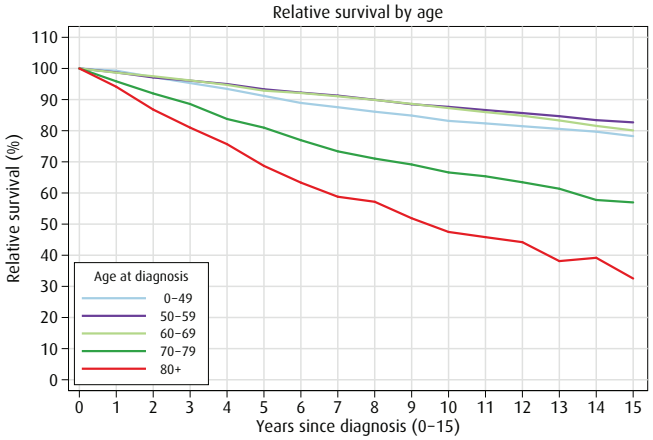


Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10L: Breast (ICD-10 C50)



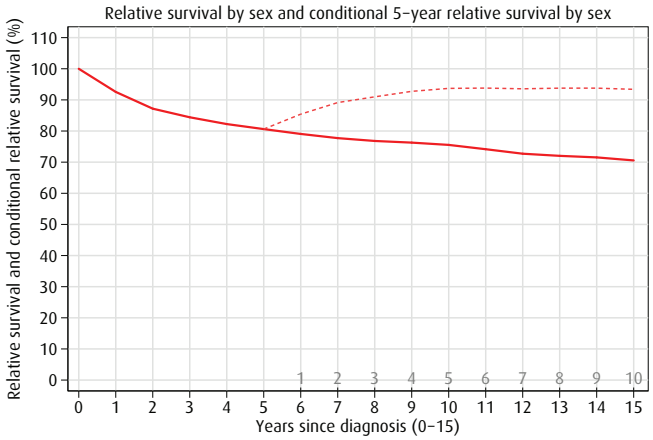
Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis



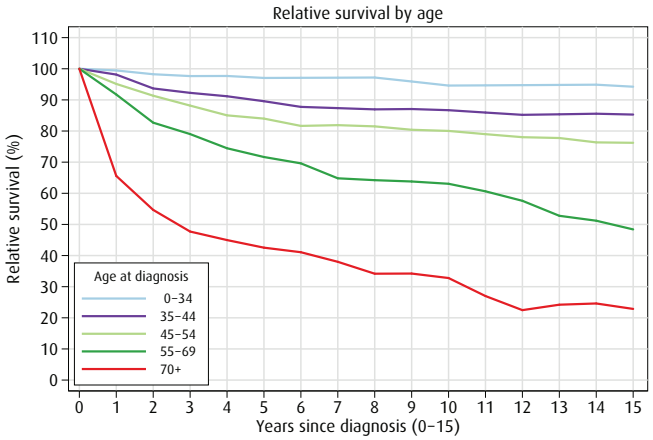
Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10. Relative survival (RS) up to 15 years after diagnosis by sex and age (2012–14)

Figure 10M: Cervix uteri (ICD-10 C53)

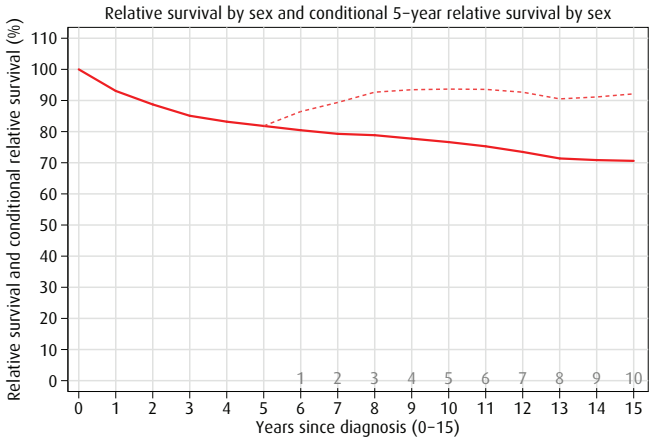


Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis

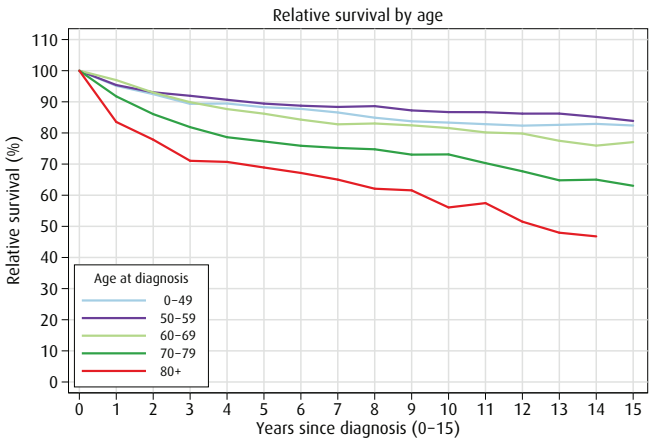


Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10N: Corpus uteri (ICD-10 C54)

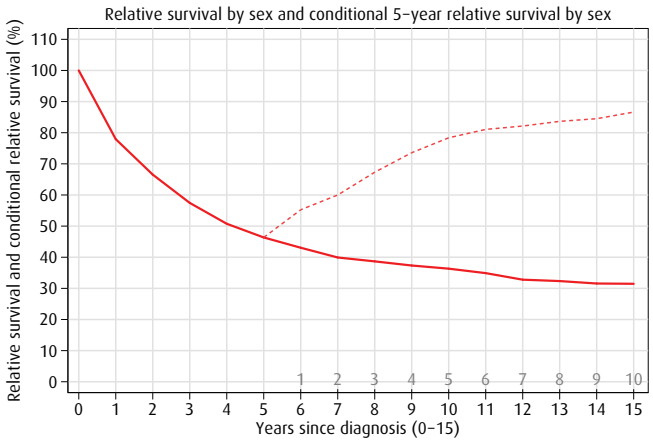


Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis

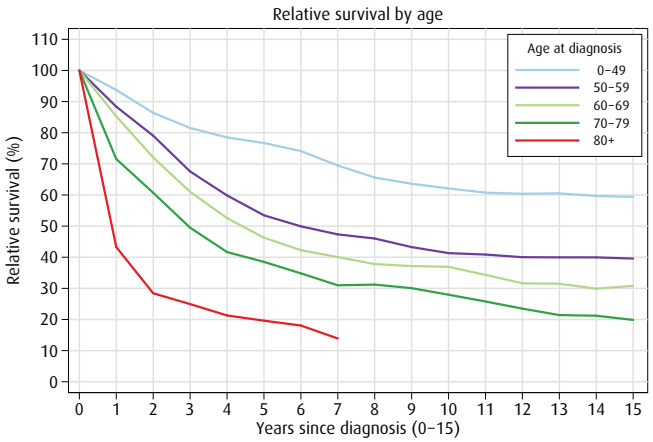


Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10O: Ovary (ICD-10 C56)



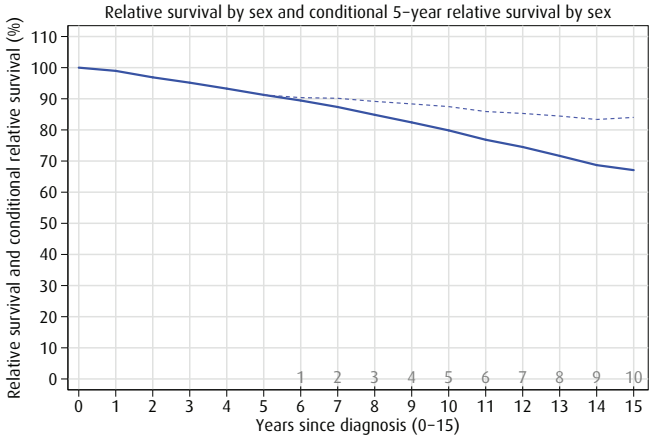
Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis



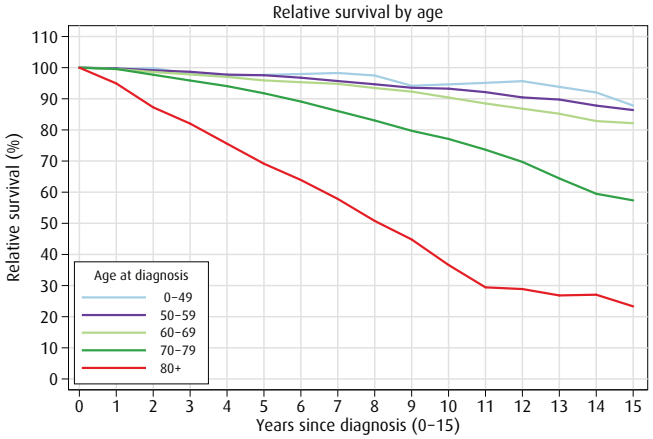
Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10. Relative survival (RS) up to 15 years after diagnosis by sex and age (2012–14)

Figure 10P: Prostate (ICD-10 C61)

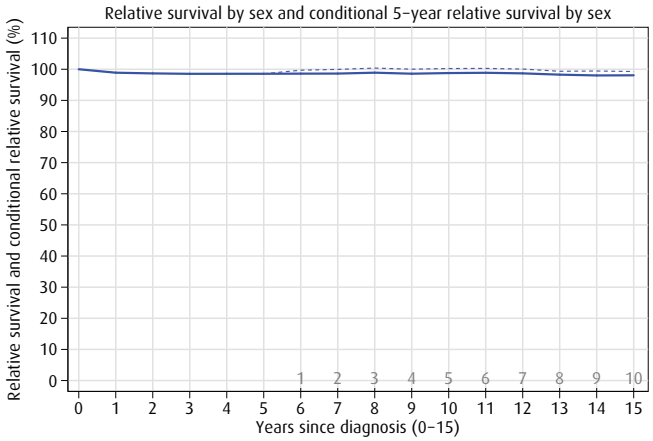


Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis

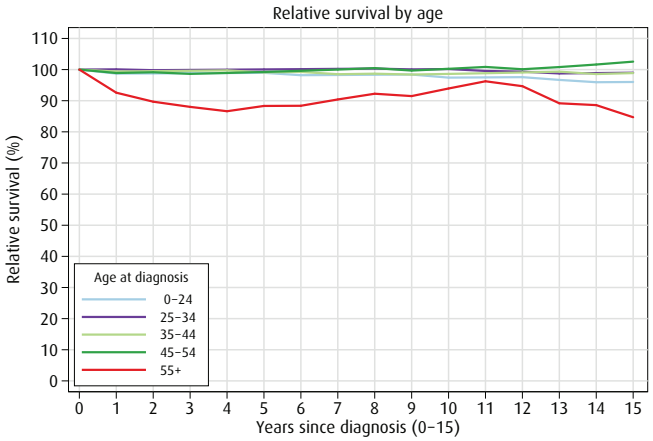


Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10Q: Testis (ICD-10 C62)

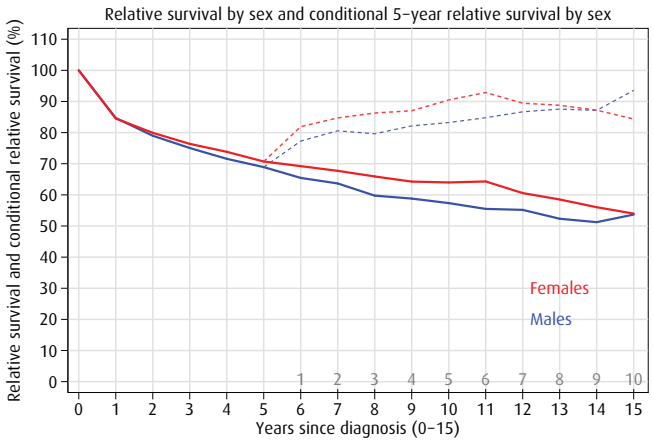


Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis

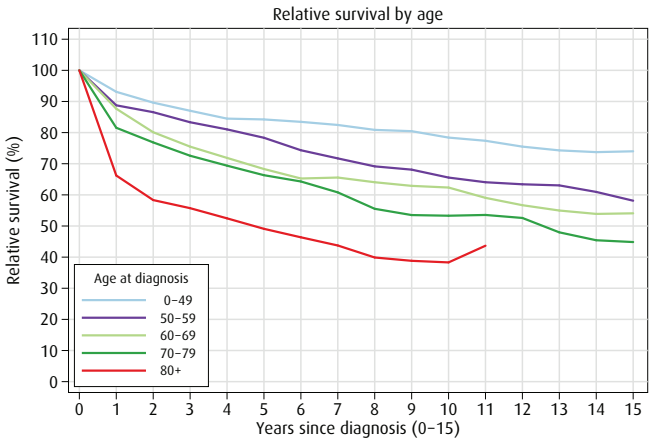


Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10R: Kidney excluding renal pelvis (ICD-10 C64)



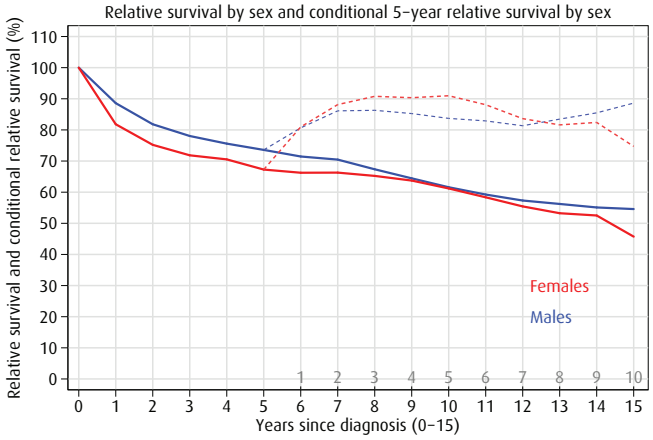
Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis



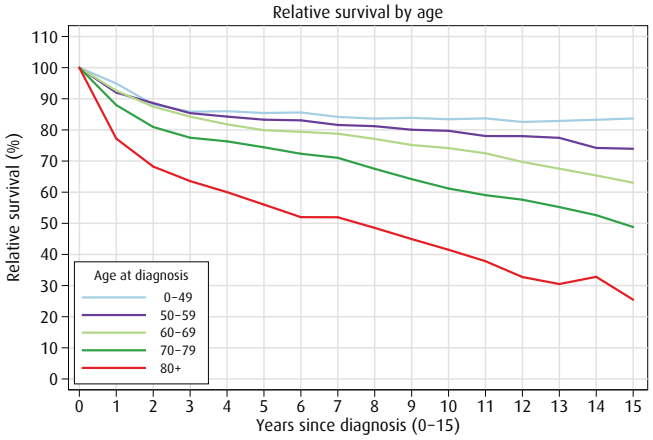
Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10. Relative survival (RS) up to 15 years after diagnosis by sex and age (2012–14)

Figure 10S: Bladder, ureter, urethra (ICD-10 C66–68)

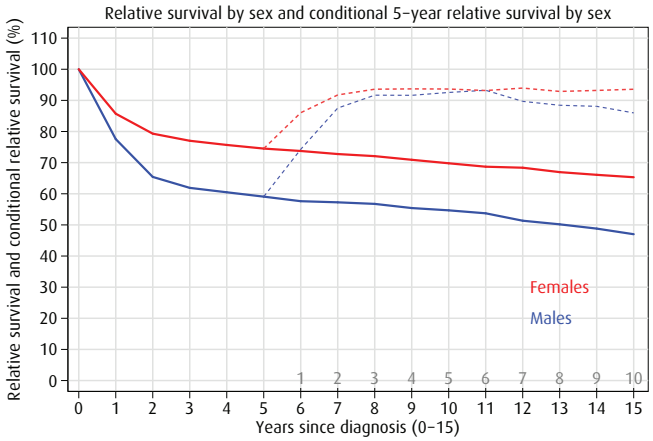


Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis

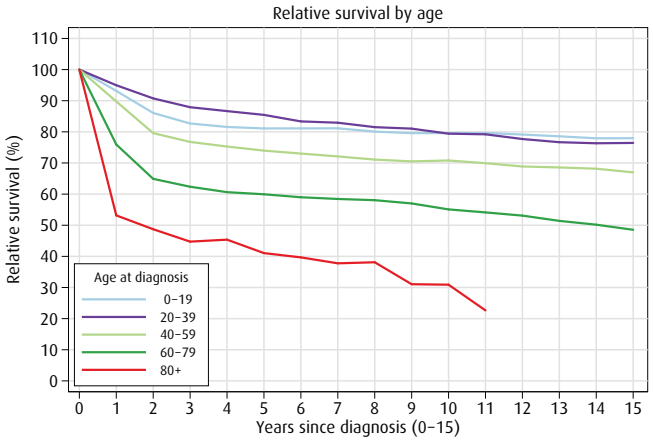


Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10T: Central nervous system (ICD-10 C70–72, D32–33, D42–43)

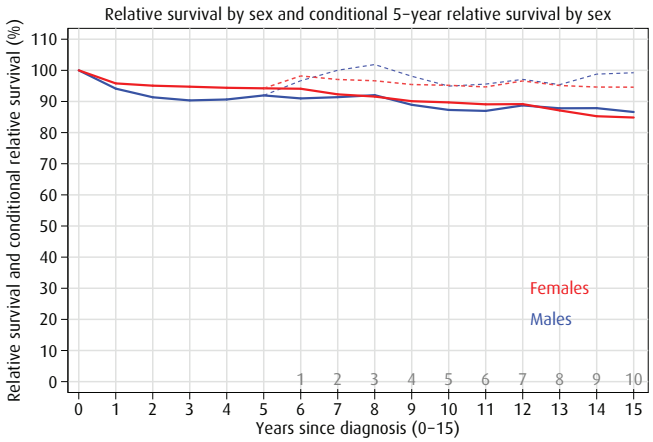


Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis

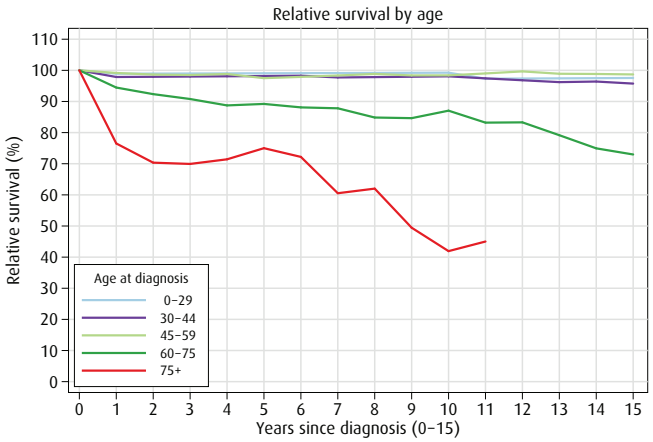


Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10U: Thyroid gland (ICD-10 C73)



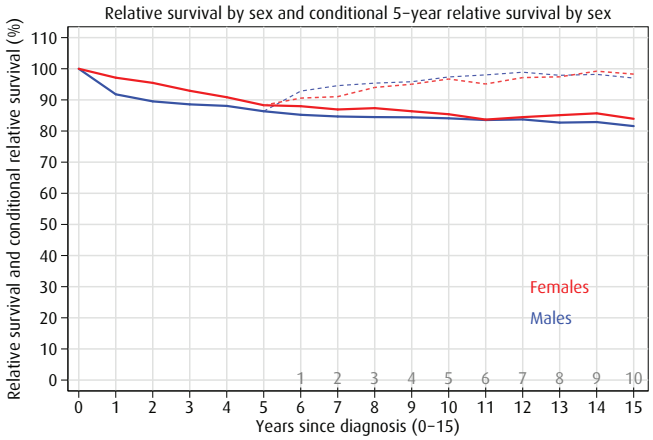
Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis



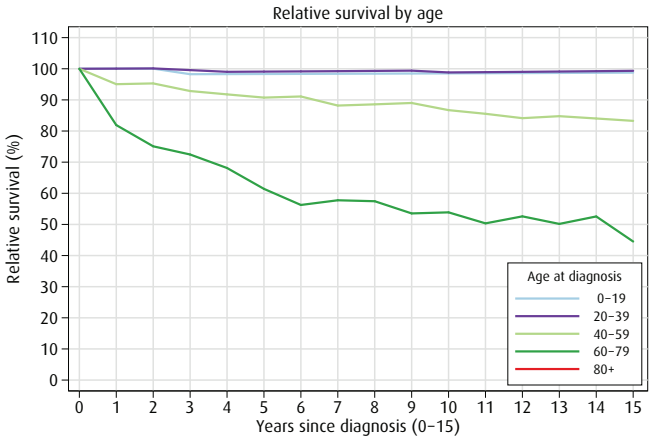
Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10. Relative survival (RS) up to 15 years after diagnosis by sex and age (2012–14)

Figure 10V: Hodgkin lymphoma (ICD-10 C81)

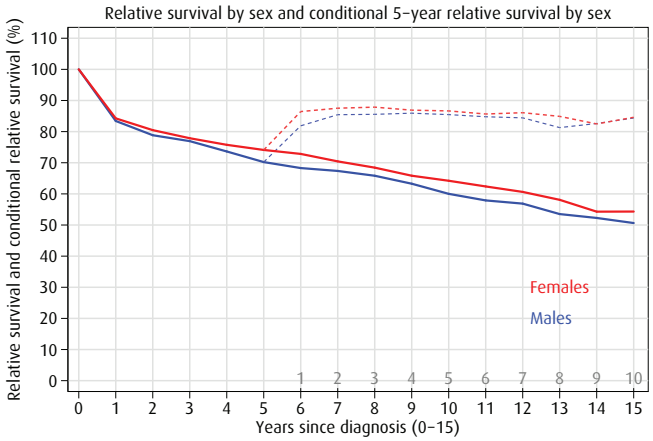


Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis

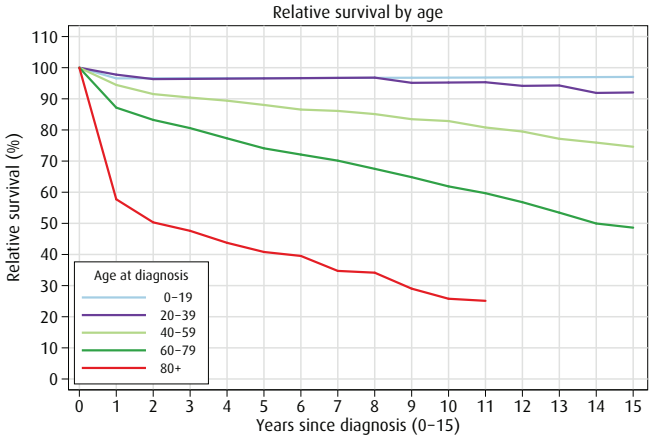


Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10W: Non-Hodgkin lymphoma (ICD-10 C82–86, C96)

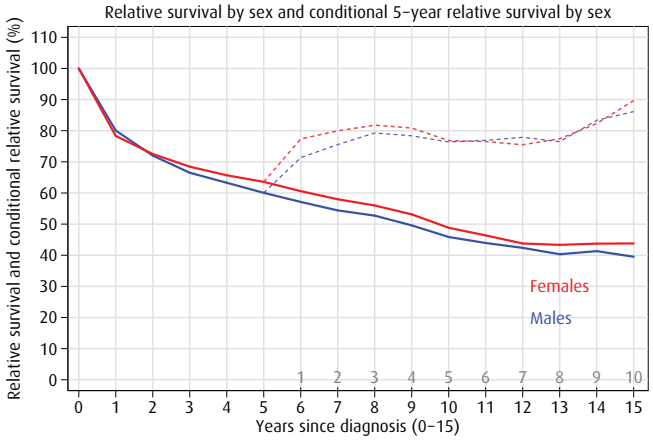


Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis

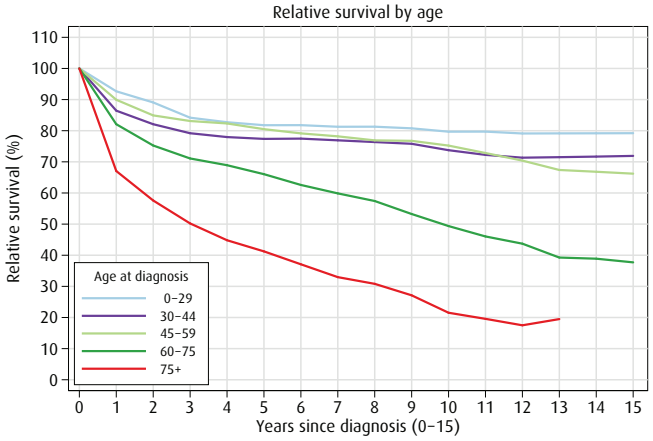


Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Figure 10X: Leukaemia (ICD-10 C91–95, D45–47)



Dashed lines denote 5-year RS conditioned on surviving 1–10 years after diagnosis



Estimates are plotted if 20 or more patients are alive at start of the follow-up year

Trends in incidence, mortality and survival, Norway 1965–2014

There has been considerable discussion as to the relative merits of incidence, mortality and survival analysis in cancer research generally, and in time trend analysis specifically (Boyle, 1989; Coleman, 2000; Doll & Peto, 1981; Peto & al, 2000). Analysing trends in incidence may provide some insight into changes in the incidence and distribution of risk factors, and the impact of interventions and screening aimed at prevention and early diagnosis. Mortality rates and survival proportions are both key measures of disease outcome, and may alert us to the beneficial effects of screening, more effective therapies or better disease management.

The contribution of artefacts to the observed cancer incidence and mortality trends have been comprehensively addressed (Saxen,1982 ; Muir & al, 1994). Others have investigated the accuracy of death certificates (e.g. Percy & al, 1981; Alfsen & al, 2010). Apart from artefacts related to registration practices, many of the factors that affect incidence also apply to mortality, given that both rely on the accuracy of the initial cancer diagnosis. As with incidence, survival estimates may be affected by changes in diagnostic methods and disease classifications, as well as the extent of cancer screening that detect cases in an earlier stage of the disease.

There is a general consensus that a combined description of trends in incidence, mortality and survival aids our understanding of the underlying biological, epidemiological and clinical processes. As each indicator is subject to unique or shared artefacts that tend to vary according to cancer type over time, their simultaneous assessment often enables the identification of systematic deviations in one or more of the three measures. Figure 11-A to 11-X present time trends during 1965–2014 for age-standardised incidence and mortality rates and five-year relative survival estimates based on a moving three-year observation (period) window. It should be noted that these summary measures will often fail to reflect true underlying age-calendar-year interactions for specific cancers, such as differences in survival and mortality trends by age with respect to calendar time, or the presence of strong birth cohort influences in incidence trends.

The trends for "All sites" in Figure 11-A is a persistent increase in cancer incidence and survival in Norway over the last four to five decades, combined with a fairly stable mortality until the early 1990s. The decline in mortality that follows is more rapid in men than in women. The interpretation of these aggregated estimates is complex, in that they comprise many different cancer types variable in terms of their capacity to be diagnosed as well as treated. Important contributions to the downward trend in men came from lung cancer, prostate cancer and stomach cancer, and in women, from breast cancer and stomach cancer.

Among men, nearly 30% of all cancers diagnosed in 2014 were prostate cancers. General screening for prostate cancer using the PSA test is not recommended in Norway. However, the proportion of cases where PSA testing has led to further examination is still increasing and it is the maine cause for performing a biopsy. The increase in both incidence and five-year relative survival from 1990 (Figure 10-O) probably reflects the availability of the PSA test and the upsurge in its use and in the detection of disease. However, mortality has declined from around 1996 and both early diagnosis and improved and more active treatment may have had an impact.

Breast cancer comprises more than 20% of all female cancer cases. There has been a monotonous increase in incidence rates up to 2005 with a steeper increase in the mid-1990s followed by a notable decline 2005 and 2009 (Figure 11-M). The Norwegian Breast Cancer Screening Programme started as a four-year pilot project in four of the 19 Norwegian counties in 1996, and gradually expanded to become nationwide by 2005. The programme invites women aged 50–69 years to biennial screening. The implementation of the screening programme explains much of the increasing incidence trend from the mid-1990s to 2005.

During the last decade, there have been some fluctuations in the breast cancer rates, but no clear picture emerges when we examine the trends in age-specific rates. The fluctuations probably represent a combination of new diagnostic methods being used in the program, or locally in studies, and random variation. The breast cancer mortality was almost stable from

1965 up to the mid-1990s when it began declining (Figure 11-M). These good news most likely reflect improved diagnostics, better treatment, and the implementation of the systematic screening programme for breast cancer.

Trends in lung cancer incidence and mortality follow each other closely, reflecting the poor survival over time. The varying trends by sex reflect the different phases of the smoking epidemic in Norwegian men and women (Figure 11-J). Overall, lung cancer incidence and mortality rates among males began to level off in the early 1990s and declined the past three years. This is in contrast to the continuing increase in women. It is worth noting that the age-standardised lung cancer rates conceal a stabilisation in younger women (< 60 years). During the last two decades lung cancer has surpassed breast cancer as the most frequent cause of cancer death among women, and the incidence is now surpassing that of colon cancer. The lung cancer trends reflect the historical changes in smoking habits. In fact, the first strong evidence of the close relationship between smoking and lung cancer came 60 years ago, in the early 1950s. The trends year by year seemed to stabilise after 2010 for women, but the rate for 2014 suggests a slight increase.

Both colon and rectal cancer incidence havebeen increasing for many decades, but the rectal cancer rates have levelled off since the 1990s (Figure 11-E and 11-F). Of particular note is the increasing survival and declining mortality from rectal cancer in both sexes, and the mortality is nearly half of what it used to be The most important determinans are probably the national introduction of total mesorectal excision in the early 1990s, increasing specialisation, and use of preoperative radiation. However, our colon cancer incidence and mortality rates are among the highest in the Nordic countries, and remain a health concern.

Some other specific sites are also worthy of note. The long-term decline in stomach cancer incidence and mortality is most likely caused by better hygiene and increased intake of fresh or frozen food, which have reduced the prevalence of *Helicobacter pylori* infections. The survival of stomach cancer has increased moderately over time (Figure 11-D).

In contrast, the incidence rate of testicular cancer increased gradually during the last decades (Figure 11-Q). An improvement in survival started in the 1970s with the introduction of cisplatin therapy for advanced germ-cell tumours, leading to greatly improved prognosis for testicular cancer in young and middle-aged men. This cancer now has the highest five-year relative survival.

Finally, a remarkable increase in incidence rates has been seen during the last years for liver cancer, thyroid gland malignant melanoma in both genders. The increase in incidence rates for malignant melanoma is probably best explained by sun tanning. It could also be caused by more frequent check-ups at the general practitioners' offices or in pharmacies. However, the moderate but steady increase in melanoma mortality indicates that some of the increase in incidence is caused by a higher risk of disease. The rise of thyroid cancers during the last decade is also seen in the other Nordic countries, except in Iceland where the rates have been consistently higher than in Scandinavia since 1960. The increase in Norway may be due to an increased use of ultrasound, CT or MRI for other indications, resulting in incidental findings of tumours in the thyroid. We suspect that the increased rate of liver cancer is due to immigration from areas with higher incidence of this disease.

In summary, the overall trends in cancer survival probably reflect both artefacts, such as screening and improved diagnostics, and improved treatment. For prostate and breast cancer both early diagnosis and improvements in treatment are likely to have played a role. For rectal cancer, the improved survival is most likely caused by better treatment.

Note to figures 11-A to 11-X:

The mortality rates used in the trends figures have some deviations from the incidence and survival estimates. Anal cancer is included in the mortality rates in figure 11-F, and cases of topography ICD10 D45-47 are not included in the mortality rates in figure 11-X.

Figure 11. Trends in incidence and mortality rates and 5-year relative survival proportions

Figure 11-A: All sites (ICD10 C00–96, D32–33, D35.2–35.4, D42–43, D44.3–44.5, D45–47)

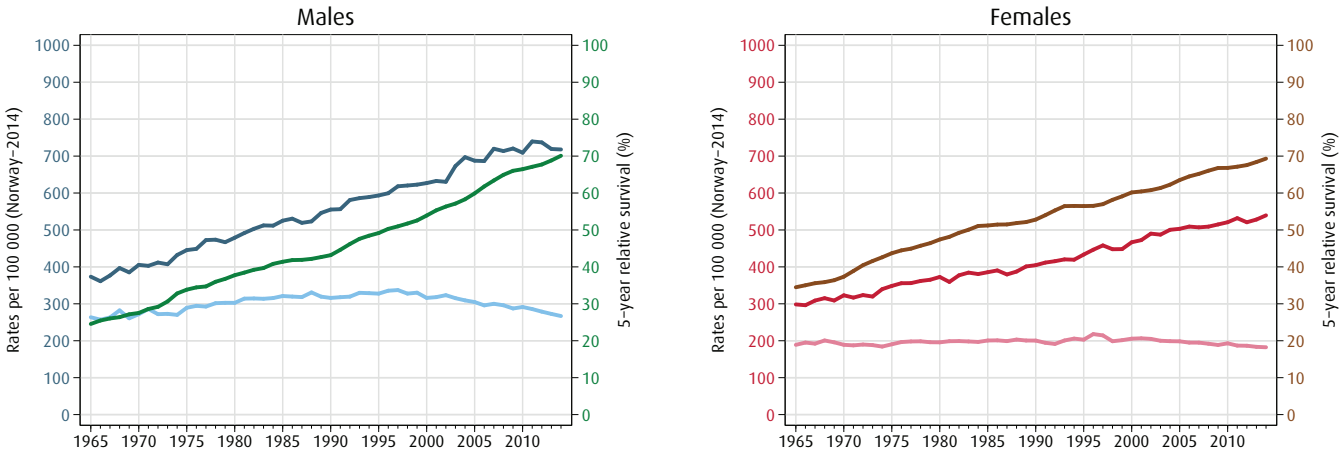


Figure 11-B: Mouth, pharynx (ICD-10 C00–14)

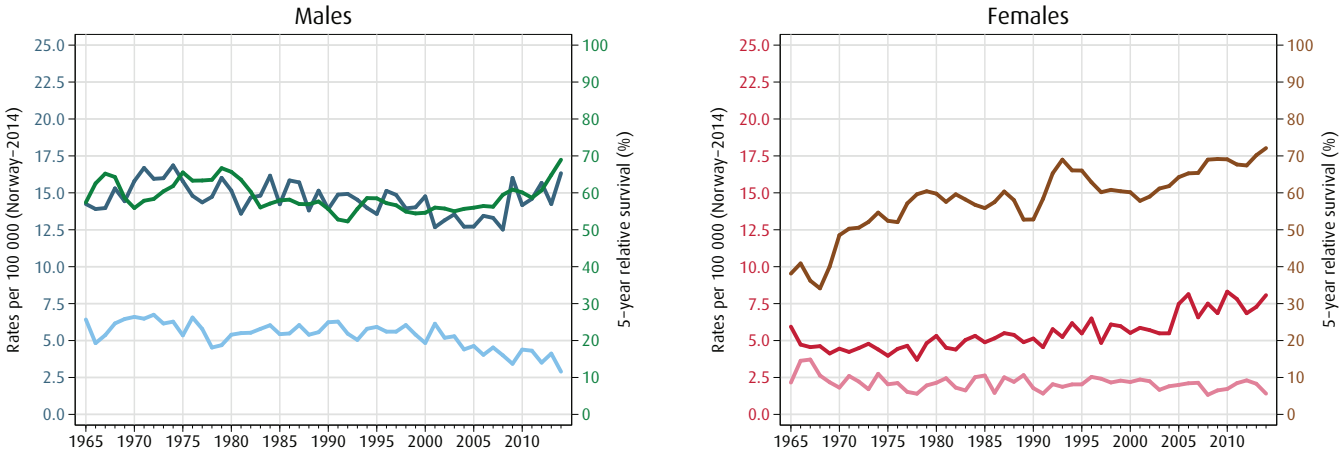


Figure 11-C: Oesophagus (ICD-10 C15)

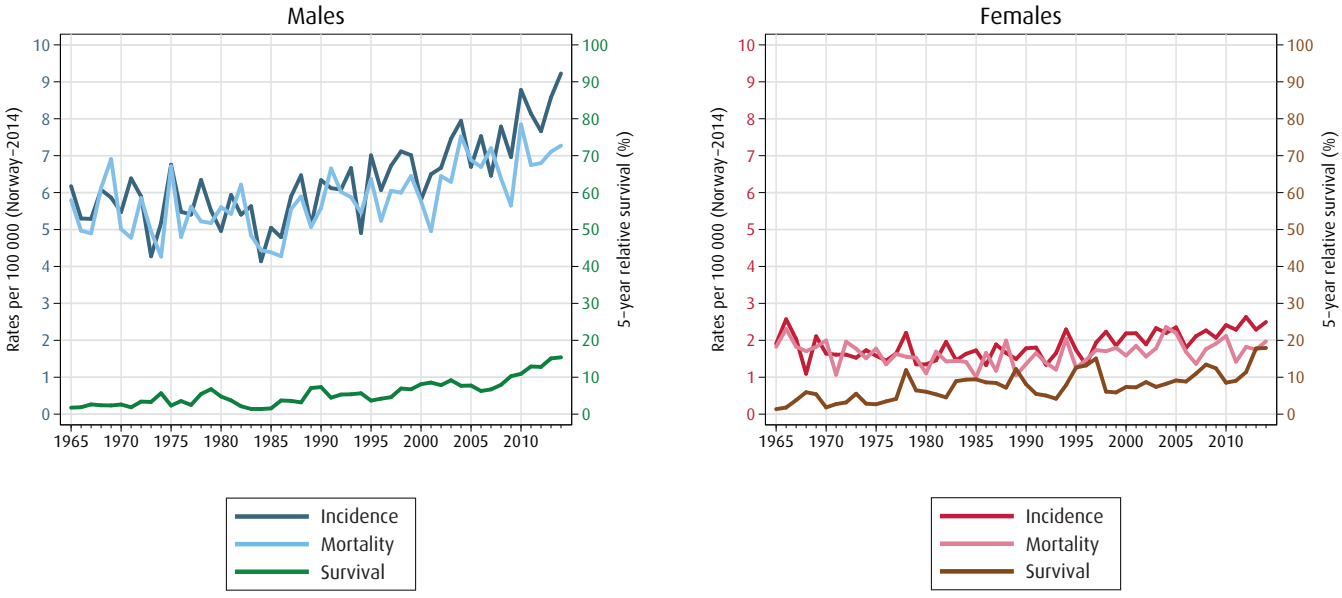


Figure 11. Trends in incidence and mortality rates and 5-year relative survival proportions

Figure 11-D: Stomach (ICD-10 C16)

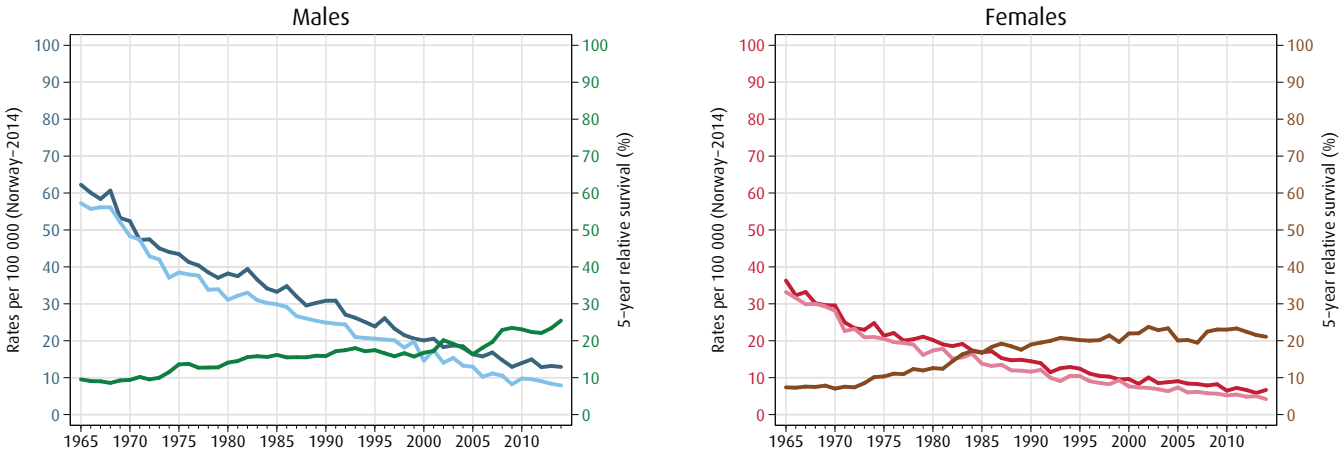


Figure 11-E: Colon (ICD-10 C18)

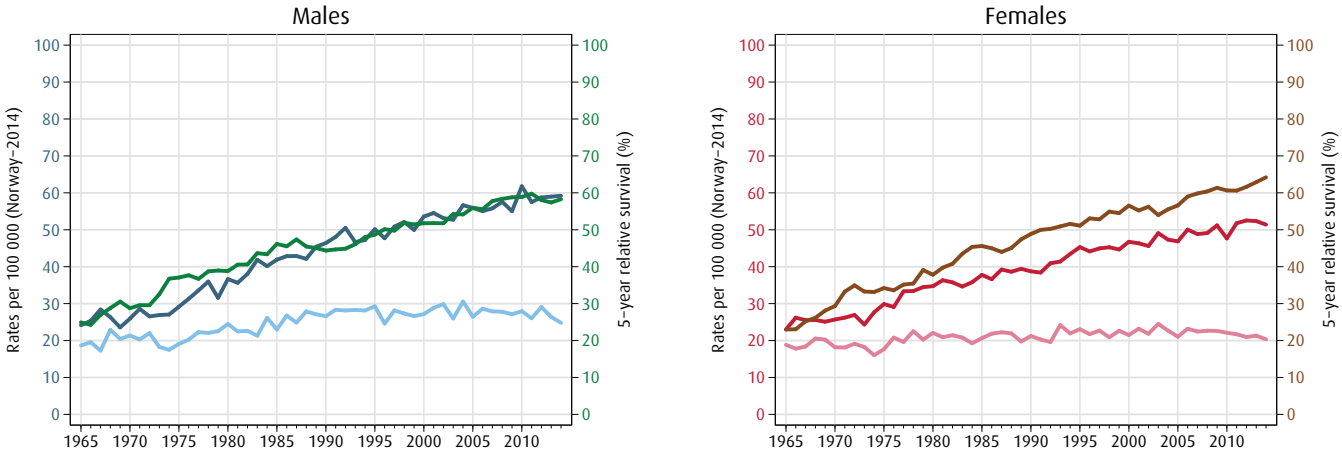


Figure 11-F: Rectum, rectosigmoid (ICD-10 C19–20)

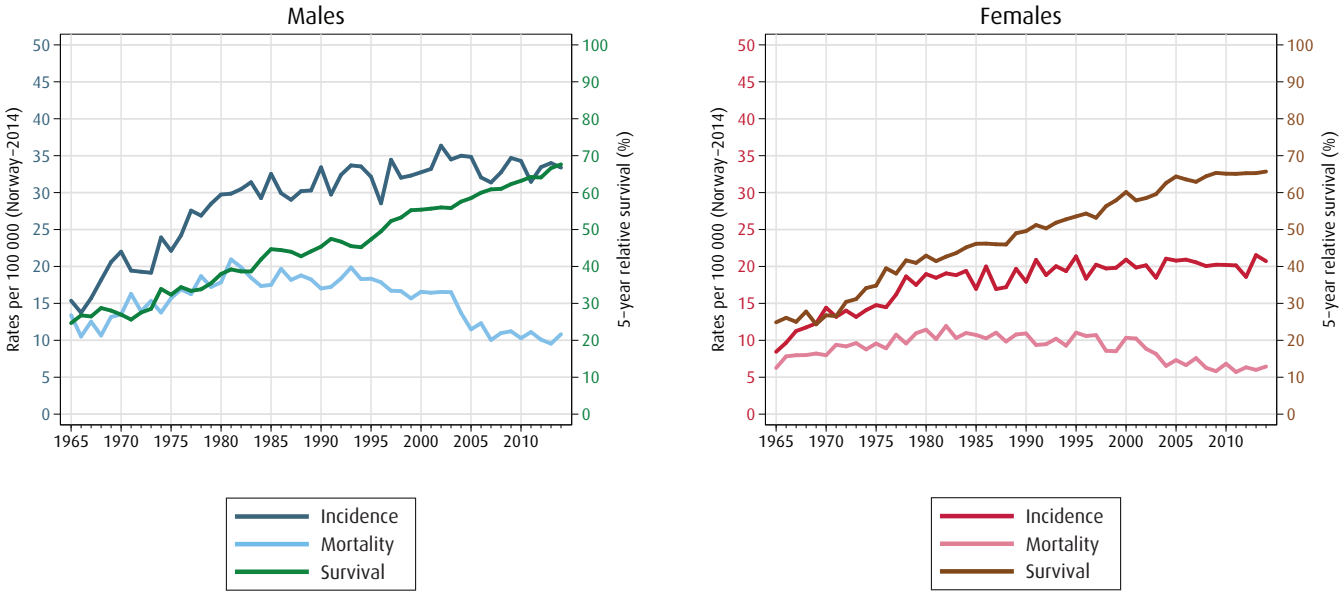


Figure 11. Trends in incidence and mortality rates and 5-year relative survival proportions

Figure 11-G: Liver (ICD-10 C22)

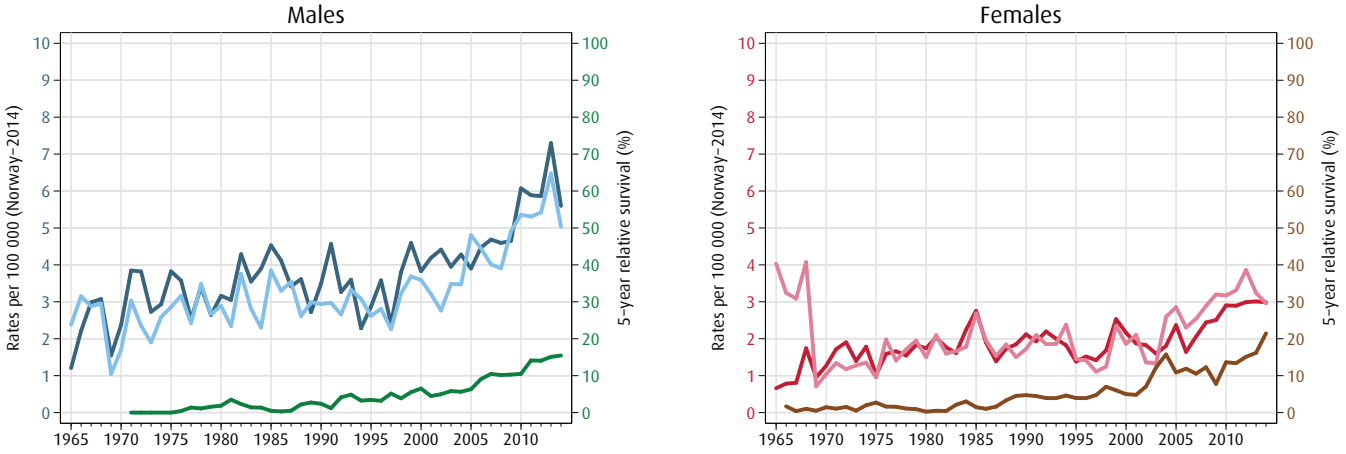


Figure 11-H: Gallbladder, bile ducts (ICD-10 C23–24)

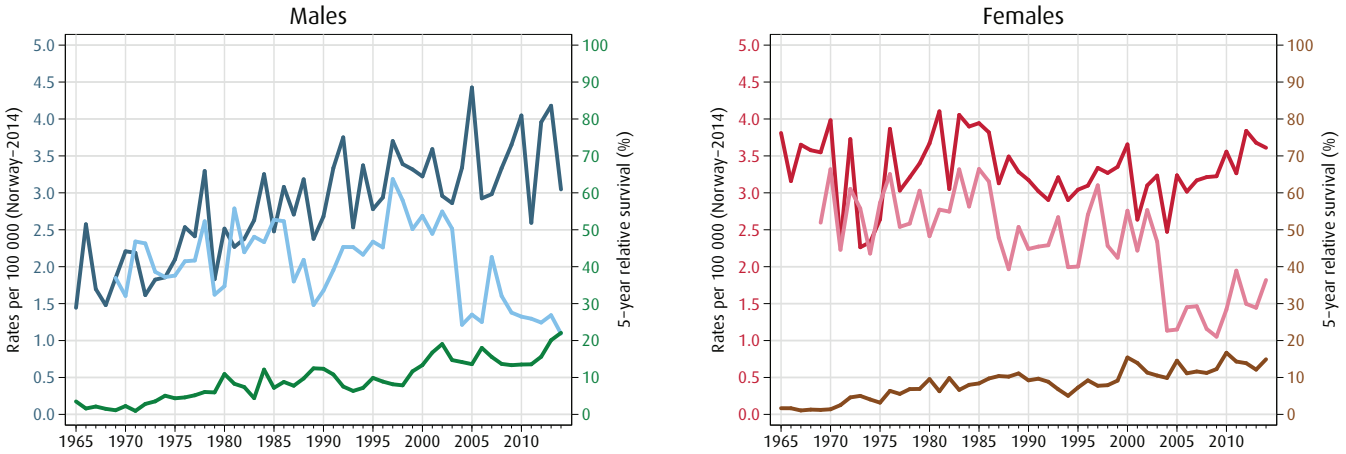


Figure 11-I: Pancreas (ICD-10 C25)

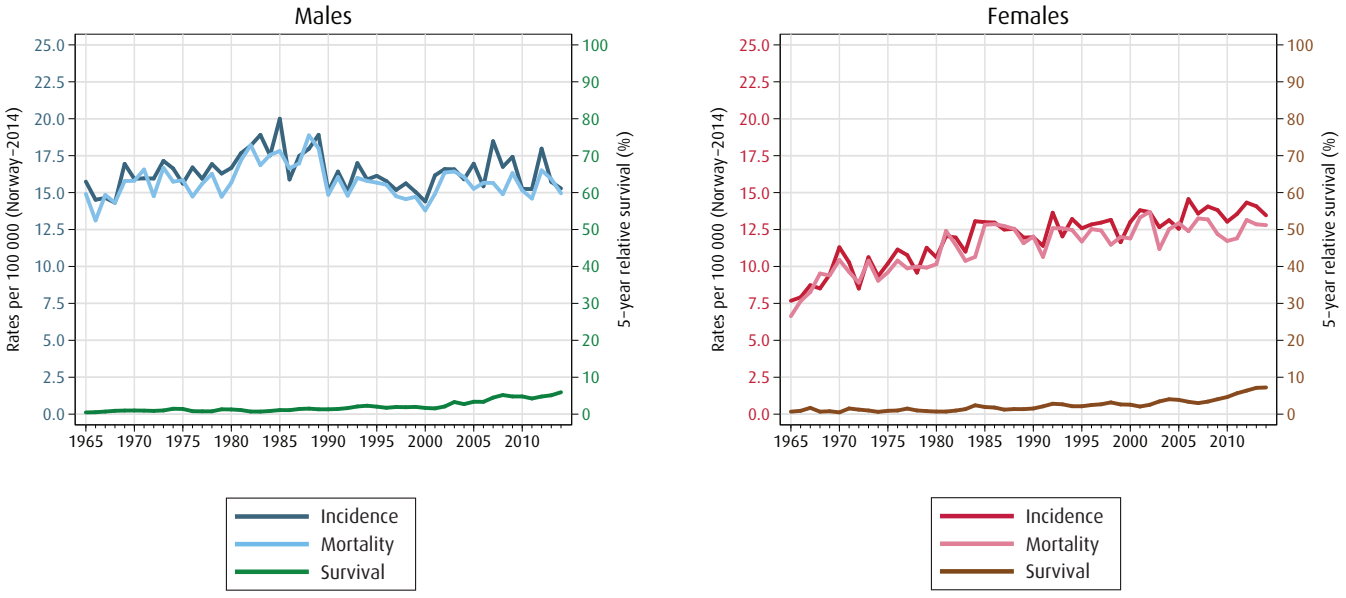


Figure 11. Trends in incidence and mortality rates and 5-year relative survival proportions

Figure 11-J: Lung, trachea (ICD-10 C33–34)

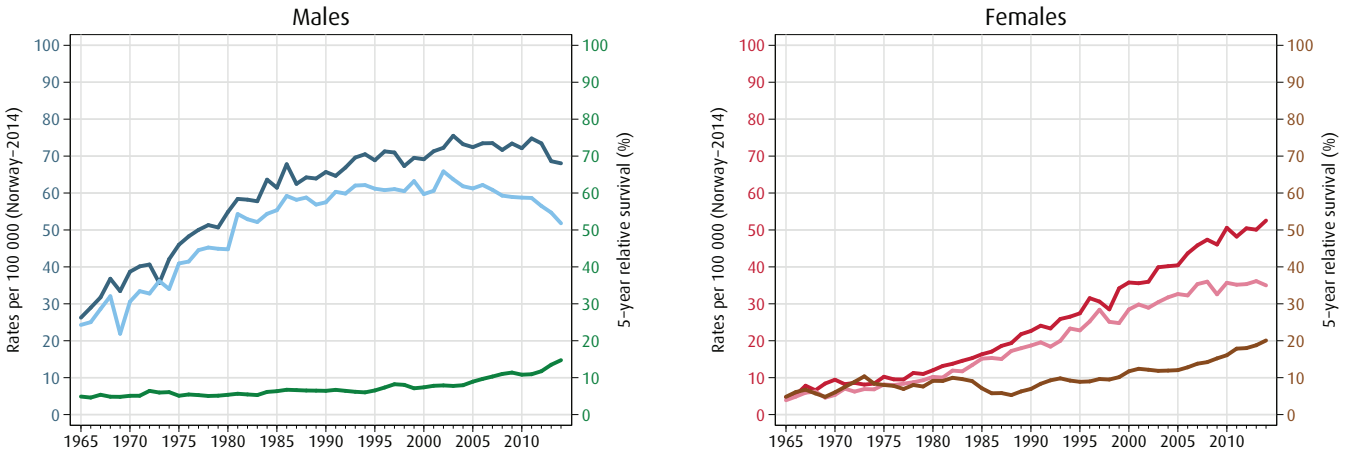


Figure 11-K: Melanoma of the skin (ICD-10 C43)

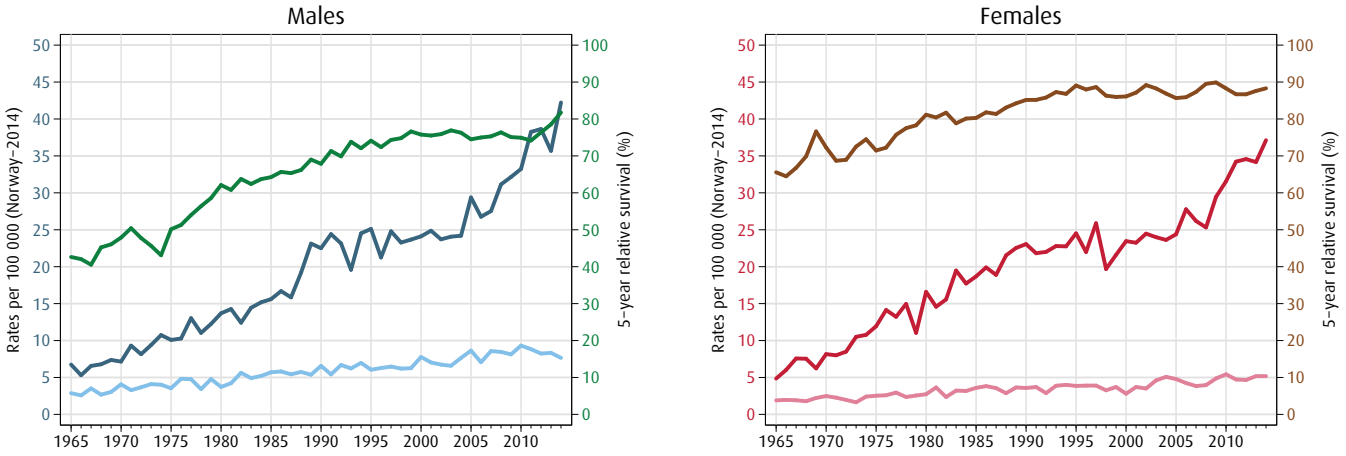


Figure 11-L: Kidney excluding renal pelvis (ICD-10 C64)

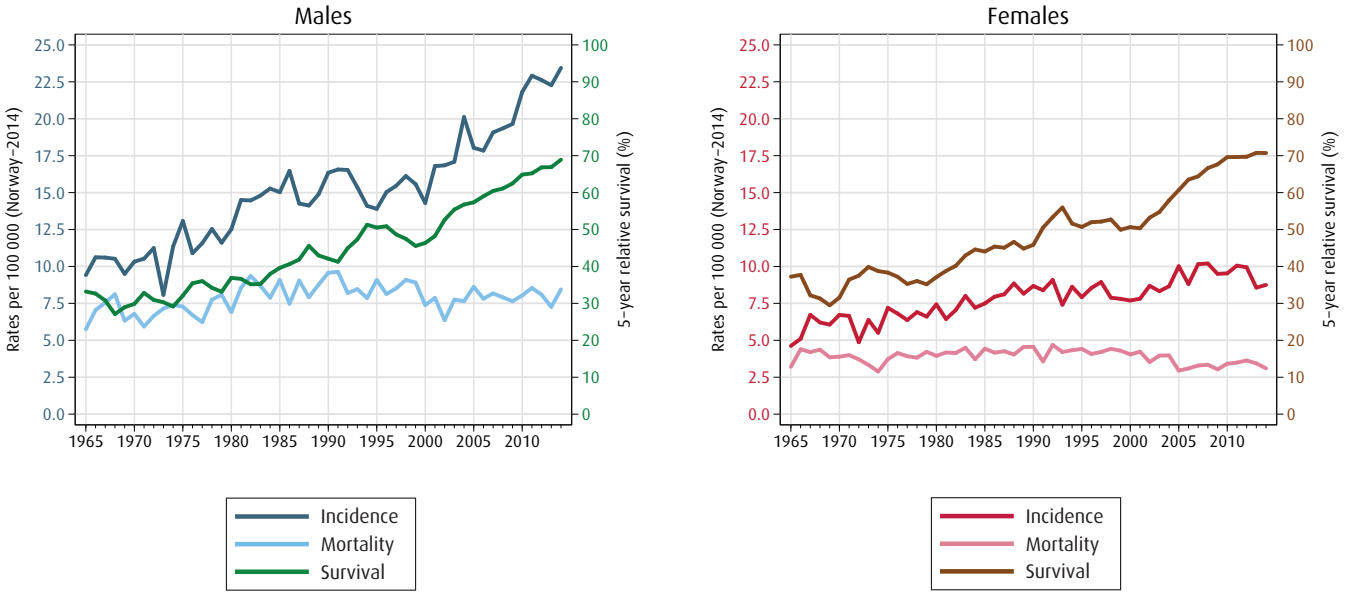


Figure 11. Trends in incidence and mortality rates and 5-year relative survival proportions

Figure 11-M: Breast (ICD-10 C50)

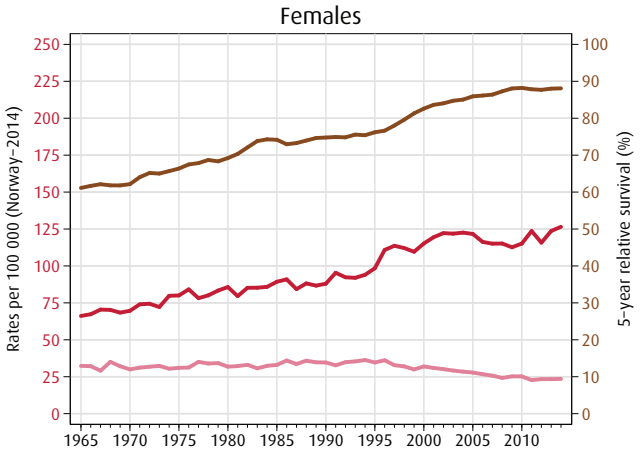


Figure 11-N: Cervix uteri (ICD-10 C53)

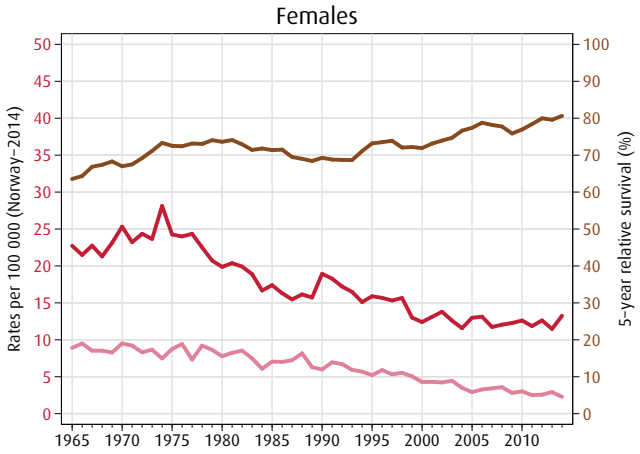


Figure 11-O: Prostate (ICD-10 C61)

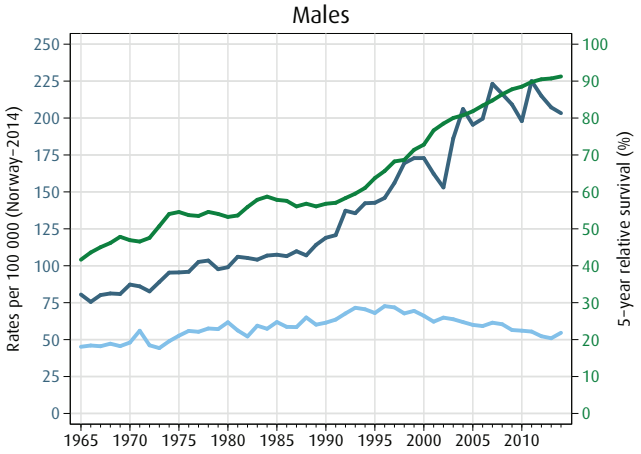


Figure 11-P: Corpus uteri (ICD-10 C54)

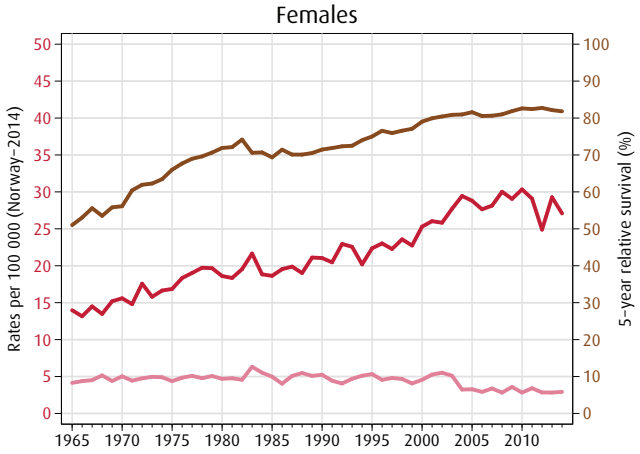


Figure 11-Q: Testis (ICD-10 C62)

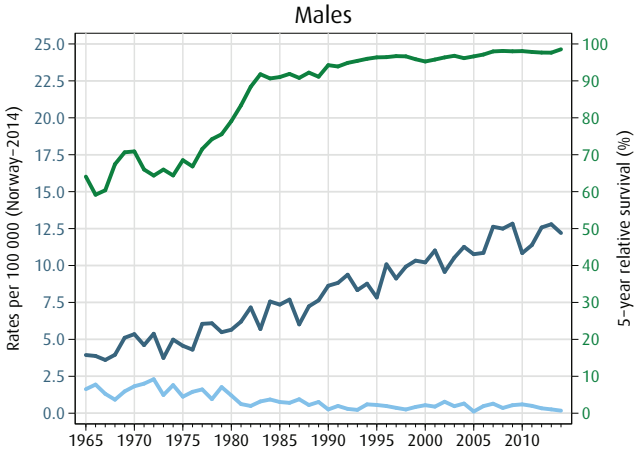
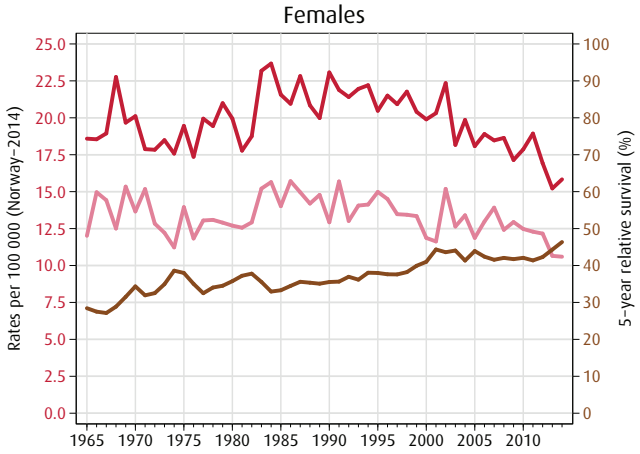


Figure 11-R: Ovary (ICD-10 C56)



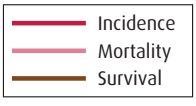


Figure 11. Trends in incidence and mortality rates and 5-year relative survival proportions

Figure 11-S: Bladder, ureter, urethra (ICD-10 C66–68)

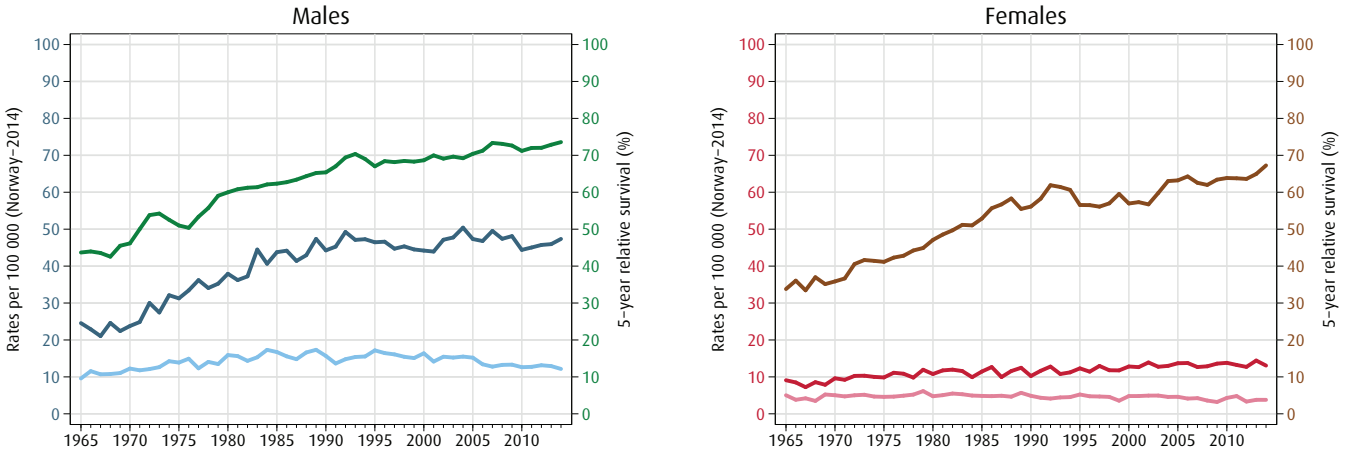


Figure 11-T: Central nervous system (ICD-10 C70–72, D32–33, D42–43)

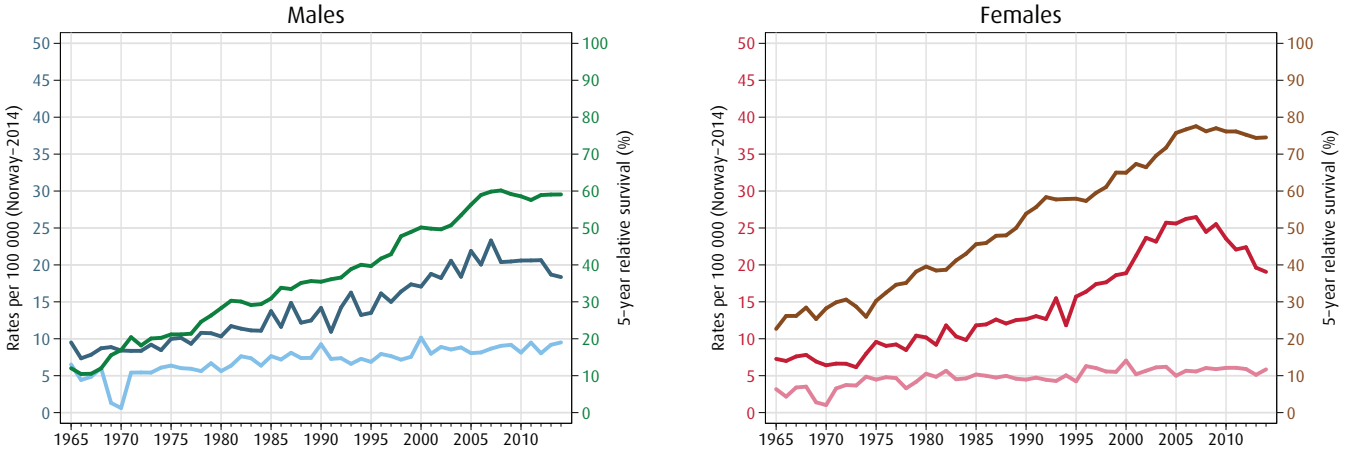


Figure 11-U: Thyroid gland (ICD-10 C73)

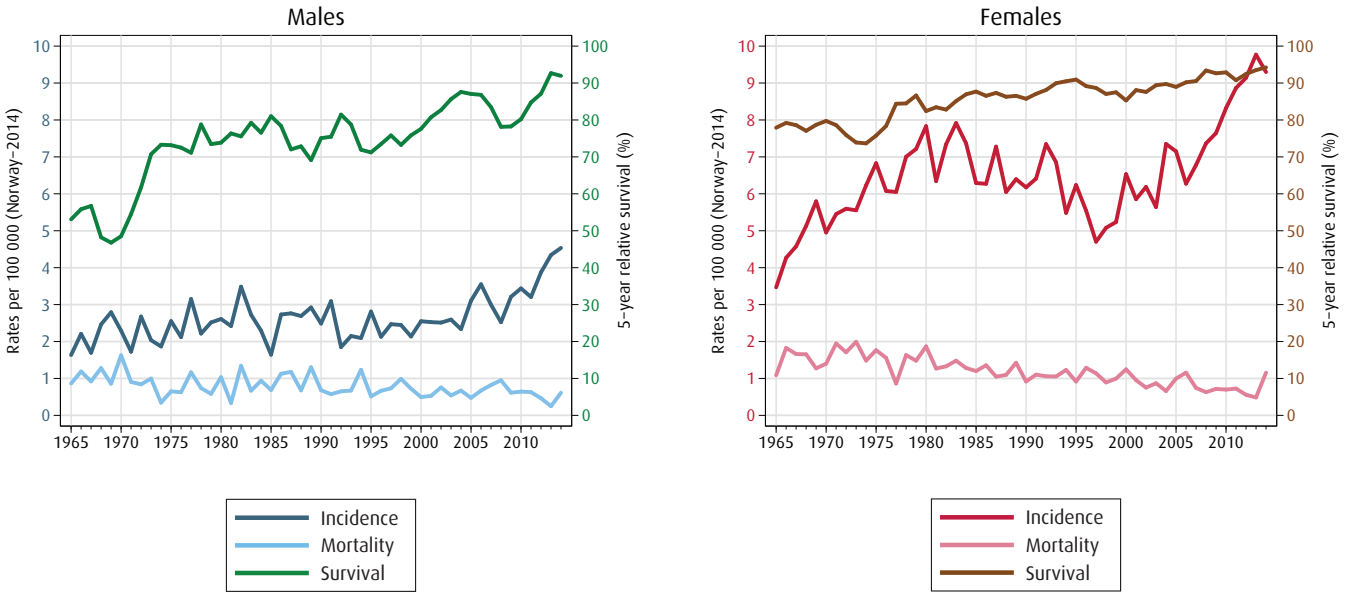


Figure 11. Trends in incidence and mortality rates and 5-year relative survival proportions

Figure 11-V: Hodgkin lymphoma (ICD-10 C81)

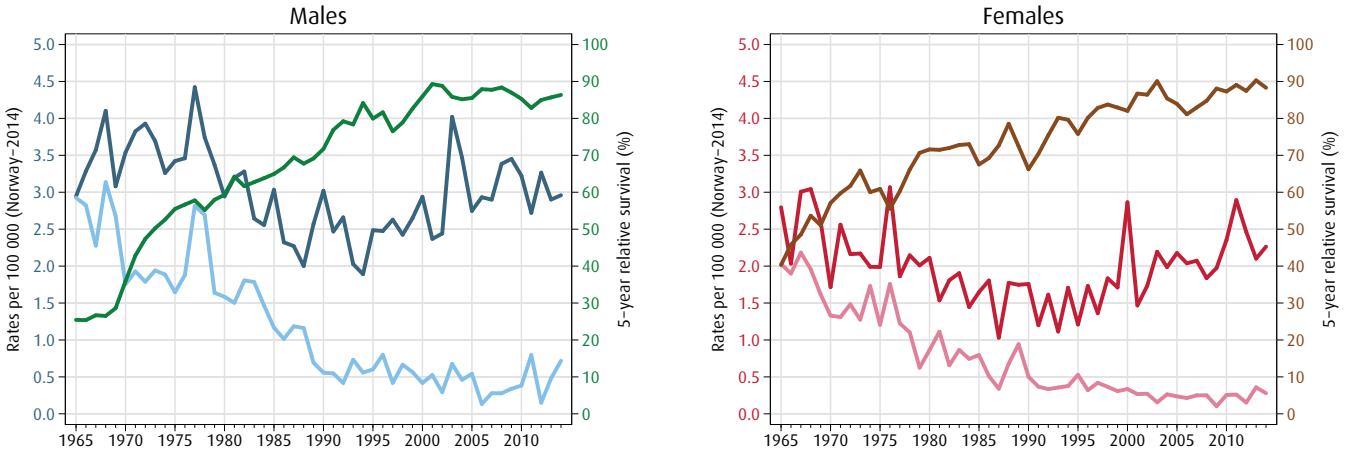


Figure 11-W: Non-Hodgkin lymphoma (ICD-10 C82–86, C96)

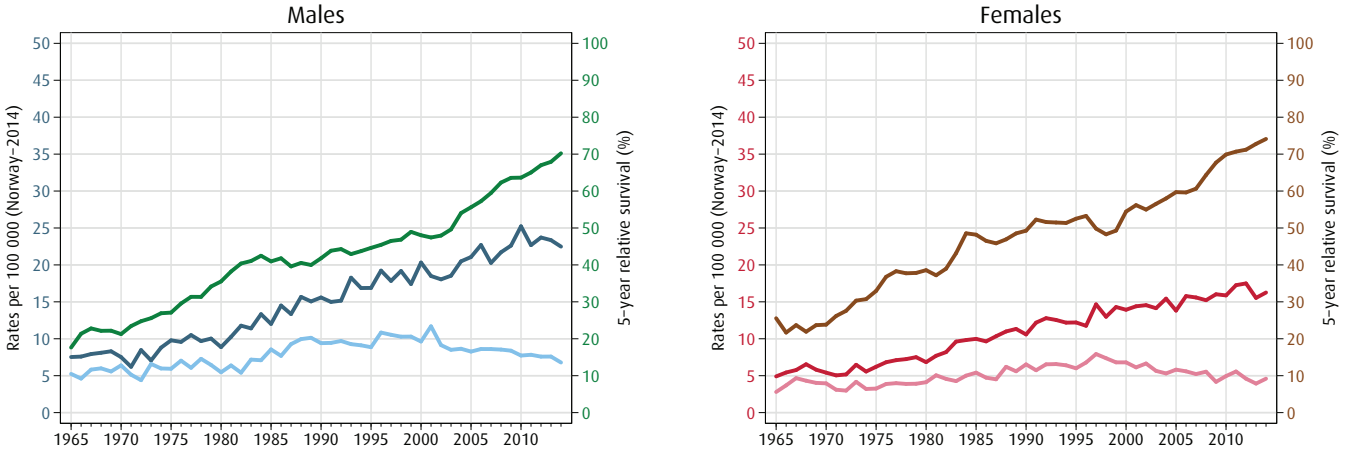
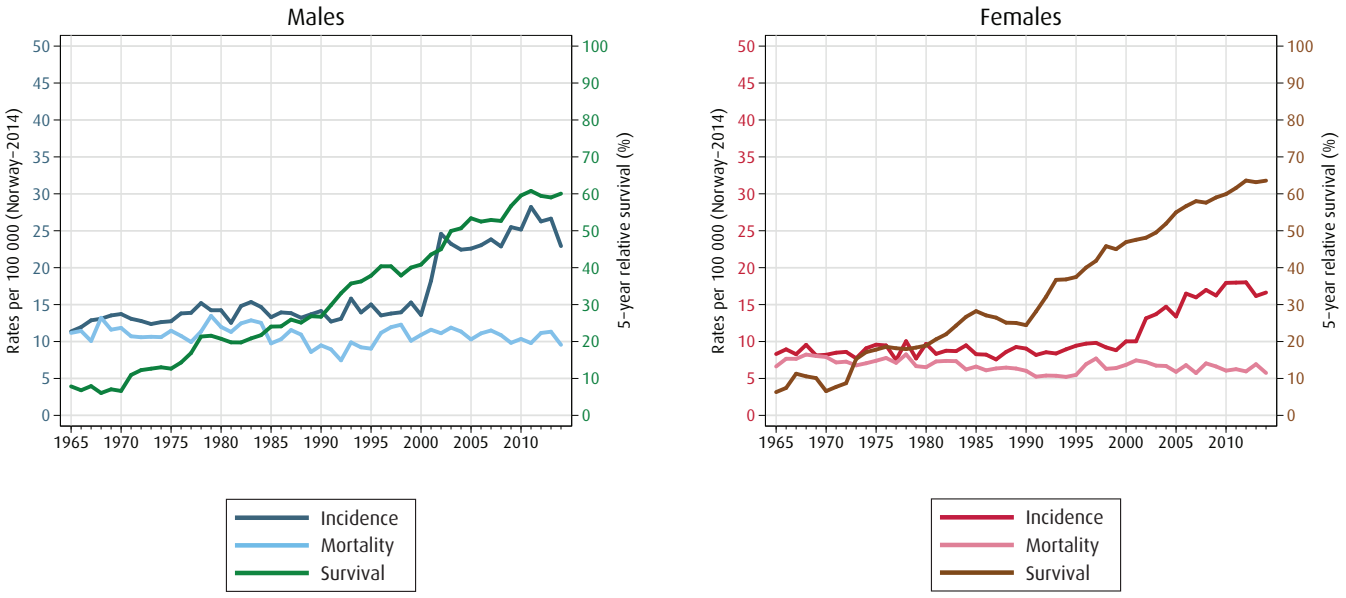


Figure 11-X: Leukaemia (ICD-10 C91–95, D45–47)



References

Alfsen GC, Lyckander LG, Lindboe AW, Svaar H. Kvalitetssikring ved dødsfall i sykehus. Tidskrift Nor Legeforen 2010; 130:476-9. http://dx.doi.org/10.4045/tidsskr.09.0744

Boyle P. Relative value of incidence and mortality data in cancer research. Recent Results Cancer Res 1989; 114:41-63.

Bray F, Parkin DM. Evaluation of data quality in the cancer registry: principles and methods. Part I: comparability, validity and timeliness. Eur J Cancer 2009; 45(5):747-755.

Brenner H, Hakulinen T. Very-long-term survival rates of patients with cancer. J Clin Oncol 2002;20(21):4405-4409. http://dx.doi.org/10.1200/JCO.2002.99.060

Brenner H, Hakulinen T. Maximizing the benefits of model-based period analysis of cancer patient survival. Cancer Epidemiol Biomarkers Prev 2007; 16(8):1675-1681. http://dx.doi.org/10.1158/1055-9965.EPI-06-1046

Coleman MP. Trends in breast cancer incidence, survival, and mortality. Lancet 2000; 356(9229):590-591. http://dx.doi.org/10.1016/S0140-6736(00)02593-9

Day, N. E. Cumulative rate and cumulative risk. In: D. M. Parkin, C. S. Muir, S. L. Whelan et al. (Eds) Cancer Incidence in Five Continents, Volume VI (IARC Scientific Publications No.120). International Agency for Research on Cancer, Lyon, 1992.

Doll R., Payne P., & Waterhouse J. (Eds) Cancer Incidence in Five Continents: A Techical Report. Springer-Verlag (for UICC), table 38. Genève: UICC, 1966: 217 – 9., Berlin, 1966.

Doll R, Peto R. The causes of cancer: quantitative estimates of avoidable risks of cancer in the United States today. J Natl Cancer Inst 1981; 66(6):1191-1308. http://dx.doi.org/10.1093/jnci/67.6.1191

Ederer F, Heise H. Instructions to IBM 650 programmers in processing survival computations. Methodological note no. 10. End Results Evaluation Section, National Cancer Institute, Bethesda, MD; 1959.

Fritz A, Percy C, Jack A, Shanmugaratnam K, Sobin L, Parkin DM, Whelan S. International classification of diseases for oncology: ICD-O. Third Edition.World Health Organization, Geneva, 2000.

Gade FG. Undersøkelser over kræftsygdommene i Norge, paa grundlag av den officielle mortalitetsstatistik 1902–1911 samt det av den norske komité for kræftforskning samlede materiale 1908–1912 [Investigations on cancer diseases in Norway, based on official mortality statistics 1902–1911 and material collected by the Norwegian Committee for cancer research 1908–1911]. Kristiania (Oslo): Dybwad, 1916:p1–102. [In Norwegian] http://archive.org/stream/skrifterutgitavv161chri#page/n5/mode/2up

Hakulinen T. Cancer survival corrected for heterogeneity in patient withdrawal. Biometrics 1982; 38(4):933-942. Hankey BF, Steinhorn SC. Long-term patient survival for some of the more frequently occurring cancers. Cancer 1982; 50(9):1904–1912. http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1097-0142

Hankey BF, Steinhorn SC. Long-term patient survival for some of the more frequently occurring cancers. Cancer 1982; 50:1904–1912. DOI: 10.1002/1097-0142(19821101)50:9<1904::AID-CNCR2820500943>3.0.CO;2-S.

Janssen-Heijnen ML, Houterman S, Lemmens VE, Brenner H, Steyerberg EW, Coebergh JW. Prognosis for long-term survivors of cancer. Ann Oncol 2007; 18(8):1408-1413. http://dx.doi.org/10.1093/annonc/mdm127

Lambert PC. Modelling of the cure fraction in survival studies. The Stata Journal 2007; 7(3):351-375.

Larsen IK, Smastuen M, Johannesen TB, Langmark F, Parkin DM, Bray F, Moller B. Data quality at the Cancer Registry of Norway: an overview of comparability, completeness, validity and timeliness. Eur J Cancer 2009; 45(7):1218-1231. http://dx.doi.org/10.1016/j.ejca.2008.10.037

Last, J. M. A Dictionary of epidemiology, 4th ed. New York, Oxford Uni. Press, 2001.

Muir CS, Fraumeni JF, Jr., Doll R. The interpretation of time trends. Cancer Surv 1994; 19-20:5-21.

Parkin DM, Bray F. Evaluation of data quality in the cancer registry: principles and methods Part II. Completeness. Eur J Cancer 2009; 45(5):756-764. http://dx.doi.org/10.1016/j.ejca.2008.11.033

Percy C, Stanek E, III, Gloeckler L. Accuracy of cancer death certificates and its effect on cancer mortality statistics. Am J Public Health 1981; 71(3):242-250. http://www.ncbi.nlm.nih.gov/pmc/articles/ PMC1619811/

Peto R, Boreham J, Clarke M, Davies C, Beral V. UK and USA breast cancer deaths down 25% in year 2000 at ages 20-69 years. Lancet 2000; 355(9217):1822. http://dx.doi.org/10.1016/S0140-6736(00)02277-7

Rosso S, De Angelis R, Ciccolallo L, Carrani E, Soerjomataram I, Grande E, Zigon G, Brenner H. Multiple tumours in survival estimates. Eur J Cancer 2009; 45(6):1080-1094. http://dx.doi.org/10.1016/j.ejca.2008.11.030

Saxen, E. Trend: Facts or Fallacy. In: Trends in cancer incidence: Causes and Practical Implications. The international Union Against Cancer and The Norwegian Cancer Society, Oslo, 1982.

Segi, M. Cancer mortality for selected sites in 24 countries (1950-1957). Tohoku University of Public Health, Sendai, 1960.

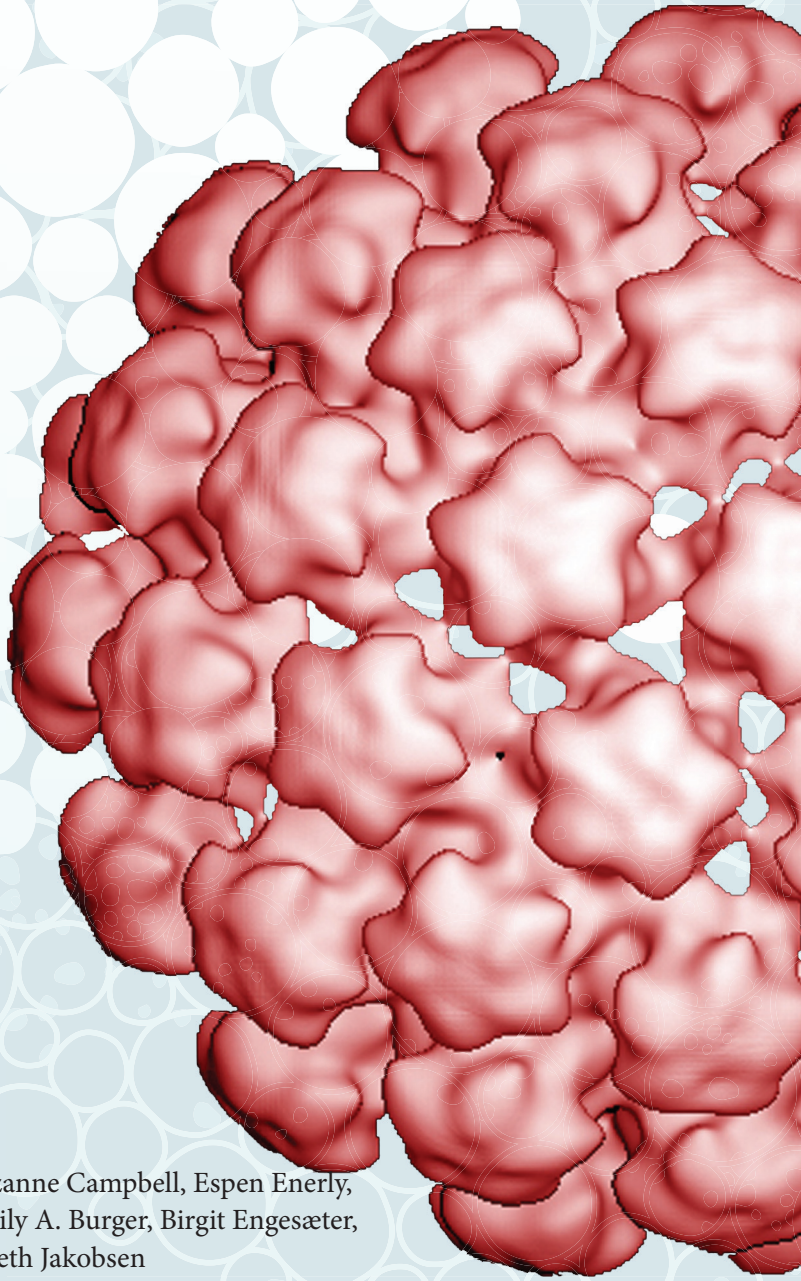
Statistics Norway. www.ssb.no. Accessed date: October 27th 2015.

Tønnessen MS, Syse A, Aase, KN. Befolkningsframskrivinger 2014-2100: Hovedresultater. In: Økonomiske analyser 4/2014. Oslo: Statistisk sentralbyrå; 2014. p. 30-7.

Catch-**HPV**

Hva vet vi om HPV-relatert kreft i Norge og hva kan vi gjøre med det?

What is known about HPV-related cancers in Norway and how to act?



Special issue: Catch-HPV

Redaktør/Editor:
Mari Nygård

Skrivegruppe/Writing group:
Mari Nygård, Philip E. Castle, Bo Terning Hansen, Suzanne Campbell, Espen Enerly, Christian Munk, Madleen Orumaa, Susanne Kjær, Emily A. Burger, Birgit Engesæter, Stefan Lönnberg, Sagar Sen, Tomas Ruiz Lopez, Elisabeth Jakobsen

Oppsett og design/Layout and design:
Gunther Zerener

Image: Computerized reconstructions of HPV L1 capsids
By courtesy Dr. Benes Trus, NIH, Bethesda, MD USA, Buck et al, J Virology (2008)

HPV= humant papillomavirus

Forord

Kunnskap om rollen humant papillomavirus (HPV) spiller i utviklingen av alvorlige og mindre alvorlige sykdommer er i ferd å føre til et paradigmeskifte innen kreftforebygging. Kreft forårsaket av HPV kan unngås etter at forskningen de siste årene har kommet fram til effektive vaksiner mot HPV, i tillegg til teknologiske løsninger som gir oss mulighet til å oppdage viruset i en tidlig fase av sykdomsutviklingen. Sammenliknet med andre kreftformer, er "verktøykassen" vi har mot HPV-relaterte sykdommer variert og effektiv. Dette er positivt, siden sykdomsbyrden som HPV-smitte fører med seg, målt både i antall nye pasienter og i tapte leveår, er betydelig og øker i Norge.

Forståelsen om HPV, de helsemessige effektene virusene forårsaker, HPV-vaksiner og screening er sammensatt. I denne utgaven av spesialnummer har vi samlet sentral og aktuell kunnskap rundt HPV-relaterte sykdommer, og vi har beskrevet mulige forebyggingsscenarier. Tittelen "Catch-HPV" ble valgt for å understreke behovet for inngående forståelse rundt beslutninger om HPV-testing i screening mot livmorhalskreft, samt HPV-vaksinering av jenter (og gutter). Målet er å presentere et faktagrunnlag for alle som ønsker å bidra til debatt om kreftforebygging, og som er nyttig både for den enkelte og for samfunnet.

I 2008 opprettet Kreftregisteret en gruppe som skal jobbe målrettet med problemstillinger relatert til HPV. Gruppen, som i starten besto av 2–3 personer, har blitt betraktelig større og har flere nasjonale og internasjonale samarbeidspartnere. Jeg takker medarbeiderene Sophie Berger, Kristina Schee, Ragnhild Flingtorp, Paul Anthony Frontéri, Madleen Orumaa, Kristina Stormo Gjøtterud, Suzanne Campbell, Soheil Mashayekhi, Maarit Leinonen, Tomas Ruiz Lopez, Bo Terning Hansen og Espen Enerly for innsats og entusiasme.

Catch-HPV!

Mari Nygård.

dr.med Mari Nygård, overlege

Leder, gruppe for HPV-basert epidemiologisk forskning

Kreftregisteret har mottatt forskningsmidler fra MSD Norge til HPV-vaksineprosjekter. Kreftforeningen har bidratt med midler til forskning på bruk av HPV-test i screeningen, og Nordic Center of Excellence in Health Related eScience har bidratt med forskningsmidler til forskning på spillifisering av kunnskapen om HPV.

Cervical Cancer Prevention in 21st Century in Norway

Philip E. Castle, PhD, MPH[1,2]
[1]Department of Epidemiology and Population Health, Albert Einstein College of Medicine, Bronx, NY, USA
[2]Global Coalition Against Cervical Cancer, Arlington, VA, USA

Background: Natural History of HPV and Cervical Cancer

Since the discovery of human papillomavirus (HPV) in cervical cancer tissue by Harald Zur Hausen (2008 Nobel Laureate in Medicine) and colleagues more than 30 years ago [1], there have been rapid advances in our understanding of cervical cancer and its cause. We now know that persistent cervical infections by certain types of HPV, designated as high-risk, carcinogenic, or cancer-associated, cause virtually all cervical cancer everywhere in the world [2]. HPV meets all Hill's criteria for causation for cervical cancer [3]: Strength, Consistency, Specificity, Temporality, Biological Gradient, Plausibility, Coherence, Experiment, and Analogy.

The natural history of HPV and cervical carcinogenesis now can be represented by a simple, causal schema composed of four, reliably measured stages: 1) HPV acquisition, 2) HPV persistence (vs. clearance), 3) progression to cervical precancer, and 4) invasion [2]. This model replaces the older morphological, step-wise or lock-and-key model of normal, CIN1, CIN2, CIN3, and cancer. HPV infection is very common, perhaps universal, among sexually active populations. However, on a per event basis HPV infection is an uncommon cause of cancer. Most (~90%) HPV infections are benign and are cleared or controlled within two years; although there is now evidence that some infections may become quiescent (latent) or undetectable [4], the fraction of HPV infections that become latent is unknown. However, the clinical importance of their re-emergence in peri- and post-menopausal women for causing cervical cancer is uncertain. It is possible that these remerging infections are less likely to cause cancer due the absences of hormones thought to contribute to the carcinogenic process [5].

Thus, a key step in cervical carcinogenesis is overt, measurable high-risk HPV (hrHPV) persistence. After a year or two, HPV persistence strongly predicts the development of cervical precancer, surrogates of which are histopathologic diagnoses of cervical intraepithelial neoplasia grade 3 (CIN3) or adenocarcinoma in situ (AIS) [6–7]. Biologically, productive HPV infections, those that make more virus, can sometimes become transforming but the exact mechanism(s) by which that occurs is not well understood. Epidemiologically, the longer an infection persists, the greater the risk for development of precancerous cellular changes in the epithelium. At some unknown average duration, HPV persistence probably becomes synonymous with CIN3/AIS although it may go undetected and may even regress.

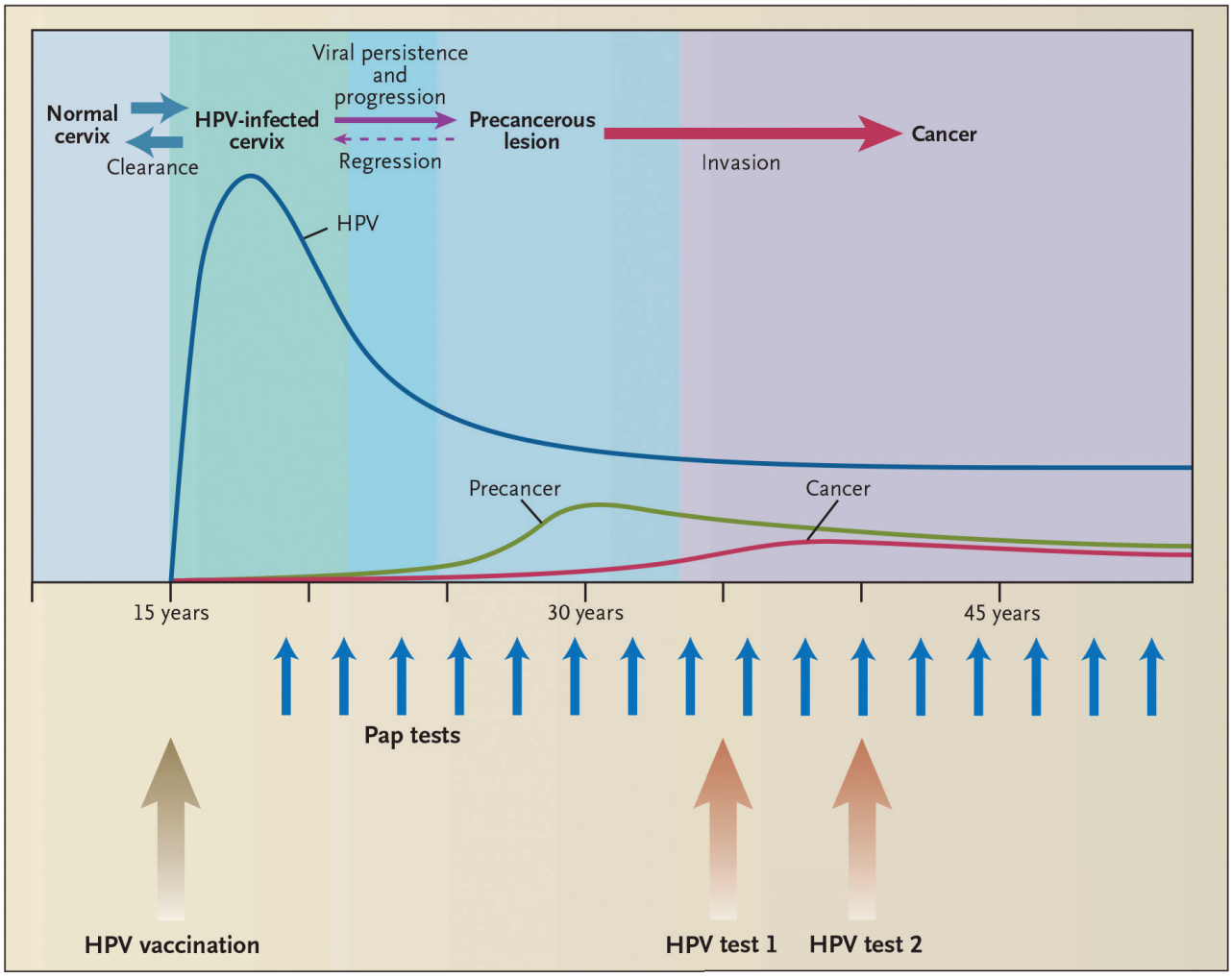
The transition between the precancer and microinvasive cancer is imperfectly understood because of the imperfect sensitivity of colposcopy and biopsy to detect it. There are also errors in the pathological diagnosis of cervical precancer. These errors are probably most common for the earliest and smallest CIN3/AIS lesions with low malignant potential that must arise from the persisting infection [8]. If a small CIN3/AIS is undetected and/or untreated, it likely enlarges laterally and accumulate somatic genetic changes until finally it is truly precancerous i.e., it will at some time become invasive if not treated beforehand. For example, untreated CIN3/AIS lesions in older women (median age 38 years) - about 15 years after the earliest, smallest precancerous lesions can be found in the population by screening - have about a 30% risk of becoming invasive over the next 30 years [9–10]. Persistent CIN3/AIS in this same population had a 50% risk of becoming invasive cancer. The carcinogenic process for cancer to develop from incident HPV infection on average takes time - approximately 5-10 years at a minimum and 20-25 years on average. A recent statistical modelling analysis [11] estimated that the progression time from CIN2/3 to invasive cervical cancer was 23.5 years, an estimate that may have been affected by the inclusion of CIN2, which is known to be an equivocal diagnosis of precancer and may reflect diagnostic error in distinguishing between CIN1 and CIN3 [12], resulting in a longer time interval.

HPV also causes a significant number and proportion of vulvar, vaginal, anal, penile, and oropharyngeal cancers [13]. Approximately 5.2% of the human burden of cancer is caused by HPV [13]. HPV16 is the most important HPV genotype, responsible for

60% of cervical cancer [14]. HPV18 is the next most important HPV genotype, responsible for 10% of cervical cancer, including 30% of adenocarcinoma of the cervix [14], which is on the rise in Western Countries [15–16]. A greater proportion of HPV-related cancers at other anatomic sites are caused by HPV16 such that HPV16 alone is responsible for 3.0-3.5% of all cancer globally. Together, HPV16 and HPV18 account for approximately 70% of cervical cancer [14]. The same 12-15 HPV types cause 95%-99% of cervical cancer on all continents everywhere in the world [14]. Thus, the first important corollary of these findings is that HPV does not discriminate by race or ethnicity in causing cancer. In fact, there is no evidence of a significant genetic predisposition for cervical cancer. Thus, the two main causes of cervical cancer are persistent cervical infections by hrHPV genotypes AND a lack of access to preventive services.

Targeting HPV

The discovery of hrHPV as the necessary cause of cervical cancer has led to revolutionary advances in cervical cancer prevention by targeting its cause. These include 1) the development of prophylactic vaccines for primary prevention and 2) sensitive molecular hrHPV testing for cervical cancer screening (with diagnosis and treatment of precursor lesions) for secondary prevention (Figure 1). HPV vaccination and testing are highly efficacious (≥90%) for preventing infection and detection of cervical precancer and early cancer. If used in an age-optimized manner that takes into account the natural history of HPV and cervical cancer, both interventions can be highly effective and cost-effective. A second important corollary (of the findings above) is that the HPV-targeted interventions likely will work equally well everywhere in the world.



The Natural History of HPV Infection and Cervical Cancer.

The peak prevalence of transient infections with carcinogenic types of HPV (blue line) occurs among women during their teens and 20s, after the initiation of sexual activity. The peak prevalence of cervical precancerous conditions occurs approximately 10 years later (green line) and the peak prevalence of invasive cancers at 40 to 50 years of age (red line). (The peaks of the curves are not drawn to scale.) The conventional model of cervical-cancer prevention is based on repeated rounds of cytologic examination, including Papanicolaou smears, and colposcopy (small blue arrows). Alternative strategies include HPV vaccination of adolescents (large beige arrow), one or two rounds of HPV screening at the peak ages of treatable precancerous conditions and early cancer (large reddish-brown arrows), or both.

Figure 1. From The New England Journal of Medicine. Schiffman M, Castle PE. The promise of global cervical-cancer prevention.

Advances in HPV and Cervical Cancer Prevention in Norway

These are exciting times for cervical cancer prevention in Norway as the implementation of both of these technologies are underway. Following clinical trials for prophylactic HPV vaccination that included Norway as one of the participating countries, prophylactic HPV vaccination was introduced in 2009 and now approximately 80% of adolescent females age 12 years get vaccinated every year. In 2015, a large demonstration/implementation project to evaluate a switch from three-yearly Pap testing to five-yearly HPV testing was launched in four counties in Norway.

In the near future, adult women will be screened less often for the same cervical cancer prevention benefits and younger adult women will be less likely to have abnormal Paps, need colposcopy, and receive treatment. Over the next 20 years, HPV-related cancers will become less common, cervical cancer will be classified as a rare cancer, and adult women will need even fewer screens in their lifetime. If Norway introduces the next generation HPV vaccine [17], which is predicted to reduce cervical cancer by 90% (vs. ~70% reduction in cervical cancer achieved by best cervical cancer screening programs), cervical cancer screening may become obsolete or at most an once-in-a-lifetime event.

This Special Issue of Cancer in Norway

In this Special Issue of Cancer in Norway, these and other advances in HPV and cervical cancer prevention are discussed by some of the leading HPV researchers in Norway as well as the world. Dr. Bo Terning Hansen discusses the historical trends and current burden of HPV-related cancers. Dr. Espen Enerly presents the current evidence from clinical trials on the efficacy of first[18–20] and second generation [17] HPV vaccines. Drs. Mari Nygård and Suzanne Krüger Kjær (from the Danish Cancer Society) discuss the observed early impact on HPV-related outcomes and the adverse events following the introduction of HPV vaccination into the general population [21]. Dr. Emily Burger discusses the cost-effectiveness, or the value proposition, of introducing HPV vaccination despite the already relatively low incidence of cervical cancer in Norway. Dr. Birgit Engesæter discusses the rationale and the roll-out of HPV testing-based cervical cancer screening. Finally, Dr. Sagar Sen presents new strategies for increasing the knowledge of HPV in the general population, with the eventual goal of increasing awareness and participation in cervical cancer prevention programs and reducing the unnecessary and unfortunate stigma that can be associated with HPV infection and related diseases.

It is with great admiration and envy that I observe the roll-out of these programs for cervical cancer prevention and control in Norway. In the U.S., younger women are under-vaccinated [22] and older women are over-screened [23–24], leading to missed opportunities for prevention and excessive expenditures, respectively, and resulting in an overall inefficient and cost-inefficient program. As a collaborator with the Cancer Registry of Norway, I look forward to learning from my Norwegian colleagues on how to provide better cervical cancer prevention and control services to women living in the U.S. populations.

Dr. Castle has received commercial HPV tests for research at a reduced or no cost from Roche, Qiagen, Norchip, Arbor Vita Corporation, BD, and mtm. He has been compensated financially as a member of a Merck Data and Safety Monitoring Board for HPV vaccines. Dr. Castle has been a paid as consultant for BD, Gen-Probe/Hologic, Roche, Cepheid, ClearPath, Guided Therapeutics, Teva Pharmaceutics, Genticel, Inovio, and GE Healthcare. Dr. Castle has received honoraria as a speaker for Roche and Cepheid.

References

1. Durst M, Gissmann L, Ikenberg H, zur HH. A papillomavirus DNA from a cervical carcinoma and its prevalence in cancer biopsy samples from different geographic regions. Proc Natl Acad Sci U S A 1983;80:3812-3815.

2. Schiffman M, Castle PE, Jeronimo J, Rodriguez AC, Wacholder S. Human papillomavirus and cervical cancer. Lancet 2007;370:890-907.

3. Hill ab. The environment and disease: association or causation? Proc R Soc Med 1965;58:295-300:295-300.

4. Rositch AF, Burke AE, Viscidi RP, Silver MI, Chang K, Gravitt PE. Contributions of recent and past sexual partnerships on incident human papillomavirus detection: acquisition and reactivation in older women. Cancer Res 2012;72:6183-6190.

5. Plummer M, Peto J, Franceschi S. Time since first sexual intercourse and the risk of cervical cancer. Int J Cancer 2012;130:2638-2644.

6. Castle PE, Rodriguez AC, Burk RD et al. Short term persistence of human papillomavirus and risk of cervical precancer and cancer: population based cohort study. BMJ 2009;339:b2569.

7. Kjaer SK, Frederiksen K, Munk C, Iftner T. Long-term absolute risk of cervical intraepithelial neoplasia grade 3 or worse following human papillomavirus infection: role of persistence. J Natl Cancer Inst 2010;102:1478-1488.

8. Schiffman M, Rodriguez AC. Heterogeneity in CIN3 diagnosis. Lancet Oncol 2008;9:404-406.

9. McCredie MR, Sharples KJ, Paul C et al. Natural history of cervical neoplasia and risk of invasive cancer in women with cervical intraepithelial neoplasia 3: a retrospective cohort study. Lancet Oncol 2008;9:425-434.

10. Cervical Cancer Inquiry. N Z Nurs Forum 1988;16:5-6.

11. Vink MA, Bogaards JA, van Kemenade FJ, de Melker HE, Meijer CJ, Berkhof J. Clinical progression of high-grade cervical intraepithelial neoplasia: estimating the time to preclinical cervical cancer from doubly censored national registry data. Am J Epidemiol 2013;178:1161-1169.

12. Darragh TM, Colgan TJ, Cox JT et al. The Lower Anogenital Squamous Terminology Standardization Project for HPV-Associated Lesions: background and consensus recommendations from the College of American Pathologists and the American Society for Colposcopy and Cervical Pathology. J Low Genit Tract Dis 2012;16:205-242.

13. Forman D, de MC, Lacey CJ et al. Global burden of human papillomavirus and related diseases. Vaccine 2012;30 Suppl 5:F12-23.

14. de SS, Quint WG, Alemany L et al. Human papillomavirus genotype attribution in invasive cervical cancer: a retrospective cross-sectional worldwide study. Lancet Oncol 2010;11:1048-1056.

15. Bray F, Carstensen B, Moller H et al. Incidence trends of adenocarcinoma of the cervix in 13 European countries. Cancer Epidemiol Biomarkers Prev 2005;14:2191-2199.

16. Adegoke O, Kulasingam S, Virnig B. Cervical cancer trends in the United States: a 35-year population-based analysis. J Womens Health (Larchmt) 2012;21:1031-1037.

17. Joura EA, Giuliano AR, Iversen OE et al. A 9-valent HPV vaccine against infection and intraepithelial neoplasia in women. N Engl J Med 2015;372:711-723.

18. Garland SM, Hernandez-Avila M, Wheeler CM et al. Quadrivalent vaccine against human papillomavirus to prevent anogenital diseases. N Engl J Med 2007;356:1928-1943.

19. Quadrivalent vaccine against human papillomavirus to prevent high-grade cervical lesions. N Engl J Med 2007;356:1915-1927.

20. Paavonen J, Naud P, Salmeron J et al. Efficacy of human papillomavirus (HPV)-16/18 AS04-adjuvanted vaccine against cervical infection and precancer caused by oncogenic HPV types (PATRICIA): final analysis of a double-blind, randomised study in young women. Lancet 2009;374:301-314.

21. Baldur-Felskov B, Dehlendorff C, Munk C, Kjaer SK. Early impact of human papillomavirus vaccination on cervical neoplasia--nationwide follow-up of young Danish women. J Natl Cancer Inst 2014;106:djt460.

22. Reagan-Steiner S, Yankey D, Jeyarajah J, Elam-Evans LD, Singleton JA, Curtis CR, MacNeil J, Markowitz LE, Stokley S. 2015. National, Regional, State, and Selected Local Area Vaccination Coverage Among Adolescents Aged 13-17 Years--United States, 2014. MMWR Morb Mortal Wkly Rep 64:784-792.

23. Kim JJ, Campos NG, Sy S, Burger EA, Cuzick J, Castle PE, Hunt WC, Waxman A, Wheeler CM, New Mexico HPVPRSC. 2015. Inefficiencies and High-Value Improvements in U.S. Cervical Cancer Screening Practice: A Cost-Effectiveness Analysis. Ann Intern Med 163:589-597.

24. Habbema D, De Kok IM, Brown ML. 2012. Cervical cancer screening in the United States and the Netherlands: a tale of two countries. Milbank Q 90:5-37.

HPV-relatert kreft i Norge

Bo Terning Hansen, PhD[1], Suzanne Campbell[1], Mari Nygård, MD, PhD[1]
[1]Forskningsavdelingen, Kreftregisteret

Humant papillomavirus (HPV) kan forårsake kreft i flere organer i underlivet og svelget, blant både kvinner og menn. I denne artikkelen viser vi at det i Norge årlig forekommer cirka 371 krefttilfeller som sannsynligvis er assosiert med HPV-typer som det i dag vaksineres mot. Av disse forekommer 210 tilfeller i livmorhalsen og 161 tilfeller i andre organer. Tallene antyder potensialet for kreftforebygging ved HPV-vaksinering i Norge. Vi viser også at forekomsten av HPV-relatert kreft har økt i flere organer i perioden 1953 til 2014.

Innledning

Oppfinnelsen av HPV-vaksinen har gjort det mer allment kjent at humant papillomavirus kan forårsake livmorhalskreft. Mindre kjent er det at HPV også kan forårsake kreft i andre organer i det anogenitale området, det vil si i vulva, vagina, anus og penis. Viruset kan i tillegg forårsake kreft i visse deler av svelget, nærmere bestemt i oropharynx, mandler og tungebasis. Felles for organene som kan rammes av HPV-relatert kreft er at de kan bli eksponert for smitte ved seksuell kontakt, og at de består av en vevstype som er sårbar for viruset.

En høy andel HPV-relatert kreft, uansett i hvilket organ det forekommer, kan sannsynligvis forhindres ved vaksinering. For å anslå det kreftforebyggende potensialet ved HPV-vaksinering i Norge er det derfor viktig å vurdere kreft i alle organer hvor HPV kan forårsake kreft. I dagens vaksineprogram i Norge brukes en vaksine som beskytter mot to av de farligste HPV-typene, kalt HPV16 og HPV18.

Forekomsten av HPV-relatert kreft påvirkes av flere faktorer som kan endre seg over tid. Derfor er det interessant å undersøke tidstrender i forekomst av HPV-relatert kreft. Siden HPV er seksuelt overførbart vil endringer i befolkningens seksualatferd kunne påvirke kreftinsidensen. En annen faktor som kan påvirke forekomst av HPV-relatert kreft er endringer i helsetjenesten. Dette er spesielt relevant for livmorhalskreft, som det lenge har vært mulig å forebygge ved celleprøve og påfølgende behandling av forstadier til kreft.

Metode

Vi presenterer data på primærtilfeller av kreft i de følgende organer (Den internasjonale statistiske klassifikasjon av sykdommer ICD-10 kode i parentes): Vulva (C51), vagina (C52), anus (C21), penis (C60), livmorhals (C53) og svelg (oropharynx (C10), tungebase (C01) og tonsiller (C09) kombinert). For alle organer presenterer vi data for kreft i plateepitelceller, fordi det er kreft i denne celletypen som er mest relevant for HPV-relatert kreft. Unntaket er livmorhalskreft, hvor vi presenterer data for kreft både i kjertelepitel og i plateepitel. I livmorhalsen forårsaker HPV kreft i begge celletyper, men det er hovedsakelig kreft i plateepitel som oppdages ved screening. For organer som finnes hos begge kjønn, presenterer vi data samlet for menn og kvinner. Vi presenterer årlig insidens for hele perioden hvor Kreftregisteret har komplette data, altså fra og med 1953 til og med 2014. Ratene er aldersjusterte etter verdensstandarden [1].

Kreftinsidensen varierer tilfeldig mellom ulike år, og for sjeldne typer kreft kan denne variasjonen gi store relative forskjeller mellom år. For å gi et mer robust grunnlag for estimeringen av HPV-vaksinens forebyggende potensiale, bruker vi derfor gjennomsnittlig antall tilfeller i siste femårsperiode.

Siden Kreftregisteret ikke har data om hvorvidt hvert krefttilfelle inneholder HPV, bruker vi estimater for andel krefttilfeller som tilskrives HPV for hvert organ. Estimatene er tatt fra studier som har testet et stort antall kreftsvulster for innhold av HPV. Alle estimater er tatt fra meta-analyser som har sammenstilt data fra flere ulike studier, og vi har brukt de mest oppdaterte og presumptivt mest presise estimater som per i dag finnes. For å anslå årlig antall tilfeller som kan tilskrives HPV, multipliserer vi andelen krefttilfeller som tilskrives HPV i et gitt organ med antallet årlige tilfeller av kreft i dette organet. Samme prosedyre følges for antall årlige tilfeller tilskrevet HPV16/18, som det i dag vaksineres mot.

Resultater

Trender i insidens av HPV-relatert kreft i Norge

Analkreft viser en gradvis økning over perioden 1953-2014 (Figur 1). Selv om analkreft fremdeles er relativt sjeldent er forekomsten mangedoblet fra 50-tallet til i dag. Kreft i svelget øker også, især i siste halvdel av perioden (Figur 1). En trend med økende forekomst i løpet av perioden ser vi også for livmorhalskreft i kjertelepitel (Figur 2) – en kreftform som i liten grad påvirkes av screening. Et fellestrekk for kreft i de organene som viser en økende forekomst, er at økningen starter eller blir noe brattere i løpet av 1970-tallet.

For livmorhalskreft i plateepitel ser vi en økning til midten av 70-tallet, og deretter en betydelig nedgang (Figur 3). Legg merke til at y-aksen her er forskjellig fra de øvrige figurene, grunnet en langt høyere forekomst av livmorhalskreft i plateepitel.

Trendene for vulva, vagina og penis viser ikke store endringer for perioden 1953-2014. Det store bildet for krefttrender i disse organene er at insidensen har holdt seg omtrent på samme nivå gjennom hele perioden (Figur 4 og 5).

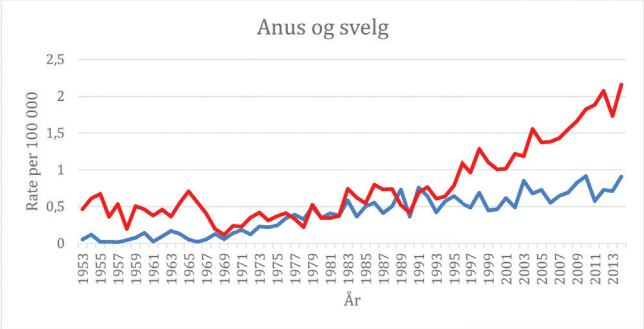
Antall tilfeller tilskrevet HPV

Årlig oppstår tilsammen 669 nye tilfeller av kreft i organer hvor HPV-relatert kreft oppstår (antall nye tilfeller årlig, basert på gjennomsnittet for perioden 2010-2014: 308 i livmorhals, 76 i vulva, 17 i vagina, 73 i anus, 39 i penis og 156 i svelg). Kun en andel av disse tilfellene skyldes HPV, og andelen varierer mellom de ulike organene. Det er først og fremst krefttilfeller i plateepitelceller som er relatert til HPV, og disse utgjør sammen med kreft i kjertelceller i livmorhalsen (som også er assosiert med HPV) 619 nye krefttilfeller årlig (Tabell 1). Vi anslår at det blant disse 619 årlige krefttilfellene er 480 tilfeller (78 %) som kan tilskrives HPV, hvorav 371 (60 %) kan tilskrives HPV-typene 16 eller 18 som det i dag vaksineres mot. Cirka 210 årlige tilfeller i livmorhalsen og 161 årlige tilfeller i andre organer kan tilskrives HPV16 eller 18, hvorav 87 tilfeller forekommer blant menn (Tabell 1).

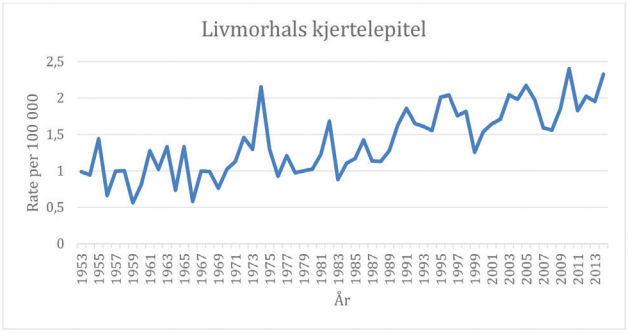
Tabell 1. Årlig antall krefttilfeller i organer som rammes av HPV-relatert kreft, og årlig antall tilfeller tilskrevet HPV i Norge

Organ (celletype)	Årlig antall tilfeller i Norge[1]	Andel tilskrevet HPV (%)	Andel tilskrevet HPV 16/18[3] (%)	Årlig antall tilfeller i Norge tilskrevet HPV	Årlig antall tilfeller i Norge tilskrevet HPV 16/18[3]	Kilde for andel tilskrevet HPV
Livmorhals (plateepitel)	223	100	73	223	163	Walboomers et al. 1999[10]; Li et al. 2011[11]
Livmorhals (kjertelepitel)	65	100	73	65	47	Walboomers et al. 1999 [10]; Li et al. 2011[11]
Vulva (plateepitel)	65	29	21	19	14	de Sanjosé et al. 2013[18]; Serrano et al. 2015[19]
Vagina (plateepitel)	13	81	51	11	7	Alemany et al. 2014[20]
Anus (plateepitel), kvinner	45	90	76	41	34	Alemany et al. 2015[21]
Anus (plateepitel), menn	21	90	76	19	16	Alemany et al. 2015[21]
Penis (plateepitel)	37	47	35	17	13	Miralles-Guri et al. 2009 [22]
Svelg[2] (plateepitel), kvinner	37	57	51	21	19	Ndiaye et al. 2014 [23]
Svelg[2] (plateepitel), menn	113	57	51	64	58	Ndiaye et al. 2014 [23]
Totalt	**619**			**480**	**371**	

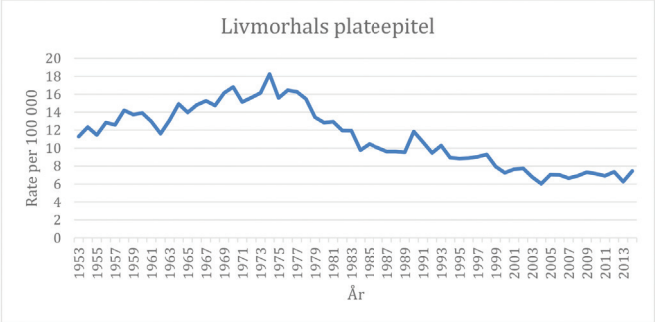
[1] Årlig gjennomsnitt for perioden 2010-2014
[2] Svelg = tungebasis, mandler og oropharynx
[3] HPV 16 og HPV 18 er kreftfremkallende HPV-typer som det vaksineres mot i Barnevaksinasjonsprogrammet



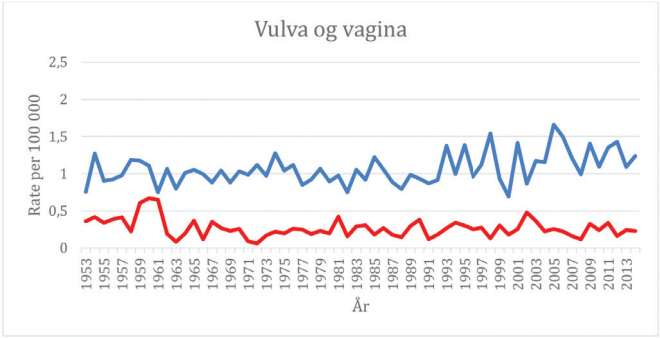
Figur 1. Aldersjustert insidens av plateepitelkreft i svelg (rødt) og anus (blått) blant menn og kvinner for perioden 1953-2014. Svelg omfatter oropharynx, mandler og tungebasis



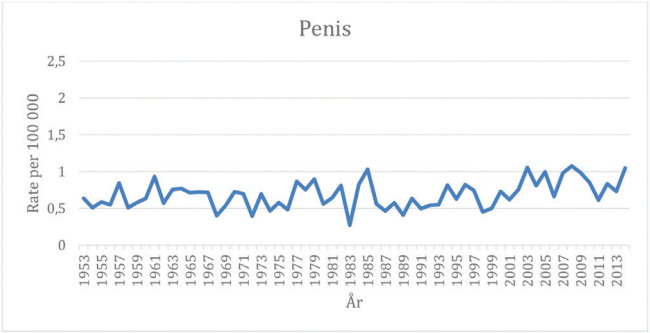
Figur 2. Aldersjustert insidens av kjertelepitel reft i livmorhals for perioden 1953-2014



Figur 3. Aldersjustert insidens av plateepitelkreft i livmorhals for perioden 1953-2014



Figur 4. Aldersjustert insidens av plateepitelkreft i vulva (blått) og vagina (rødt) for perioden 1953-2014



Figur 5. Aldersjustert insidens av plateepitelkreft i penis for perioden 1953-2014

Diskusjon

Kreft i anus, svelg og kjertelepitel i livmorhals viser en økende forekomst over tid i den norske befolkningen. Dette er kreft som i hovedsak forårsakes av HPV, og som det ikke finnes effektiv screening mot. Et lignende mønster observeres også i andre land [2–3]. Vi vet ikke årsaken til dette, men en sannsynlig forklaring er at eksponeringen for HPV har vært økende i befolkningen i nyere tid. HPV er seksuelt overførbart, og studier av befolkningens seksualatferd har blant annet vist at alder for seksuell debut har gått ned, mens gjennomsnittlig antall seksualpartnere, samt erfaring med oral- og analsex, har økt [4–7]. Den økende trenden av flere typer HPV-relatert kreft gjør forebyggende tiltak enda viktigere.

Det viktigste unntaket fra den økende trenden gjelder livmorhalskreft i plateepitel, som har blitt kraftig redusert siden celleprøven ble utbredt i den kvinnelige befolkningen. Celleprøven kan påvise forstadier til livmorhalskreft som kan behandles slik at kreft ikke oppstår. Vi har tidligere estimert at forekomsten av livmorhalskreft i dag ville vært cirka 29 per 100 000 kvinneår dersom vi ikke hadde hatt screening mot denne kreftformen, mens den faktiske forekomsten er rundt 7 per 100 000. Det tilsvarer en reduksjon på 74 % [8]. Screening mot livmorhalskreft har vært og kommer fortsatt til å være et viktig bidrag til forbedret kvinnehelse.

Forekomst av kreft i vulva, vagina og penis ser heller ikke ut til å øke, men har holdt seg på omtrent samme nivå siden 50-tallet. Vi vet ikke hvorfor HPV-relatert kreft i disse organene eventuelt skulle påvirkes på en annen måte enn for eksempel kreft i anus eller svelg. Merk imidlertid at kreft i disse organene forekommer relativt sjelden, og at andelen tilfeller tilskrevet HPV er lavere enn ellers, særlig for penis og vulva. Tallene blir derfor mer variable, og en eventuell økning i den HPV-relaterte andelen kan lettere maskeres av endringer i den relativt store andelen krefttilfeller som ikke er relatert til HPV. Forstadier til kreft i vulva og vagina kan også ha blitt oppdaget og behandlet i forbindelse med screening mot livmorhalskreft, slik at kreft har blitt unngått. Cellulære forskjeller mellom organer som rammes av HPV-relatert kreft [9] kan også tenkes å være av betydning for ulike mønstre i forekomst.

Selv om screening har redusert forekomsten av livmorhalskreft betraktelig, forekommer fremdeles de fleste tilfeller av HPV-relatert kreft i livmorhalsen. Samlet sett er det likevel et betydelig antall HPV-relaterte krefttilfeller i andre organer, også blant menn.

Kreft som kan tilskrives HPV-typer som det i dag vaksineres mot (HPV16/18) anslås å utgjøre 210 årlige tilfeller av livmorhalskreft pluss 161 årlige tilfeller tilsammen i vulva, vagina, anus, penis og svelg.

Det er knyttet en viss usikkerhet til anslagene for antall krefttilfeller tilskrevet HPV. For de organer hvor HPV-relatert kreft sjeldent oppstår er estimatene av andel tilfeller tilskrevet HPV basert på færre prøver, og er derfor mer usikre. De organer som i tillegg har en relativt høy andel tilfeller som ikke er relatert til HPV er også ekstra sårbare for skjevheter i utvalget av svulsttyper, hvilket er med på å øke usikkerheten for disse estimatene.

Påvisningen av HPV i svulster har blitt bedre over tid [10–11], og siden de fleste estimatene av andel tilfeller tilskrevet HPV også bruker eldre data kan det medføre en viss underestimering av HPV-relaterte krefttilfeller. Videre er det også mulig at HPV er relatert til en liten andel kreft i flere områder i hode-hals regionen enn de som her er definert til svelget [12], hvilket også kan medføre en viss underestimering av den HPV-relaterte kreftbyrden.

Med hensyn til potensialet for forebygging av kreft ved HPV-vaksine er et annet usikkerhetsmoment samtidige infeksjoner av andre kreftfremkallende HPV-typer enn 16 og 18. Vi vet ikke i hvilken grad eliminering av HPV16/18 fra en svulst som i tillegg inneholder ytterligere kreftfremkallende HPV-typer vil forhindre kreft.

Det er nylig utviklet en HPV-vaksine som beskytter mot ni ulike typer HPV. Den vil sannsynligvis beskytte mot enda flere krefttilfeller enn det som her er tilskrevet HPV16 eller HPV18, og nærme seg anslagene for HPV-relatert kreft uavhengig av HPV-type.

Til nå er det bevis for at HPV-vaksinen effektivt forhindrer forstadier til kreft i livmorhals, vagina, vulva og anus [13–17], mens dette ennå ikke er tilstrekkelig undersøkt for svelg og penis. Siden HPV-relatert kreft tar mange år å utvikle, har ikke vaksinen vært i bruk lenge nok til å påvise effekter på kreft i noen organer. Antallet HPV16/18-relaterte krefttilfeller som presenteres her angir derfor potensialet for vaksinen som brukes i dagens vaksineprogram, sannsynliggjort ved virustypenes anerkjente rolle som nødvendig for kreftutvikling i hvert organ. Tallene viser at det er et betydelig kreftforebyggende potensial for HPV-vaksinen i Norge.

Mari Nygård har mottatt finansiell støtte fra MSD Norge til forskningsprosjekter gjennom sin tilknyttede institusjon. Prosjektene ledes av Nygård, med Bo Terning Hansen og Suzanne Campbell som prosjektmedarbeidere.

Referanser

1. Doll R, Payne P, Waterhouse JAH. Cancer Incidence in Five Continents, Vol. I. Geneva: Union Internationale Contre le Cancer, 1966.

2. Chaturvedi AK. Beyond cervical cancer: burden of other HPV-related cancers among men and women. J Adolesc Health 2010;46:S20-26.

3. Forman D, de Martel C, Lacey CJ, et al. Global burden of human papillomavirus and related diseases. Vaccine 2012;30 Suppl 5:F12-23.

4. Jaeger AB, Gramkow A, Sorensen P, et al. Correlates of heterosexual behavior among 23-87 year olds in Denmark and Sweden, 1992-1998. Arch Sex Behav 2000;29:91-106.

5. Pedersen W, Samuelsen SO. Nye mønstre av seksualatferd blant ungdom. Tidsskr Nor Laegeforen 2003;123:3006-09.

6. Stigum H, Samuelsen SO, Traeen B. Analysis of first coitus. Arch Sex Behav 2010;39:907-914.

7. Tyden T, Palmqvist M, Larsson M. A repeated survey of sexual behavior among female university students in Sweden. Acta Obstet Gynecol Scand 2012;91:215-219.

8. Lonnberg S, Hansen BT, Haldorsen T, et al. Cervical cancer prevented by screening: Long-term incidence trends by morphology in Norway. Int J Cancer 2015;137:1758-1764.

9. Herfs M, Yamamoto Y, Laury A, et al. A discrete population of squamocolumnar junction cells implicated in the pathogenesis of cervical cancer. Proc Natl Acad Sci U S A 2012;109:10516-10521.

10. Walboomers JMM, Jacobs MV, Manos MM, et al. Human papillomavirus is a necessary cause of invasive cervical cancer worldwide. J Pathol 1999;189:12-19.

11. Li N, Franceschi S, Howell-Jones R, et al. Human papillomavirus type distribution in 30,848 invasive cervical cancers worldwide: Variation by geographical region, histological type and year of publication. Int J Cancer 2011;128:927-935.

12. Gillison ML, Alemany L, Snijders PJF, et al. Human papillomavirus and diseases of the upper airway: head and neck cancer and respiratory papillomatosis. Vaccine 2012;30 Suppl 5:F34-54.

13. FUTURE I/II Study Group. Four year efficacy of prophylactic human papillomavirus quadrivalent vaccine against low grade cervical, vulvar, and vaginal intraepithelial neoplasia and anogenital warts: randomised controlled trial. BMJ 2010;341:c3493.

14. Lehtinen M, Paavonen J, Wheeler CM, et al. Overall efficacy of HPV-16/18 AS04-adjuvanted vaccine against grade 3 or greater cervical intraepithelial neoplasia: 4-year end-of-study analysis of the randomised, double-blind PATRICIA trial. Lancet Oncol 2012;13:89-99.

15. Giuliano AR, Palefsky JM, Goldstone S, et al. Efficacy of quadrivalent HPV vaccine against HPV Infection and disease in males. NEJM 2011;364:401-411.

16. Palefsky JM, Giuliano AR, Goldstone S, et al. HPV vaccine against anal HPV infection and anal intraepithelial neoplasia. NEJM 2011;365:1576-1585.

17. Schiller JT, Castellsague X, Garland SM. A review of clinical trials of human papillomavirus prophylactic vaccines. Vaccine 2012;30 Suppl 5:F123-138.

18. de Sanjose S, Alemany L, Ordi J, et al. Worldwide human papillomavirus genotype attribution in over 2000 cases of intraepithelial and invasive lesions of the vulva. Eur J Cancer 2013;49:3450-3461.

19. Serrano B, de Sanjose S, Tous S, et al. Human papillomavirus genotype attribution for HPVs 6, 11, 16, 18, 31, 33, 45, 52 and 58 in female anogenital lesions. Eur J Cancer 2015;51:1732-1741.

20. Alemany L, Saunier M, Tinoco L, et al. Large contribution of human papillomavirus in vaginal neoplastic lesions: a worldwide study in 597 samples. Eur J Cancer 2014;50:2846-2854.

21. Alemany L, Saunier M, Alvarado-Cabrero I, et al. Human papillomavirus DNA prevalence and type distribution in anal carcinomas worldwide. Int J Cancer 2015;136:98-107.

22. Miralles-Guri C, Bruni L, Cubilla AL, et al. Human papillomavirus prevalence and type distribution in penile carcinoma. J Clin Pathol 2009;62:870-878.

23. Ndiaye C, Mena M, Alemany L, et al. HPV DNA, E6/E7 mRNA, and p16INK4a detection in head and neck cancers: a systematic review and meta-analysis. Lancet Oncol 2014;15:1319-1331.

Utvikling av HPV-vaksiner: Fra kliniske studier til vaksineringsprogrammer

Espen Enerly, PhD[1], Mari Nygård,MD, PhD[1]
[1]Forskningsavdelingen, Kreftregisteret

Siden HPV-vaksinen ble tilgjengelig har et stort antall kliniske studier levert gode data på dens evne til å beskytte mot HPV-infeksjoner. Dette har videre blitt fulgt opp med studier i den generelle befolkningen, hvor vaksinen til syvende og sist har mulighet til å gjøre en forskjell på kreftstatistikken og i folks liv.

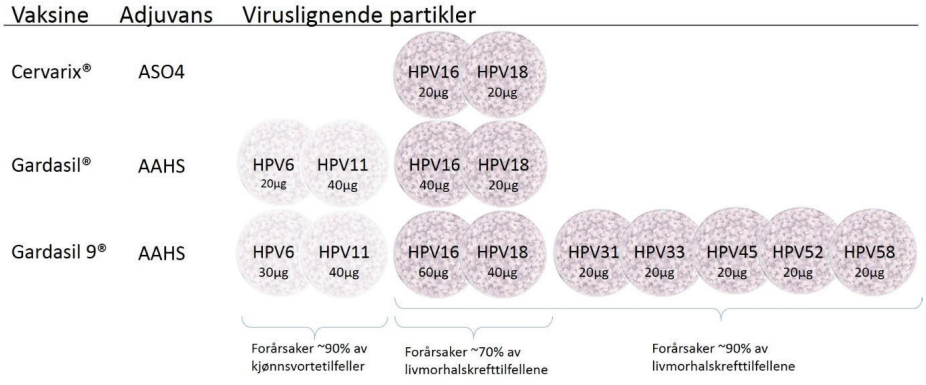
HPV = humant papillomavirus. *Svært utbredt, seksuelt overførbar virusgruppe. HPV-smitte er en forutsetning for å utvikle livmorhalskreft, og smitten kan også forårsake andre former for kreft, samt plager som kjønnsvorter*

Oppbygning av vaksinene

Alle humant papillomavirus (HPV) vaksinene består av ikke-infeksiøse kunstig fremstilt partikler, kalt viruslignende partikler (VLP), som lages ved at det produseres proteiner som tilsvarer overflaten til viruset og som på egenhånd setter seg sammen til partikler [1]. Partiklene inneholder derfor ikke noe arvestoff fra viruset og er ikke smittefarlige. Når personen vaksineres med disse partiklene produserer immunforsvaret nøytraliserende antistoffer mot det HPV-et som samsvarer med overflaten på partiklene. De nøytraliserende antistoffene dekker til viktige områder av HPV-et og hemmer således at det kommer inn i cellene som finnes i livmorhalsen [2]. I tillegg inneholder vaksinene andre virkestoffer som forsterker immunreaksjonen, såkalte adjuvanter [3].

Denne teknologien er benyttet til å lage de tre vaksinene som per dags dato er godkjent i EU for å beskytte mot forstadier til kreft og kreft forårsaket av humant papillomavirus (HPV) infeksjoner [4–5]. De tre er Cervarix® fra GlaxoSmithKline (GSK), Gardasil® og Gardasil-9® fra Merck & Co (Tabell 1). Vaksinene er rettet mot de HPV-typene som i størst grad forårsaker livmorhalskreft [6]. Både Cervarix og Gardasil inneholder partikler basert på HPV16 og HPV18 og kan beskytte mot infeksjon fra disse to HPV-typene. Disse er valgt fordi de forårsaker ~70 prosent av alle livmorhalskrefttilfeller. Gardasil 9 inneholder i tillegg partikler basert på fem andre HPV-typer (31/33/45/52/58) som sammen med 16 og 18 forårsaker ~90 prosent av livmorhalskrefttilfellene [7]. En positiv overraskelse fra de tidlige forsøkene var at vaksinene i tillegg hadde noe beskyttelse mot enkelte andre HPV-typer enn de som i utgangspunktet er inkludert i vaksinen. Det gjenstår derimot å se langtidsbetydningen av dette i den generelle populasjonen.

Enkelte HPV-typer kan forårsake kjønnsvorter, noe som rammer omtrent 10 prosent av befolkningen i løpet av livet og er den vanligste virusutløste kjønnssykdommen i Norge. Gardasil og Gardasil 9 er utviklet for også å gi beskyttelse mot HPV6 og HPV11, to typer som forårsaker ~90 prosent av alle tilfeller av kjønnsvorter [8].



Tabell 1: Virkestoffer i vaksinene er HPV L1 overflateprotein i angitte konsentrasjoner med enten AS04, 3-O-desacyl-4'-monofosforyl lipid A (MPL) adsorbert til aluminiumhydroksid, hydrert (Al(OH)3) (Cervarix) eller HPV L1 protein adsorbert på amorft aluminium hydroksyfosfatsulfat-adjuvans (AAHS) (Gardasil og Gardasil 9).

Tidlige resultater

De mest sentrale studiene som lå til grunn for godkjennelse av Cervarix og Gardasil var henholdsvis PATRICIA-studien [9], FUTURE I og II [10 11]. Fra infeksjon med HPV til utvikling av livmorhalskreft tar det som regel mer enn ti år. Det var derfor uhensiktsmessig av både praktiske og etiske grunner at livmorhalskreft skulle være endemålet i disse studiene. Isteden målte studiene først og fremst vaksinenes evne til å forebygge behandlingstrengende forstadier til kreft i livmorhalsen, kalt cervikal intraepitelial neoplasi grad 2 (CIN2) og grad 3 (CIN3), og sammenlignet vaksinerte med en placebogruppe. Kvinnene som ble inkludert var 15-26 år, da det var her man raskest kunne måle en effekt. Andre endemål for å måle vaksinens effekt er blant annet tilstedeværelse av kjønnsvorter og vedvarende HPV-infeksjon samt forstadier til kreft i vulva, vagina og anus.

Tolkningen av resultatene fra disse studiene kan være forvirrende da de involverer analyser av ulike grupper deltakere [12]. En gruppe består av deltakere som gjennomførte studiene helt i henhold til protokoll og dermed representerer en «ideell» situasjon, hvor alle fikk tre doser av vaksinen og ingen hadde tegn på at de var smittet på forhånd (*Per-Protokoll populasjon*). En annen gruppe består i tillegg av kvinner som kunne ha tegn på HPV-smitte ved inngang til eller umiddelbart etter vaksinering og fikk minst én dose (*Intention-to-treat populasjon*). Denne gruppen tilsvarer til en viss grad vaksinering av en vanlig populasjon av seksuelt aktive unge kvinner (15-26 år).

De mest sentrale fase 3-studiene viste at etter ~4 år hadde vaksinene opp mot full beskyttelse mot HPV16/18 behandlingstrengende forstadier i gruppen som ikke hadde noen tegn på tidligere HPV-smitte (Tabell 2). I populasjonene som også inkluderte deltakere som hadde tegn på tidligere smitte var beskyttelsen generelt redusert, men fortsatt markant. Dette understreker hvor viktig det er å vaksinere før man debuterer seksuelt og kan bli eksponert for HPV-viruset. Har personen først fått en infeksjon kan ikke vaksinen fjerne infeksjonen.

Det er en stor fordel at denne beskyttelsen holder seg så lenge som mulig slik at det ikke blir behov for noen oppfriskningsvaksine. Foreløpige data viser at beskyttelsen er opprettholdt i minst 8-9 år [13]. Kreftregisteret i Norge med samarbeidspartnere fra Danmark, Island og Sverige bidrar her med langtidsoppfølging av de nordiske deltakerne fra FUTURE II (Gardasil)-studiene. Dette foregår ved passiv oppfølging via ulike registre for å fange opp HPV-relaterte sykdomshendelser og bivirkninger, samt aktiv oppfølging hvor det samles inn blodprøver av deltakerne for å måle mengden av HPV-spesifikke antistoffer [14]. Foreløpig vet man ikke hvor grensen går på at mengden av HPV-spesifikke-antistoffer ikke lenger gir noen beskyttelse. Måling av HPV-spesifikke antistoffer har også blitt brukt til å vise at barn i 9-12 års-alderen har minst like god immunrespons etter vaksinering som personer i alderen 15-26 år.

Basert på den kunnskapen man allerede hadde om effekten av den første Gardasil-vaksinen, var det for Gardasil 9 ikke etisk forsvarlig å benytte en placebogruppe i de kliniske forsøkene. Kontrollgruppen er isteden deltakere som fikk den opprinnelige Gardasil-vaksinen. De første resultatene fra Gardasil 9 studien kom ut i 2015 og viste en 97 % beskyttelse mot forstadier til kreft i livmorhalsen, vulva og vagina forårsaket av de fem kreftfremkallende HPV-typene som kommer i tillegg til HPV16/18 [15]. For HPV16/18 viste den tilsvarende immunologisk respons som Gardasil.

	Per-Protokoll populasjon	Intention-to-treat populasjon
	Effektivitet % (95% CI)	Effektivitet % (95% CI)
Kjønnsvorter		
Garland [11]	100 (92-100)	76 (61-86)
CIN2+		
Paavonen [9]	93 (80-98)	95 (86-98)
FUTURE II [10]	100 (86-100)	57 (38-71)
Garland [11]	100 (81-100)	30 (<0-56)
CIN3+		
Paavonen [9]	80 (30-98)	91 (61-99)
FUTURE II [10]	97 (79-100)	45 (23-61)
Garland [11]	100 (76-100)	12 (<0-44)

Tabell 2: Utvalgte sentrale studier på effekt av HPV-vaksinene på forebygging av kjønnsvorter, CIN2+ og CIN3+. (CIN2+ = CIN grad 2 eller mer alvorlig) forårsaket av HPV-typene i vaksinene. Studiene er gjennomført i ulike populasjoner og med noe forskjellig design som gjør at resultatene ikke er direkte sammenlignbare. (CI=konfidensintervaller)

Fra kliniske forsøk til den virkelige verden

Selv om effekten av vaksinene i de kliniske forsøkene har vist seg å være særdeles bra, så er det avgjørende at vaksinene har god effekt også når de benyttes i et massevaksineringsprogram. I andre land som var tidlig ute med HPV-vaksinering og som i tillegg tilbød opphentingsvaksine har man allerede begynt å se de første tegnene. I Australia så man de første tegn på en vaksineeffekt allerede i 2011[16], og det er siden vist at hos jenter i vaksinealder er det en nedgang i forekomst av HPV16/18 infeksjoner og av kjønnsvorter [17]. En meta-analyse som dekker 20 studier fra ni forskjellige land (USA, Australia, England, Skottland, New Zealand, Sverige, Danmark, Canada og Tyskland) viser at dette også gjelder andre land [18]. I Australia har man i tillegg også sett nedgang i behandlingstrengende forstadier til livmorhalskreft.

I Norge ble organisert HPV-vaksinering en del av barnevaksinasjonsprogrammet fra skoleåret 2009/2010. Fra og med 2016 kan norske jenter opp til 26 år få tilbud om opphentingsvaksine[19]. Dette gir en ny mulighet for vaksinering for norske jenter som enten var for gamle i 2009 eller som av ulike grunner ikke tok vaksinen. I flere andre land, deriblant Danmark og Australia har dette vært mulig helt fra de startet med vaksineringen. At Norge først setter i gang dette nå, har ført til at vi så langt ikke har noen målbare effekter av vaksineringen. De første effektene forventes å kunne måles på endringer i forekomst av HPV-infeksjoner og kjønnsvorter. Når kvinnene blir 25 år og begynner å gå til screening mot livmorhalskreft vil vaksineeffekt på forekomst av forstadier til kreft og etter hvert kreft bli mulig å måle.

HPV-vaksinenes effekt må veies opp mot alvorlighetsgraden av bivirkninger. De vanligste bivirkningene av vaksinene er hevelse og ømhet i armen der vaksinen er satt, feber, hodepine, kvalme, oppkast, diaré og magesmerter [20]. I Norge er det Statens Legemiddelverk i samarbeid med Folkehelseinstituttet som overvåker alle bivirkningsmeldinger. Frem til nå har ca. 150 000 jenter blitt vaksinert i Norge og det er meldt om få alvorlige bivirkninger, opplyser Statens Legemiddelverk [20]. Rapporterte alvorlige bivirkninger som potensielt kan være forårsaket av HPV-vaksine undersøkes av Statens Legemiddelverk i nærmere i samarbeid med andre Europeiske legemiddelmyndigheter. Fordelen med et slik samarbeid er at man vil være bedre i stand til å avdekke alvorlige bivirkninger som forekommer svært sjeldent da grunnlaget (antall vaksinerte) for å vurdere eventuelle årsakssammenhenger er bedre. Så selv om de tidlige kliniske vaksine-studiene [21] og foreløpige data fra massevaksinering fra mange land viser at vaksinen generelt er trygg [22] er det viktig med fortsatt kontinuerlig langtidsoppfølging.

Noen kreftfremkallende HPV-typer er ikke dekket av vaksinene. Bør vi bekymre oss for at disse blir mer vanlig når vi reduserer forekomsten av dagens vanligste kreftfremkallende HPV-typer? Det er ingen trend som tyder på at dette er i ferd med å skje, og en observasjon som taler mot at dette vil skje er at HPV-typene som finnes i dag allerede er side om side, tilsynelatende uten å konkurrere med hverandre [23]. Likevel må dette følges opp for å se hva som skjer på lengre sikt.

Hva er vaksinen godkjent for?

Vaksinene er godkjent for beskyttelse mot følgende sykdommer forårsaket av de aktuelle HPV-typene:

Cervarix (HPV-typer 16/18) [4]

- forstadier til kreft i kvinnelig kjønnsorganer: livmorhalsen, ytre kjønnsorganer (vulva og vagina)
- livmorhalskreft

Gardasil (HPV-typer 6/11/16/18) [5]

- forstadier til kreft i kvinnelig kjønnsorganer: livmorhalsen, ytre kjønnsorganer (vulva og vagina)
- forstadier til kreft i anus
- kjønnsvorter hos menn og kvinner
- livmorhals- og analkreft

Gardasil 9 (HPV-typer 6/11/16/18/31/33/45/52/58)

- Gardasil 9 er under behandling for godkjenning i Norge, men har fått europeisk godkjennelse for beskyttelse mot tilsvarende sykdommer som Gardasil

Vaksinering av gutter og to-dose alternativet

Gutter rammes også av HPV-relatert kreft, blant annet i anus, penis og halsregionen. Gardasil er godkjent for bruk hos gutter mot analkreft og dets forstadier. Likevel debatteres det både i Norge og andre land om det er riktig å tilby organisert vaksinering til gutter. Problemstillingen er innfløkt. En viktig faktor er at guttene til dels blir beskyttet via flokkimmunitet, noe som oppstår når en høy andel av jentene er vaksinert. Fra et kostnadsperspektiv konkluderte Kunnskapssenteret i en rapport at det sannsynligvis ikke er kostnadseffektivt å vaksinere gutter i Norge [24]. Andre forskere derimot mente at det kan være kostnadseffektivt å vaksinere gutter [25]. Begge rapportene påpekte at vaksineprisen var det viktigste faktoren som påvirker kostandseffektiviteten. Vaksineprisen var en av de viktigste faktorene som påvirket om vaksinering av gutter ble kostnadseffektivt eller ikke. I tillegg til kostnader er det også andre vurderinger, blant annet hensynet til at homofile gutter trolig ikke vil være beskyttet i samme grad via flokkimmuniteten og om det er riktig at kun det ene kjønnet i en smittekjede, her jentene, skal ha oppgaven med å vaksineres mot et seksuelt overførbart virus. En ekspertgruppe gjennomgår nå i 2015 grunnlaget for å gi et råd til helsemyndighetene om HPV-vaksinering av gutter bør inngå i barnevaksinasjonsprogrammet [26].

Helsemyndighetene i Australia har vedtatt å vaksinere gutter i tillegg til jenter. I Australia startet HPV vaksinering av gutter i skolevaksinasjonsprogrammet i 2013 og gutter i alderen 14–15 år fikk i tillegg tilbud om opphentingsvaksine [27]. I USA anbefaler det offentlige via Centers for Disease Control and Prevention (CDC) HPV-vaksinering for gutter i 11-12 års alderen, men der er ikke kostnadene dekket av det offentlige.

Etter gjennomgang av nyere studier konkluderte Verdens helseorganisasjon (WHO) at to doser av HPV-vaksinen (Cervarix og Gardasil) er like effektiv som tre doser. Det europeiske legemiddelverket (EMA) har også godkjent et alternativt behandlingsregime med to doser til jenter i alderen 9-13 år, men fortsatt tre doser for jenter fra 14 år. I Norge er fortsatt anbefalingen at jenter i 7. klasse skal tilbys tre doser. Dette er begrunnet i at det finnes begrensede langtidsdata på effekten av to-doser [27].

I hvilken grad to-dose- og gutte-vaksinering blir en del av skolevaksinasjonsprogrammet i fremtiden gjenstår å se. Dette er noe politikere og helsemyndighetene må avgjøre på bakgrunn av blant annet råd fra Folkehelseinstituttet og deres nedsatte ekspertgrupper.

Mari Nygård har mottatt finansiell støtte fra MSD Norge til forskningsprosjekter gjennom sin tilknyttede institusjon. Prosjektene ledes av Nygård, med Espen Enerly som prosjektmedarbeider.

Referanser

1. Kirnbauer R, Booy F, Cheng N, et al. Papillomavirus L1 major capsid protein self-assembles into virus-like particles that are highly immunogenic. Proc Natl Acad Sci U S A 1992;24:12180-12184.

2. Schiller JT, Day PM, Kines RC. Current understanding of the mechanism of HPV infection. Gynecol Oncol 2010;1 Suppl:S12-17.

3. Buonaguro FM, Tornesello ML, Buonaguro L. Virus-like particle vaccines and adjuvants: the HPV paradigm. Expert Rev Vaccines 2009;10:1379-1398.

4. Cervarix. (Besøkt: 01.09.2015). http://www.felleskatalogen.no/medisin/pasienter/pil-cervarix-glaxosmith-kline-547411.

5. Gardasil. (Besøkt: 01.09.2015). http://www.felleskatalogen.no/medisin/pasienter/pil-gardasil-sanofi-pasteur-msd-559566.

6. Bruni L, Diaz M, Castellsague X, et al. Cervical human papillomavirus prevalence in 5 continents: meta-analysis of 1 million women with normal cytological findings. J Infect Dis 2010;12:1789-1799.

7. Serrano B, Alemany L, Ruiz PA, et al. Potential impact of a 9-valent HPV vaccine in HPV-related cervical disease in 4 emerging countries (Brazil, Mexico, India and China). Cancer Epidemiol 2014;6:748-756.

8. Giuliano AR, Tortolero-Luna G, Ferrer E, et al. Epidemiology of human papillomavirus infection in men, cancers other than cervical and benign conditions. Vaccine 2008:K17-28.

9. Paavonen J, Naud P, Salmeron J, et al. Efficacy of human papillomavirus (HPV)-16/18 AS04-adjuvanted vaccine against cervical infection and precancer caused by oncogenic HPV types (PATRICIA): final analysis of a double-blind, randomised study in young women. Lancet 2009;9686:301-314.

10. The FUTURE II Study group. Quadrivalent vaccine against human papillomavirus to prevent high-grade cervical lesions. N Engl J Med 2007;19:1915-1927.

11. Garland SM, Hernandez-Avila M, Wheeler CM, et al. Quadrivalent vaccine against human papillomavirus to prevent anogenital diseases. N Engl J Med 2007;19:1928-1943.

12. Schiller JT, Castellsagué X, Garland SM. A Review of Clinical Trials of Human Papillomavirus Prophylactic Vaccines. Vaccine 2012:F123-F38.

13. De Vincenzo R, Conte C, Ricci C, et al. Long-term efficacy and safety of human papillomavirus vaccination. Int J Womens Health 2014:999-1010.

14. Nygard M, Saah A, Munk C, et al. Evaluation of the Long-Term Anti-Human Papillomavirus 6 (HPV6), 11, 16, and 18 Immune Responses Generated by the Quadrivalent HPV Vaccine. Clin Vaccine Immunol 2015;8:943-948.

15. Joura EA, Giuliano AR, Iversen OE, et al. A 9-valent HPV vaccine against infection and intraepithelial neoplasia in women. N Engl J Med 2015;8:711-723.

16. Brotherton JM, Fridman M, May CL, et al. Early effect of the HPV vaccination programme on cervical abnormalities in Victoria, Australia: an ecological study. Lancet 2011;9783:2085-2092.

17. Garland SM. The Australian experience with the human papillomavirus vaccine. Clin Ther 2014;1:17-23.

18. Drolet M, Benard E, Boily MC, et al. Population-level impact and herd effects following human papillomavirus vaccination programmes: a systematic review and meta-analysis. Lancet Infect Dis 2015;5:565-580.

19. Nilsen L. Jubler over gratis HPV-opphentningsvaksine. (Besøkt: 01.10.2015). http://www.dagensmedisin.no/artikler/2015/09/07/jubler-over-hpv-opphentingsvaksine/.

20. Legemiddelverk S. Bivirkningsmeldinger for HPV-vaksinen Gardasil - oppdaterte tall per 23. juli 2015. (Besøkt: 01.10.2015). http://www.legemiddelverket.no/Nyheter/Bivirkninger/Sider/Bivirkningsmeldinger-for-HPV-vaksinen-Gardasil---oppdaterte-tall-per-23.-juni-2015.aspx.

21. Lu BB, Kumar A, Castellsague X, et al. Efficacy and Safety of Prophylactic Vaccines against Cervical HPV Infection and Diseases among Women: A Systematic Review & Meta-Analysis. Bmc Infectious Diseases 2011;11:13.

22. Macartney KK, Chiu C, Georgousakis M, et al. Safety of human papillomavirus vaccines: a review. Drug Saf 2013;6:393-412.

23. Safaeian M, Rodriguez AC. Invited Commentary: Multiple Human Papillomavirus Infections and Type Replacement—Anticipating the Future After Human Papillomavirus Vaccination. American Journal of Epidemiology 2014;11:1076-1081.

24. Jiménez E, Torkilseng EB, Klemp M. Økonomisk evaluering av HPV-vaksinasjon for 12-årige gutter . Rapport fra Kunnskapssenteret nr. 2 – 2015. ISBN 978-82-8121-938-0 ISSN 1890-1298.

25. Burger EA, Sy S, Nygard M, et al. Prevention of HPV-Related Cancers in Norway: Cost-Effectiveness of Expanding the HPV Vaccination Program to Include Pre-Adolescent Boys. PLoS One 2014;9:3:e89974.

26. Folkehelseinstituttet, HPV-vaksine til gutter? (Besøkt 01.09.2015). http://www.fhi.no/artikler/?id=113711.

27. Garland SM, Molesworth EG, Machalek DA, et al. How to best measure the effectiveness of male human papillomavirus vaccine programmes? Clin Microbiol Infect 2015;(9):834-841.

28. Folkehelseinstituttet. Anbefalt regime for HPV-vaksinasjon i barnevaksinasjonsprogrammet. (Besøkt: 01.09.2015 2015). http://www.fhi.no/artikler/?id=114829.

Early impact of quadrivalent HPV vaccination catch-up program: comparing Denmark and Norway

Mari Nygård, MD, PhD[1], Christian Munk, MD, PhD[2], Madleen Orumaa, MPH[1], Bo Terning Hansen, PhD[1], Susanne Kjær, MD, PhD[2,3]

[1] Research Department, Cancer Registry of Norway

[2] Unit of Virus, Lifestyle and Genes, Danish Cancer Society Research Center, Copenhagen, Denmark

[3]Department of Gynecology, Rigshospitalet, University of Copenhagen, Copenhagen, Denmark

In 2009, Denmark and Norway launched similar routine vaccination programs against HPV that causes genital warts and cervical cancer, with 11-12 year old girls as the target group for vaccination. Only Denmark launched additional catch-up vaccination of older girls. Here, we show that the HPV vaccination rates during the first four years of the vaccination programs were much higher in Denmark than in Norway, and that the concurrent incidence of genital warts was markedly reduced in Denmark, but was not reduced in Norway. We conclude that the difference in national HPV vaccination strategies was likely the main reason behind the observed differences in vaccine uptake and incidence of genital warts.

Introduction

Genital warts (GW) are caused mostly by HPV type 6 and 11 and is the earliest clinical manifestation of genital HPV infection, with an incubation period of three months [1]. Genital warts manifests in about 64% of those who are exposed to incident HPV6/11 infection [1] and is a common condition in the Nordic countries, affecting about 10% of Danish and Norwegian women [2]. The first episode of GW is on average diagnosed at age 23 years in Denmark and 22 years in Norway [2]. In most cases, genital warts regress spontaneously, but the use of imidazoquinolone compounds, such as imiquimod, can accelerate the clearance through inducing directly Th1-type cytokines from activated macrophages [3]. The quadrivalent and the nine-valent HPV vaccines provide protection against infection with HPV types 6, 11, and has been shown to be highly effective against GW in clinical trials [4–5] if administered before exposure to the infection. Countries that introduced mass-vaccination with the quadrivalent HPV vaccine including a catch-up for older girls and young women, such as Australia, Denmark and Sweden, were able to demonstrate a reduction in the overall GW incidence shortly after the start of vaccination [6–8]. Australia and Denmark even demonstrated a reduction among non-vaccinated men, indicating herd immunity, i.e. an indirect protection of sexual partners against HPV infection if one partner has been vaccinated [6–9].

GW are sexually transmitted, and the risk of GW is thus strongly associated with sexual behavior. Smoking seems to be an additional risk factor for GW [10]. We have previously described sexual behavior and smoking habits among women in Denmark and Norway [11–14] and found small differences only, suggesting similar background risk for genital warts in these two neighboring Scandinavian countries. The countries are also comparable with respect to age-structure and size.

The quadrivalent HPV vaccine (qHPV) was licensed in 2006 in both countries, and in 2009, both countries initiated a free-of-charge routine HPV vaccination program, targeting 11-12 year old girls with the qHPV. The first cohort of girls to be routinely vaccinated was born in 1996 and 1997 in Denmark and Norway, respectively. In Norway, catch-up vaccination of older cohorts was not initiated, and only non-subsidized qHPV vaccine at market prize (approximately NOK 3 400 for full vaccination) has been available to girls and women born before 1997. In contrast, Denmark provided free-of-charge qHPV vaccination also for women born in 1985–1995 through catch-up vaccination programs.

The aim of the present study was to describe the qHPV vaccine coverage in Denmark and Norway by 2013, and to describe the concurrent incidence trends of genital warts in each country.

Methods

Data source

In Norway, GW cases are registered in the Norwegian Patient Registry. Since 2007, this information has been personalized. Two parallel reporting systems are used – one that collects data from hospitals and one that receives additional information from specialized physicians (avtalespesialister somatikk). The latter was initiated in 2008, and was considered more complete and suitable for our analyses. The hospital data was only used for quality assurance in this study. Information on HPV vaccination coverage was obtained from the Norwegian Immunization Registry, and population data was obtained from the Population Registry.

In Denmark, GW cases are registered in the Danish National Patient Register since 1977, but registration was expanded in 1995 to include also out-patients and emergency room contacts. Danish HPV vaccination data was obtained from the National Health Service Registry and from the Danish National Prescription Registry. Information about the population was obtained from Statistics Denmark.

Subjects and Statistical analysis

From the relevant National Registries we extracted all records of GW, coded as A63.0 according to the International Classification of Diseases, 10th Revision [15], for the period from January 2008 to December 2013 in Norway, and from January 2007 to December 2013 in Denmark. An episode of GW was defined as "incident" if it was preceded by at least one year without any contact with a hospital or outpatient clinic for the same diagnose. Hence, for the Norwegian data, 2008 served to exclude prevalent cases, and incidence was assessed from 2009 onward.

We stratified by gender and year and calculated GW incidence rates per 100 000 person-years. For the analyses we used Stata14 software.

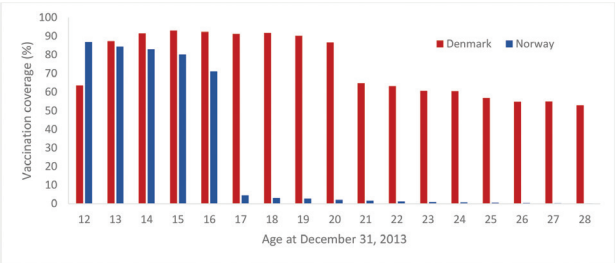


Figure 1. HPV vaccine uptake (at least one dose) by age in Denmark (red) and in Norway (blue), December 31st, 2013.

Results

By the end of 2013 in Denmark, nearly 432 000 girls had received at least one dose of the qHPV vaccine as compared to about 157 300 girls in Norway (Figure 1). Among girls aged 14-17 in 2013, i.e. the cohorts covered by the routine vaccination program, the vaccination rates ranged from 80% to 93% in Denmark, and from 71% to 85% in Norway (Figure 1). However, a much larger difference between the countries was observed among the older birth cohorts. In 2013, HPV vaccination rates were negligible and always less than 5% for Norwegian women aged 17 or older (Figure 1). In contrast, Danish women aged 17–21 in 2013 had vaccination rates close to 90%, and women aged 22–28 had vaccination rates ranging from 53% to 65% (Figure 1).

In 2013, 1 435 and 3 420 new cases of GW were diagnosed in Denmark and Norway, respectively. In both countries, GW was more common in women compared to men. In 2008 the GW incidence rate among Danish women was $85/10^5$ (Figure 2). It decreased markedly during the following five years, to $36/10^5$. A less prominent decrease in GW incidence among Danish men was also observed. In contrast, the incidence of GW remained stable in Norway over the period 2010-2013, ranging from $76/10^5$ to $82/10^5$ in women, and $58/10^5$ to $65/10^5$ in men.

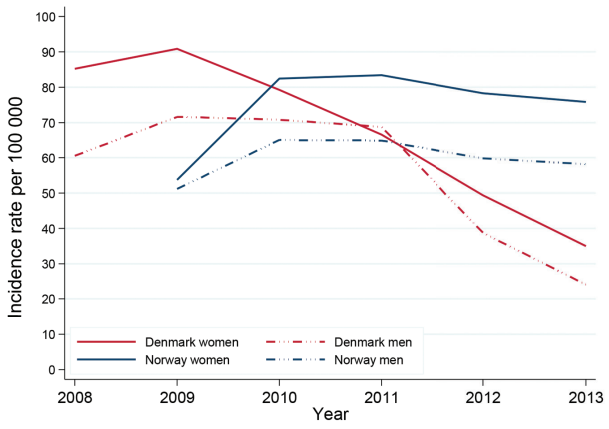


Figure 2. Incidence rates of GW per 100 000 person-years in Denmark (red) and in Norway (blue), during 2008-2013

Discussion

In the current paper we compared the qHPV vaccination coverage and the GW incidence in two neighboring countries with similar cultures and demography. In both countries, free-of-charge routine HPV vaccination of 11-12 year olds was introduced

in 2009. However, only Denmark introduced a free of-charge catch-up program, which has resulted in a significantly higher vaccination rate among young females in Denmark than in Norway. Concurrently, we show that the incidence of GW has gone down in Denmark, but has remained stable in Norway.

Evidence from clinical HPV trials suggest that vaccine efficacy is highest when the vaccine is administered before exposure to HPV, implying that cost effective mass-vaccination programs should target girls at age 11–13 years, i.e. before sexual debut [4–5 16–17]. Furthermore, cost-effectiveness analyses suggest that vaccination of girls after their early twenties leads to "less value for money", as the risk of being exposed to infection increases abruptly after sexual debut [18]. In Norway and Denmark, it was decided to routinely provide the HPV vaccine for girls 11–12 years of age. In 2013, these girls were probably still too young to demonstrate clinical effectiveness of the vaccine at the population level, since most of them would still have been virgins. Hence, it is the effectiveness of the catch-up program, present in Denmark and absent in Norway, which probably is observable in the present study. High proportions of eleven Danish female birth cohorts received the HPV vaccine, which likely induced immunity against HPV types 6/11/16/18 among individuals who received the vaccine.

In Norway, we observed an increase in the GW incidence from 2009 to 2010, both in men and women. The increase might reflect a real increase in incidence, as observed in e.g. Australia and Denmark before licensure of the HPV vaccine [6–7]. However, since 2008 was the first year when information from specialized physicians was registered in the Patient Registry, it may also be an artifact of registration, which may have been incomplete during the first years of individual registration. We observed minor changes in the incidence of GW in Norwegian women and men for the period 2009-2013. This was as expected, given the low HPV vaccination coverage in women aged 18-29 years in Norway (Figure 1).

In Denmark, a marked decrease in the incidence of GW among Danish women in the period 2010–2013 was observed, likely caused by the free-of-charge catch-up vaccination. The observed effect was striking, although many of the women vaccinated through the catch-up program probably were sexually active and hence exposed to genital HPV before vaccination. A slight decrease in GW was also seen in Danish men, for whom HPV vaccination has not been implemented. The decrease in men was first observed in 2012, two years later than among women. Data from Australia suggests that unvaccinated heterosexual men may have been protected against GW through herd immunity [9]. Of interest, no decrease in genital warts was seen among homosexual men in Australia, confirming that indirect protection against HPV infection cannot be extended beyond heterosexual contacts in a vaccination program covering females only. More detailed analyses are needed to address whether the pattern of male GW incidence observed in the present study can be attributed to herd immunity.

Core indicators of sexual behavior, such as age at sexual debut and average number of sexual partners, is similar in Denmark and Norway [13]. Moreover, we have previously shown that HPV vaccination in itself is not associated with subsequent changes in sexual behavior [19]. Hence, national differences in sexual behavior are not likely to explain the differences in GW rates observed here.

Both in Denmark and in Norway we observed higher GW rates in women compared to men, which was somewhat surprising since previous studies have reported similar rates between the sexes [20], or even higher rates among males [21–23]. The observed difference most likely reflects limitation of the data source used, which includes information about hospitalizations and outpatient consultations only, and excludes information on GW treated by general practitioners. As the treatment of warts in male genitalia can be more easily performed at home, men are more likely to receive consultation and treatment from general practitioners. In comparison, women are more likely to visit a specialist for pelvic examination and to receive treatment at outpatient clinics. However, women may also be treated for GW by general practitioners, and our data thus underestimates the true GW burden in both sexes and in both countries.

Our study provides a strong indication for a population-level protective effect of catch-up HPV vaccination. Because of the short incubation period of GW, a reduction in the incidence of GW is one of the first markers of the effectiveness of a national HPV vaccination program. The observed difference can probably be extrapolated to the manifestation of pre-cancerous cervical lesions and cervical cancer, indicating that the protective effect of the HPV vaccine against cervical cancer will probably be observed earlier in Denmark than in Norway. Implementation of catch-up HPV vaccination of Norwegian women is needed in the near future to rapidly reduce the burden of HPV related diseases in women and men.

Mari Nygård has received funding from MSD Norway to research projects through her affiliated institution. Nygård is the Principal Investigator for the research projects, and Bo Terning Hansen and Madleen Orumaa are involved in the projects as research associates. Christian Munk has received lecture fees and support for conference participation from Sanofi Pasteur MSD. Susanne Kjær has received fees for participation in advisory board as well as research funding from Sanofi Pasteur MSD through her affiliated institution.

References

1. Winer RL, Kiviat NB, Hughes JP, et al. Development and duration of human papillomavirus lesions, after initial infection. J Infect Dis 2005;191:731-738.

2. Kjaer SK, Tran TN, Sparen P, et al. The burden of genital warts: a study of nearly 70,000 women from the general female population in the 4 Nordic countries. J Infect Dis 2007;196:1447-1454.

3. Stanley MA. Imiquimod and the imidazoquinolones: mechanism of action and therapeutic potential. Clin Exp Dermatol 2002;27:571-577.

4. Joura EA, Giuliano AR, Iversen OE, et al. A 9-valent HPV vaccine against infection and intraepithelial neoplasia in women. N Engl J Med 2015;372:711-723.

5. Munoz N, Kjaer SK, Sigurdsson K, et al. Impact of human papillomavirus (HPV)-6/11/16/18 vaccine on all HPV-associated genital diseases in young women. J Natl Cancer Inst 2010;102:325-339.

6. Baandrup L, Blomberg M, Dehlendorff C, et al. Significant decrease in the incidence of genital warts in young danish women after implementation of a national human papillomavirus vaccination program. Sex Transm Dis 2013;40:130-135.

7. Donovan B, Franklin N, Guy R, et al. Quadrivalent human papillomavirus vaccination and trends in genital warts in Australia: analysis of national sentinel surveillance data. Lancet Infect Dis 2011;11:39-44.

8. Leval A, Herweijer E, Ploner A, et al. Quadrivalent Human Papillomavirus Vaccine Effectiveness: A Swedish National Cohort Study. J Natl Cancer Inst 2013;105:469-474.

9. Ali H, Donovan B, Wand H, et al. Genital warts in young Australians five years into national human papillomavirus vaccination programme: national surveillance data. BMJ 2013;346:f2032.

10. Hansen BT, Hagerup-Jenssen M, Kjaer SK, et al. Association between smoking and genital warts: longitudinal analysis. Sex Transm Infect 2010;86:258-262.

11. Eliasen M, Kaer SK, Munk C, et al. The relationship between age at drinking onset and subsequent binge drinking among women. Eur J Public Health 2009;19:378-382.

12. Hansen BT, Kjaer SK, Munk C, et al. Early smoking initiation, sexual behavior and reproductive health - a large population-based study of Nordic women. Prev Med 2010;51:68-72.

13. Jensen KE, Munk C, Sparen P, et al. Women's sexual behavior. Population-based study among 65,000 women from four Nordic countries before introduction of human papillomavirus vaccination. Acta Obstet Gynecol Scand 2011;90:459-467.

14. Olesen TB, Jensen KE, Nygard M, et al. Young age at first intercourse and risk-taking behaviours--a study of nearly 65 000 women in four Nordic countries. Eur J Public Health 2012;22:220-224.

15. WHO. ICD-10 Version:2010. Secondary ICD-10, 2010.

16. Joste NE, Ronnett BM, Hunt WC, et al. Human papillomavirus genotype-specific prevalence across the continuum of cervical neoplasia and cancer. Cancer Epidemiol Biomarkers Prev 2015;24:230-240.

17. Paavonen J, Naud P, Salmeron J, et al. Efficacy of human papillomavirus (HPV)-16/18 AS04-adjuvanted vaccine against cervical infection and precancer caused by oncogenic HPV types (PATRICIA): final analysis of a double-blind, randomised study in young women. Lancet 2009;374:301-314.

18. Burger EA, Sy S, Nygard M, et al. Too late to vaccinate? The incremental benefits and cost-effectiveness of a delayed catch-up program using the 4-valent human papillomavirus vaccine in Norway. J Infect Dis 2015;211:206-215.

19. Hansen BT, Kjaer SK, Arnheim-Dahlstrom L, et al. Human papillomavirus (HPV) vaccination and subsequent sexual behaviour: Evidence from a large survey of Nordic women. Vaccine 2014;32:4945-4953.

20. Hoy T, Singhal PK, Willey VJ, et al. Assessing incidence and economic burden of genital warts with data from a US commercially insured population. Current medical research and opinion 2009;25:2343-2351.

21. Cassell JA, Mercer CH, Sutcliffe L, et al. Trends in sexually transmitted infections in general practice 1990-2000: population based study using data from the UK general practice research database. BMJ 2006;332:332-334.

22. Castellsague X, Cohet C, Puig-Tintore LM, et al. Epidemiology and cost of treatment of genital warts in Spain. Eur J Public Health 2009;19:106-110.

23. Marra F, Ogilvie G, Colley L, et al. Epidemiology and costs associated with genital warts in Canada. Sex Transm Infect 2009;85:111-115.

The cost-effectiveness of introducing HPV prevention and detection technologies in Norway

Emily A Burger, PhD[1,2]
[1] Center for Health Decision Science, Harvard T.H Chan School of Public Health, Harvard University
[2] Department of Health Management and Health Economics, Institute of Health and Society, University of Oslo

Several opportunities involving new human papillomavirus (HPV) infection prevention (i.e., HPV vaccination) and detection (i.e., primary HPV-based screening) approaches exist that may simultaneously improve the effectiveness of ongoing HPV-related disease prevention policies in Norway while remaining cost-effective. However, analyses, particularly those that evaluate expanding the current Norwegian HPV vaccination program to include boys, demonstrate the critical role of negotiating a lower HPV vaccine tender price.

Cost-effectiveness: What it is and why it matters

The rapid accumulation of the medical knowledge and the increasing number of medical technologies increases the availability of multiple competing technologies for management of the same condition, complicating decision making in medicine. All countries face economic (e.g., monetary) and physical (e.g., time, number of medical specialists) constraints that may restrict the ability to adopt every single new intervention that could improve population health; therefore, prioritizing the provision of new and often more expensive health services requires difficult, but necessary decisions. In Norway, the cost of providing healthcare has increased [1], that has, inter alia, motivated Norway (and other countries worldwide), to specify efficiency (maximizing output for a given input) or cost-effectiveness as one of the factors to consider when deciding whether or not to implement, and publicly fund, a new health intervention [2]. Information on the health benefits and costs of completing health interventions can be assessed alongside other important factors that contribute to health policy decision making, such as distributional and ethical implications, which are particularly relevant and are explicitly mentioned in health policy guidelines in Norway [3].

Cost-effectiveness analyses quantify the tradeoffs between the additional health benefit achieved (often measured in life years saved [LYS] or quality-adjusted life years [QALY] gained) and the additional resources (e.g., Norwegian Krone (NOK)) required for a new intervention compared with the status quo approach or the next most costly intervention [4]. Quantifying the health benefit and resource tradeoffs can help to identify health interventions that provide "value for money", i.e., the health benefits achieved by an intervention are "worth" the amount of resources expended, and facilitates comparison between health interventions across diseases within the health sector.

The incremental cost-effectiveness ratio (ICER), an efficiency indicator metric most commonly reported in cost-effectiveness analyses, is calculated by taking the difference in costs between one strategy, e.g., Strategy A, compared to the next less costly strategy, e.g., Strategy B, divided by the difference in health benefit between the two strategies.

$$\text{ICER} = \frac{\text{Cost}_A - \text{Cost}_B}{\text{Health benefit}_A - \text{Health benefit}_B}$$

In economic evaluations, the willingness-to-pay (WTP) threshold indicates the acceptable amount society is willing-to-pay for a unit of health benefit. Health interventions with an ICER just below the WTP threshold are considered "good value for money"; however, in Norway, there is no universal criterion that explicitly defines the WTP threshold value. In addition, defining a single threshold value across all health interventions is controversial; nevertheless, NOK500 000 per QALY gained (≈$83 000 (2011 USD)) has been commonly cited and can be used as a benchmark for cost-effectiveness in Norway.

For human papillomavirus (HPV)-based screening and vaccination, the cancer- and mortality-related health benefits will take decades to observe (e.g., after immunizing young girls at age 12). Calculating the long-term consequences (e.g., health benefit and cost) for a given health intervention or strategy requires synthesizing setting-specific data on epidemiologic and economic outcomes. No single clinical trial or observational study can capture all components necessary to inform complex policy decisions, such as allocating scarce resources today to immunize and prevent ill-health several decades in the future [5]. Decision-analytic modeling, or disease simulation modeling, is often used to assist in projecting long-term costs and health benefits.

Decision-analytic modeling

Decision-analytic models often reflect the underlying natural history of a disease and provide a formal framework to incorporate available epidemiological, clinical and economic data. Several decision-analytic approaches can be applied to answer health policy questions, where the type of model, methods, and technologies considered influence the estimates of the impact of an intervention (and can partially explain differences between model projections). An increasing number of national agencies are using decision-analytic methods to help guide drug and technology reimbursement decisions. In 2012, the Norwegian Directorate of Health acknowledged the necessity of model-based analyses in their guidelines for economic evaluation [3].

Several typologies exist to classify disease simulation models. A broad classification of models is whether or not they capture interaction between individuals, which is particularly relevant when modeling the spread of infectious diseases. To evaluate the impact of a vaccination program on preventing an infectious agent in the population, accounting for interaction between individuals allows for inclusion of herd immunity benefits, which is an important population-level health benefit of mass vaccination. Simulation models that ignore individual interaction may be at risk of underestimating the population-level health benefit of vaccination. All model projections inherently reflect the model input parameters; subsequently, several methods, such as uncertainty analysis, calibration, validation, and transparent reporting, help to legitimize the model upon which outcomes are generated and decisions are informed. Importantly, comparing the results across multiple models that evaluate the same policy or intervention within the same setting can identify reasons why two simulation models may come to different conclusions, isolating key parameter values.

The development and execution of model-based analyses is a complex and a timely process. For example, the model used to project the cost-effectiveness of primary HPV testing in Norway [6] involved a simulation model that was originally developed in 1999 at the Harvard T.H. Chan School of Public Health. The model has been continuously updated for nearly two decades to reflect current understanding of HPV and cervical cancer epidemiology to evaluate novel preventive interventions that have informed HPV prevention policy in both developed and less-developed countries around the world. The Norwegian-specific analysis simultaneously evaluated 96 alternative screening algorithms and accounted for uncertainty in the underlying natural history of cervical cancer, requiring 640 hours of computer simulation time to project the base case results. This does not include the simulation time required to adapt the model to the Norwegian context or the time required to test the robustness of base case model projections in sensitivity analysis.

Cost-effectiveness of HPV vaccination in Norway

The majority of cost-effectiveness analyses that have evaluated bivalent and quadrivalent HPV (qHPV) vaccination policy have been aimed at assessing vaccination of a preadolescent girls-only [7]. However, more recently, HPV vaccine prices have been declining and emerging evidence suggests the HPV vaccines may provide health benefits to non-cervical HPV-associated malignant (i.e., vaginal, vulvar, anal, penile, and oropharyngeal) and non-malignant (i.e., genital warts and recurrent respiratory papillomatosis) conditions. These factors, inter alia, have prompted Norwegian Health Authorities to revisit existing HPV-related health policy and evaluate whether the current qHPV vaccination program should be expanded to include preadolescent boys, as well as a temporary catch-up program that targets women older than 12 when the qHPV vaccine was introduced in Norway in 2009. Several key factors such as the cost per vaccine dose and the number of required doses will influence the cost-effectiveness, or value, of expanding the current vaccination program.

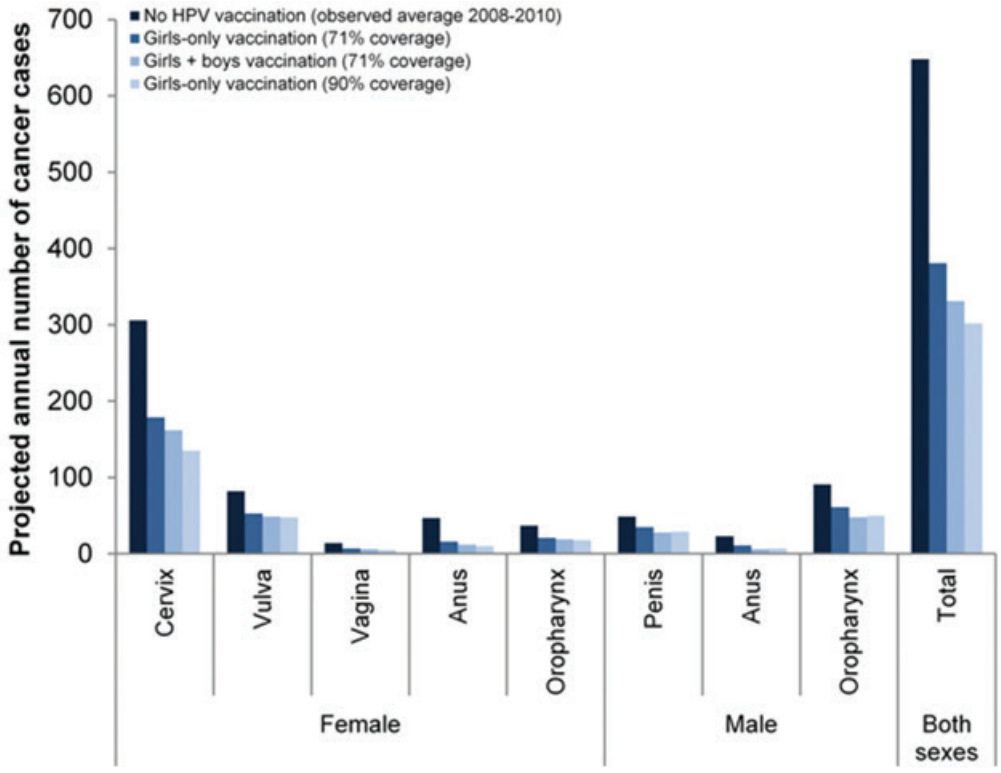
Should we vaccinate females, males or both genders?

Cost-effectiveness analyses evaluating vaccinating pre-adolescent girls against HPV6/11/16/18 have shown that a girls-only vaccination policy compared with no qHPV vaccination is likely to be very cost-effective [7]. This finding is generally robust to plausible variations across salient parameters (e.g., vaccine price). Cost-effectiveness analyses assessing an expanded, gender-neutral qHPV vaccination program targeting pre-adolescent boys are less consistent [7], where study findings are most sensitive to: vaccine price, the number of required vaccine doses, the current coverage rate among girls, and burden of HPV-associated cancers among men. In Norway, two cost-effectiveness analyses evaluating a gender-neutral qHPV vaccination policy compared with a girls-only program have been performed: one

study by Burger and Colleagues [8] published in an international peer-reviewed journal, and one health technology assessment report [9] published by the Norwegian Knowledge Centre for Health Services. Given common benchmarks for cost-effectiveness in Norway, both analyses found that for certain combinations of vaccine price, inclusion of non-cervical HPV related conditions, study perspective and society's willingness-to-pay, a gender-neutral HPV vaccination program may be cost-effective; however, in the base case analyses, the studies differed with respect to their main conclusions. One study excluded vaccine benefit to certain non-cervical HPV-associated conditions (e.g., oropharyngeal cancer), assumed the market price (versus negotiated price) of the qHPV vaccine, and a more limited scope of the type of costs considered in the analysis. Although these assumptions were reasonable, less attractive cost-effectiveness ratios were estimated as compared to the simulation which accounted for these factors. Components of the simulations models are of major importance for the outcome and help explain why the base case conclusions in the analyses differed.

Several studies have also explored whether to invest in increasing HPV vaccination coverage within a girls-only HPV vaccination program, or to add boys. These studies [8–10] find that the reduction in disease burden is most efficient under a single-sex vaccination program. For example, one Norwegian study [8] found that greater health benefit (i.e., fewer cancer cases) is yielded by increasing girls-only coverage by 20% compared with achieving equal coverage among girls and boys in a gender-neutral program. [Figure 1]This analysis, however, did not account for the small proportion of men who have sex with men.

Figure 1. Projected annual number of cases comparing expanding the current girls-only human papillomavirus (HPV) vaccination program to include 12 year-old boys versus increasing vaccine coverage in the girls-only program.



Legend: Projections reflect the expected number of cases per year using projected cancer reductions of the lifetime for the last 12-year-old cohort included Burger et al 2014. The reduction in non-cervical HPV related cancers due to vaccination are assumed to be proportional to the reduction in cumulative risk of acquiring HPV prior to age 50 and multiplied by the disease-specific HPV 16/18 attributable fractions. Projected reduction in risk of cervical cancer is estimated from the stochastic disease model and in the context of current cervical cancer screening compliance.

Adapted from Burger et al 2014 [8]

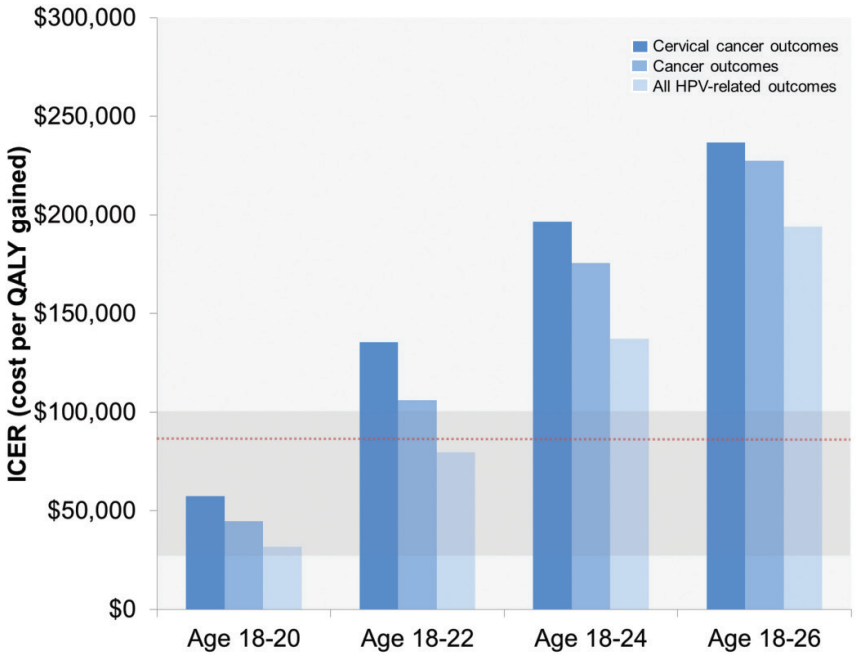
Optimal age to vaccinate women

Two studies published in international peer-reviewed journals [11–12], and one health technology assessment report [13] have evaluated the cost-effectiveness of vaccinating females older than 12 in Norway. Similar to expanding the HPV vaccination program to include boys, vaccinating females older than 12 years was found to be likely cost-effective, but depended on several factors such as vaccine price and the upper age limit of the proposed HPV vaccination program. For example, as the HPV vaccine effectiveness decreases as women age increase; exploring the upper age to vaccinate is important, but not assessed in two of the three studies. When HPV vaccination age was disaggregated, Burger and Colleagues [11] found that vaccinating beyond age 22 was only cost-effective given common benchmarks of cost-effectiveness in Norway when the vaccine price was very low (i.e., <NOK200 per dose) and comprehensive, high vaccine efficacy was assumed [Figure 2].

HPV vaccine cost and the number of doses

Another approach to reducing the cost of an HPV vaccination program is to reduce the number of doses. A recent cost-effectiveness analysis [14] found that a two dose HPV vaccine schedule is more cost-effective than a three dose schedule, provided that the protection from a 2-dose vaccine schedule lasts at least 20 years.

Figure 2. Cost-effectiveness results assuming NOK450 ($75) per HPV vaccine dose and 50% uptake among women older than 12 years



Legend: Shaded area represents the broad range of willingness-to-pay thresholds accepted across developed countries (i.e., $30,000-100,000) and the dotted red line represents the threshold commonly cited in Norway (NOK500 000≈$83,000). All HPV-related outcomes include: Cervical, vulvar, vaginal, anal, penile, oropharyngeal cancers, as well as genital warts and recurrent respiratory papillomatosis. ICER: Incremental cost-effectiveness ratio, HPV: Human papillomavirus, QALY: Quality-adjusted life years.

Adapted from Burger et al 2014 [11]

Cost-effectiveness of primary HPV-based screening in Norway

Only one cost-effectiveness analysis has assessed the value of replacing primary cytology-based screening with HPV DNA testing within the Norwegian context [6]. Given common benchmarks for cost-effectiveness in Norway, this study found that primary HPV DNA testing is likely to be a cost-effective screening approach; however, the optimal screening algorithm was dependent on the length of the screening interval, the age at which to switch from cytology-based screening to HPV-based screening, and the management of HPV-positive women. In addition, the analysis found that the preferred screening strategy varied by vaccination status (i.e., those who had or had not been vaccinated against HPV16 and -18 infections during adolescence). A recent systematic review found that 12 out of 15 cost-effectiveness analyses conducted in other developed settings concluded similar findings [15]. In addition, applying reflex HPV DNA testing in a triage setting for women with minor cervical lesions may also improve existing screening practice, particularly among younger women who may not be eligible for primary HPV DNA testing [16].

Screening interval

In the primary analysis, which explored switching women to primary HPV-based screening at age 34 years, Burger and colleagues [6] found that the most cost-effective screening strategy given the commonly-cited threshold for cost-effectiveness in Norway involved HPV-based screening every four years for unvaccinated women. For lower willingness-to-pay thresholds (i.e., NOK180 000 per life-year saved), screening every six years with primary HPV testing was preferred.

Age to start primary HPV-based screening

For the secondary analysis, which explored switching women to primary HPV-based screening at an earlier age (i.e., age 31 compared with age 34 years), the Norwegian analysis estimated that switching to HPV-based strategies at age 31 provided more health benefit for less cost and was always preferred over switching at age 34. The pooled analysis of several European randomized controlled trials concluded that improving the screening sensitivity was especially meaningful for women aged 30-35 years [17].

Follow-up of HPV-positive women

The majority of strategies identified as cost-efficient (i.e., on the efficiency frontier) involved repeated follow-up (i.e., with HPV testing 6 or 12 months later) for women HPV-positive and cytology-negative to confirm persistence of HPV infection, prior to prompting referral to diagnostic colposcopy-directed biopsy[6]. This finding remained consistent in sensitivity analysis, unless women were assumed to be unlikely to comply with follow-up recommendations.

Vaccinated cohorts

As girls vaccinated against HPV infections approach the recommended screening age (i.e., 25 years), they are expected to face a reduced risk of developing cervical cancer, necessitating the reassessment of screening algorithms for these cohorts, potentially adding complexity to existing screening programs. In a systematic review, 10 out of 12 studies concluded that screening should be continued for women vaccinated during adolescence; furthermore, 5 out of 5 studies concluded that, for vaccinated women, HPV DNA primary screening is preferred over primary cytology [15]. Within the Norwegian context, Burger and colleagues found that primary HPV-based screening was cost-effective for women aged 31 and older, but the screening interval should be extended (i.e., every six years).

Conclusions

Several opportunities involving new HPV infection prevention (i.e., HPV vaccination) and detection (i.e., primary HPV-based screening) approaches exist that may simultaneously improve the effectiveness of ongoing HPV-related disease prevention policies in Norway while remaining cost-effective. However, analyses, particularly those that evaluate expanding the current Norwegian HPV vaccination program to include boys, demonstrate the critical role of negotiating a lower HPV vaccine tender price. In general, cost-effectiveness analyses are a decision-support tool providing decision makers with information on the projected health benefit, economic consequences and efficiency of an intervention. These analyses can help inform an important component of decision-making, but should be set within the context of national priority-setting criteria based on wider societal values.

Dr. Burger has no conflicts to declare.

References

1. OECD. Health at a Glance 2013: OECD Indicators. OECD Publishing. Available at: http://dx.doi.org/10.1787/health_glance-2013-en.

2. Sabik L, Lie R. Priority setting in health care: Lessons from the experiences of eight countries. International Journal for Equity in Health 2008;7:4.

3. Norwegian Directorate of Health. [Economic Evaluation of Healthcare - A Guide]. Available at: http://helsedirektoratet.no/publikasjoner/okonomisk-evaluering-av-helsetiltak--en-veileder/Sider/default.aspx.

4. Gold, MR, Siegel, JE, Russell, LB, and Weinstein, MC (1996) Cost-effectiveness in Health and Medicine. Oxford University Press.

5. Goldie SJ, Goldhaber-Fiebert JD, Garnett GP. Chapter 18: Public health policy for cervical cancer prevention: The role of decision science, economic evaluation, and mathematical modeling. Vaccine HPV Vaccines and Screening in the Prevention of Cervical Cancer, 2006:S155-S63.

6. Burger EA, Ortendahl JD, Sy S, Kristiansen IS, Kim JJ. Cost-effectiveness of cervical cancer screening with primary human papillomavirus testing in Norway. British Journal of Cancer 2012;106:1571-1578.

7. Canfell K, Chesson H, Kulasingam SL, Berkhof J, Diaz M, Kim JJ. Modeling Preventative Strategies against HPV-Related Disease in Developed Countries. Vaccine 2012;30:F157-F167.

8. Burger EA, Sy S, Nygard M, et al. Prevention of HPV-Related Cancers in Norway: Cost-Effectiveness of Expanding the HPV Vaccination Program to Include Pre-Adolescent Boys. PLoS One 2014;9:3:e89974.

9. Jiménez E, Torkilseng E, Klemp M. Cost-effectiveness of HPV vaccination of boys aged 12 in a Norwegian setting. In: 2–2015 RfKN, ed. Oslo: Norwegian Knowledge Centre for the Health Services, 2015.

10. Bogaards JA, Kretzschmar M, Xiridou M, Meijer CJLM, Berkhof J, Wallinga J. Sex-Specific Immunization for Sexually Transmitted Infections Such as Human Papillomavirus: Insights from Mathematical Models. Plos Medicine 2011;8:e1001147.

11. Burger EA, Sy S, Nygård M, Kristiansen IS, Kim JJ. Too Late to Vaccinate? The Incremental Benefits and Cost-effectiveness of a Delayed Catch-up Program Using the 4-Valent Human Papillomavirus Vaccine in Norway. Journal of Infectious Diseases 2015;211:206-215.

12. Dasbach EJ, Largeron N, Elbasha EH. Assessment of the cost–effectiveness of a quadrivalent HPV vaccine in Norway using a dynamic transmission model. Expert Review of Pharmacoeconomics & Outcomes Research 2008;8:491-500.

13. Jimenez E, Wisløff T, Klemp M. Cost-effectiveness of a HPV-vaccination catch-up program for females aged 26 years or younger in a Norwegian setting. . Report from Kunnskapssenteret no. 5-2014: Oslo: Norwegian Knowledge Centre for the Health Services. 2014.

14. Jit M, Brisson M, Laprise J-F, Choi YH. Comparison of two dose and three dose human papillomavirus vaccine schedules: cost effectiveness analysis based on transmission model. BMJ 2015;350:g7584.

15. Mendes D, Bains I, Vanni T, Jit M. Systematic review of model-based cervical screening evaluations. BMC Cancer 2015;15:334.

16. Pedersen K, Sørbye SW, Burger EA, Lönnberg S, Kristiansen IS. Using Decision-Analytic Modeling to Isolate Interventions That Are Feasible, Efficient and Optimal: An Application from the Norwegian Cervical Cancer Screening Program. Value in Health doi: 10.1016/j.jval.2015.08.003 [published Online ahead of date].

17. Ronco G, Dillner J, Elfstrom KM, et al. Efficacy of HPV-based screening for prevention of invasive cervical cancer: follow-up of four European randomised controlled trials. The Lancet 2014;383:524-532.

HPV-test bidrar til bedre livmorhalskreft screening

Birgit Engesæter, PhD[1], Mari Nygård, MD, PhD[2], Stefan Lönnberg, MD, PhD[1]
[1]Masseundersøkelsen mot livmorhalskreft, Kreftregisteret; [2]Forskningsavdelingen, Kreftregisteret

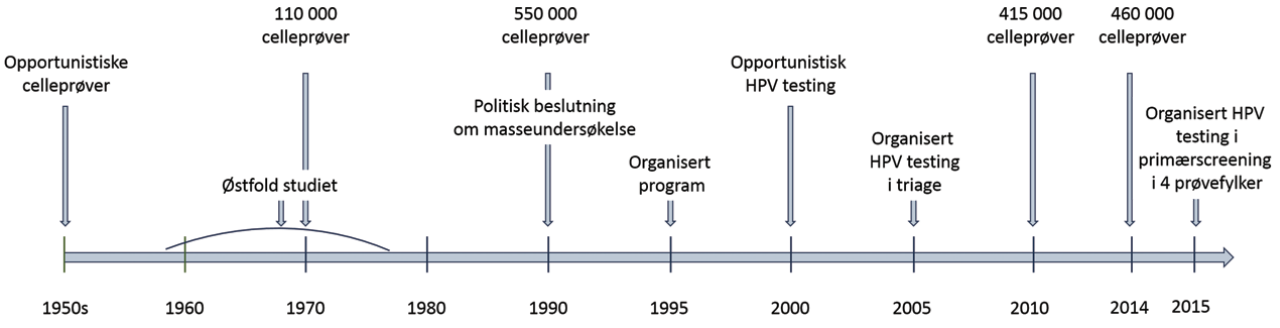
Vedvarende infeksjon med høyrisiko humant papillomavirus (hrHPV) er en forutsetning for utvikling av livmorhalskreft, og HPV-test har blitt en viktig del av screeningprogrammet. HPV-test har en sentral rolle som tilleggstest for kvinner med lavgradige celleforandringer, og det vurderes om HPV-test skal erstatte celleprøven som screeningprøve. Samlet sett bidrar HPV-test til et styrket screeningprogram bedre rustet til effektiv forebygging av livmorhalskreft.

Oppstart av screeningprogram mot livmorhalskreft i Norge

I de siste tiårene er det blitt anerkjent at vedvarende infeksjoner i livmorhalsen med høyrisiko humant papillomavirus (hrHPV) er årsaken til 99 % av alle tilfeller av livmorhalskreft [1]. Progresjon fra benigne til maligne celler er i de fleste tilfellene en langvarig prosess, og fra smitte med hrHPV til utvikling av kreft tar det stort sett minimum 10–15 år og 20–25 år i gjennomsnitt [2–3]. Denne langsomme utviklingen, gjennom flere pre-maligne trinn, gjør livmorhalskreft til en krefttype som kan forebygges gjennom screening.

På 50-tallet utviklet den greske legen Dr. Georgios Papanicolaou en cytologisk test for å påvise forstadier til livmorhalskreft [4]. Fra 1950-tallet frem til 1995 ble det i Norge tatt prøver etter initiativ fra kvinnen selv eller hennes lege, og prøveantallet økte fra 110 000 i 1970 til 550 000 prøver i 1990 (Figur 1). Noen kvinner fikk tatt celleprøver ofte, mens andre aldri fikk tatt prøver. Variasjonen på antall prøver var stor, både geografisk og i sosiale lag, og den forebyggende effekten mot forekomst av livmorhalskreft og dødelighet var begrenset sammenlignet med andre land som hadde et organisert prøvetakingsystem [5]. I perioden 1959–1977 ble det satt i gang et pilotprosjekt i Østfold der effekten av regelmessig prøvetaking og oppfølging av kvinner med positive celleprøver ble studert. Det ble påvist en betydelig reduksjon i insidens og dødelighet av livmorhalskreft [6], men likevel var det først i 1995 at et organisert screeningprogram mot livmorhalskreft ble etablert i Norge [7]. Viktige milepæler for Livmorhalsprogrammet er vist i Figur 1.

I 2014 fikk 338 kvinner livmorhalskreft og 63 kvinner døde av sykdommen [8]. Estimater anslår at screeningprogrammet har redusert antall tilfeller av livmorhalskreft i Norge med ca. 70 prosent [9]. Kreftregisteret sine data viser at omtrent 50 prosent av krefttilfellene oppstår hos kvinner som ikke har fulgt anbefalt tidsintervall på screeningprøvene [10], og økt deltakelse i screeningprogrammet er derfor viktig for å øke effekten av programmet. Den andre halvparten av krefttilfellene oppstår hos kvinner som har deltatt i screeningprogrammet, og omtrent 50 prosent av disse kvinnene har hatt normal celleprøve siste 3,5 år [10]. Bedre sensitivitet på screeningtesten kan bidra til å oppdage flere med forstadier til kreft og dermed forhindre utvikling av kreft.

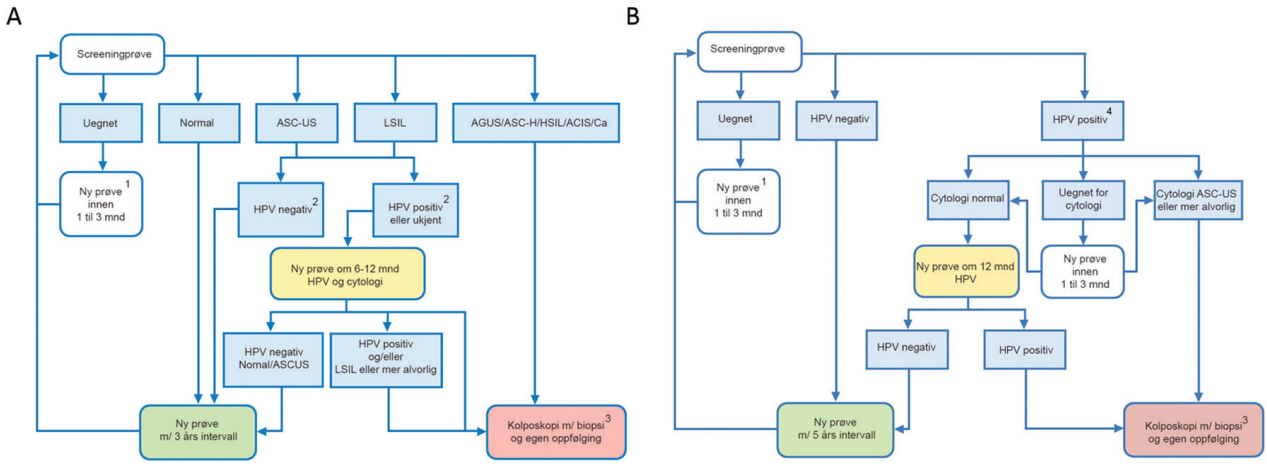


Figur 1: Viktige milepæler i Norge sin utvikling av screening mot livmorhalskreft.

Bruk av HPV-test i oppfølgning av unormale celleprøver

I dag baserer Livmorhalsprogrammet seg på morfologisk evaluering av celleprøver tatt fra livmorhalsen hos kvinner, og forebygger utvikling av livmorhalskreft ved å oppdage behandlingstrengende forstadier, cervikal intraepitelial neoplasi grad 2 (CIN2) og grad 3 (CIN3). Kvinner informeres om screeningprogrammet det året de fyller 25 år. Ved normale celleprøver oppfordres de til å ta en celleprøve fra livmorhalsen hvert tredje år frem til de fyller 69 år. Kvinner med unormal celleprøve, høygradige eller lavgradige celleforandringer, får nærmere oppfølging. Ved høygradige celleforandringer henvises kvinnen til utredning med kolposkopi og biopsi umiddelbart, mens kvinner med lavgradige celleforandringer blir HPV-testet (se Figur 2A for en skjematisk fremstilling av oppfølgingsalgoritme). En HPV-test detekterer viralt DNA (ev mRNA) tilstede i cellene fra livmorhalsen, og gir en bedre risikostratifisering for utvikling av behandlingstrengende forstadier enn bare cytologisk evaluering [11].

Nygård et al. undersøker i en analyse, som inkluderte 19 065 kvinner med lavgradige celleforandringer, risikoen for behandlingstrengende forstadier (den kumulative insidensen for CIN3 og mer alvorlige forandringer, CIN3+) [12]. Ved oppfølgningsprøven (tatt seks til tolv måneder etter unormal screeningtest) hadde 5 392 kvinner fortsatt lavgradige celleforandringer og 13 673 kvinner hadde normale celleprøver. Alle kvinnene ble testet for hrHPV. For kvinner med normale celleprøver og negativ HPV-test var risiko for CIN3+ kun 0.3 % (95 % CI: 0.1–0.5), mens ved en positiv HPV-test økte risikoen for CIN3+ til 17.7 % (95 % CI: 15.7–19.6). Med lavgradige celleforandringer, men uten hrHPV tilstede, var risiko for behandlingstrengende forstadier 3.0 % (95 % CI: 1.6-4.5), mens de som både hadde positiv HPV-test og lavgradige celleforandringer hadde 3-års risiko for CIN3+ på 31.2 % (95 % CI: 28.7–33.6). Resultatene referert her og andre studier indikerer tydelig at HPV-test, sammenlignet med bare morfologisk analyse, bedre identifiserer kvinner med økt risiko for å utvikle behandlings-trengende forstadier [11–13]. Dette gir mulighet for tettere oppfølgning av disse kvinnene.



Figur 2: Gjeldende algoritmer for screening i Norge (A) Primær cytologitest (B) Primær HPV-test.

(1) Når repeterte celleprøver er uegnet for cytologisk analyse, anbefales henvisning til gynekolog. (2) HPV-analyse gjøres på væskebasert primærprøve (refleks-testing). Hvis primærprøven er et konvensjonelt utstryk eller av annen grunn ikke egner seg for HPV-analyse, skal ny prøve for HPV-test og cytologi tas etter 6-12 måneder. (3) Diagnostisk kolposkopi med portiobiopsier og endocervikal abrasio utføres etter retningslinjer i "Veileder i gynekologisk onkologi". (4) Cytologi gjøres på væskebasert primærprøve (refleks-testing). Flytskjemaet dekker ikke alle kliniske situasjoner. I enkelte tilfeller er det nødvendig at patolog og gynekolog diskuterer det enkelte kasus og vurderer en annen oppfølgingsalgoritme. Det er satt spesifikke krav til HPV-tester for bruk i Masseundersøkelsen mot livmorhalskreft, og Helsedirektoratet avgjør hvilke HPV-tester som oppfyller kravene.

ASC-US – irregulære plateepitelceller med forandringer av usikker betydning; LSIL – lavgradig skvamøs intraepitel lesjon; ASC-H – irregulære plateepitelceller med forandringer som kan gi mistanke om høygradig lesjon, men som ikke fyller alle kriteriene til diagnosen HSIL; HSIL – høygradig skvamøs intraepitel lesjon; AGUS – irregulært sylinder/kjertelepitel av usikker opprinnelse og/eller signifikans. Enten endocervicale celler eller endometrieceller som viser kjerneforandringer utover det som sees ved reaktive eller reparative forandringer, men mangler trekkene til ACIS og infiltrerende karsinom ("atypical glandular cells of undetermined significance" i original Bethesda 2001); ACIS – adenokarsinoma in situ; Ca – alle typer cancer.

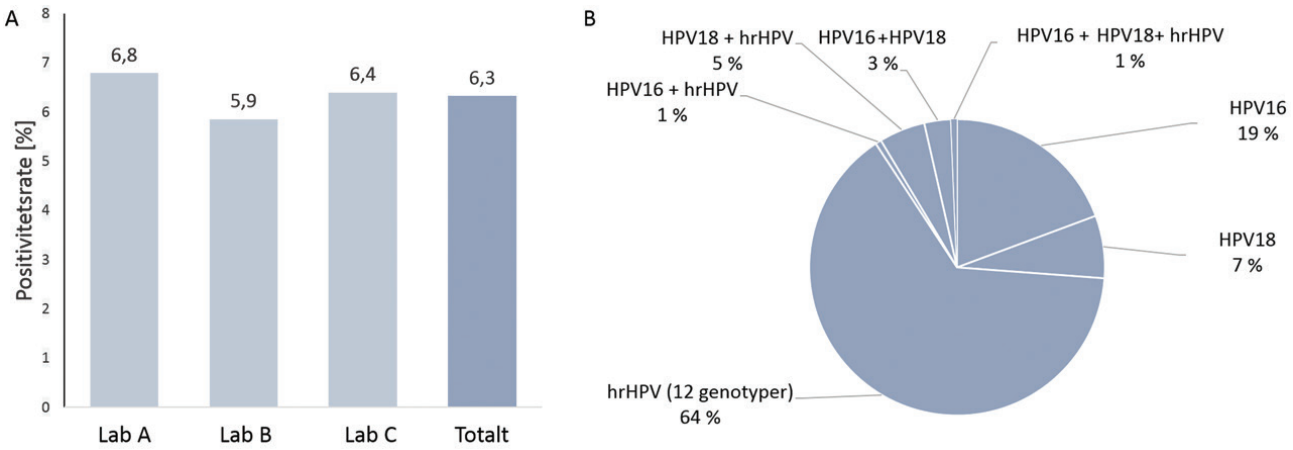
HPV-test i primærscreening

Internasjonale studier viser at HPV-basert screening har 23–27 prosent høyere sensitivitet for forstadier til livmorhalskreft i forhold til cytologibasert screening [11]. I tillegg fanger HPV-basert screening opp kvinner med forstadier tidligere i sykdomsforløpet, og screeningintervallet etter en negativ HPV-test kan være lengre enn ved en negativ cytologi test med samme sikkerhet. Studier indikerer at blant kvinner over 30–35 år er HPV-test et fullgodt eller foretrukket alternativ til cytologi som primærtest i screening mot livmorhalskreft, og det anbefales at cytologi brukes kun som sekundærtest i de tilfeller der HPV-testen er positiv [14]. Estimat viser at HPV-basert screening kan gi opptil 60–70 prosent bedre beskyttelse mot livmorhalskreft i forhold til cytologibasert screening, og effekten står i rimelig forhold til kostnadene [15–16]. Ettersom den økte sensitiviteten også sannsynligvis vil lede til en oppgang i diagnostiske og terapeutiske intervensjoner, er det særlig viktig at HPV-basert screening kun implementeres i organiserte screeningprogram. Overvåking og kvalitetssikring av programmet gjør det mulig å opprettholde en akseptabel balanse mellom fordeler (kreftforebygging) og ulemper (unødvendige diagnostiske utredninger og overbehandlinger).

I Norge ble det våren 2015 satt i gang et randomisert implementeringsprosjekt i fire prøvefylker (Rogaland, Hordaland, Sør- og Nord-Trøndelag).

Kvinner født på partallsdager får tilbud om HPV-test som primær screening (følger algoritmen vist i figur 2B), mens kvinner født på oddetallsdager får vanlig morfologisk undersøkelse av celleprøven sin (følger algoritmen vist i figur 2A). Kreftregisteret, i samarbeid med sine støttespillere i de ulike fagmiljøene, brukte mye tid på å forberede og formidle informasjon om HPV i forkant av prosjektoppstart, og de foreløpige tilbakemeldingene indikerer stor aksept for HPV-test blant norske leger og kvinner. Det er kun et fåtall av kvinnene som heller vil ha en cytologisk vurdering av celleprøven istedenfor HPV-test.

Resultatene fra fem til syv måneder med bruk av HPV-test i primærscreening viser at andel hrHPV-positive varierer lite mellom de tre involverte laboratoriene og er i snitt på 6,3 prosent (Figur 3A). Den HPV-testen som benyttes i implementeringsprosjektet, Cobas 4800 HPV Detection Kit (Roche Molecular Diagnostics), identifiserer HPV16 og 18, i tillegg til at den identifiserer 12 andre høyrisiko genotyper felles. Dette gir mulighet til å vurdere genotypeprofilen i befolkningen i de fire prøvefylkene (Figur 3B), og viser at 19 prosent av kvinnene med positiv HPV-test er infisert med HPV16, 7 prosent med HPV18, mens brorparten har en infeksjon av en eller flere av de 12 genotypene som identifiseres samlet. Det er også en del av kvinnene (10 prosent) som er infisert med multiple genotyper (positive for to eller tre av HPV16, HPV18 eller hrHPV (12 genotyper).



Figur 3: (A) hrHPV-positivitetsraten totalt og for de tre analyserende laboratoriene som deltar i implementeringen av HPV-test i primærscreening. (B) Genotypefordeling blant kvinnene med positiv HPV-test.

Randomisert og gradvis innføring av HPV-test i primærscreening

I Norge skjer implementeringen av HPV-test i primærscreening i kontrollerte former der halvparten av kvinnene i alderen 34–69 år i de fire prøvefylkene inkluderes i første omgang. Dette sikrer at eventuelle endringer i endepunkter og prosessindikatorer kan relateres til den nye screeningalgoritmen, og ikke endringer i samfunnet. En individuell randomisering ble valgt framfor f.eks. cluster randomisering for å sikre at kjente regionale forskjeller i forekomst av forstadier til livmorhalskreft ikke skulle påvirke evalueringen.

Overgang til HPV-test i primærscreening medfører en betydelig omlegging av laboratorievirksomheten i Norge og er en stor endring for fagmiljøet. Både fastleger, gynekologer og laboratorieansatte trenger informasjon og kursing for å kunne bidra på et faglig høyt nivå. Tilbakemeldingene fra de involverte partene er at informasjonsflyt, IT-infrastruktur, logistikk og instrumentpark nå fungerer nesten problemfritt etter noen utfordringer i oppstartsperioden. Implementeringen medfører at behovet for cytologivirksomheten reduseres betraktelig. Antall cytologiske prøver er estimert til å reduseres fra 400 000 til rundt 100 000 ved en landsdekkende innføring, mens antall HPV-tester vil økes fra 10 000 i dag til rundt 200 000 [17]. Dette gir nye arbeidsoppgaver til laboratoriene, og det er en sterk anbefaling om at antall laboratorier reduseres kraftig fra de 18 laboratoriene som i dag analyserer celleprøver og HPV-tester tatt som ledd i livmorhalsprogrammet.

Samlet sett vil en gradvis implementering bidra til at man kan evaluere at HPV-test i primærscreening fungerer slik det skal, samtidig som infrastrukturen og informasjonsutleveringen kan etableres og kvalitetssikres og laboratorievirksomheten får tid til å omstille og reorganisere seg. Videre vil det være mulig å gjøre protokolljusteringer ved behov før nasjonal innføring.

Hjemmeprøvetaking og HPV-test

Økt sensitivitet og økt objektivitet i analysevurderingen er fordeler med HPV-test. En tredje fordel med analysemetoden er muligheten for å kunne bruke celleprøver tatt av kvinnen selv i eget hjem. I Norge er det i de senere år registrert et synkende oppmøte til Masseundersøkelsen mot livmorhalskreft, spesielt blant yngre kvinner. Dekningsgraden for 2012-2014 var på 67 prosent [10], mens det er ønskelig at den er over 80 prosent da lavt oppmøte begrenser effektiviteten av screeningprogrammet. Årsakene til at kvinner ikke deltar i screeningprogram er mange og komplekse, og løsningen for å øke deltagelsen vil være forskjellig fra person til person. Et tiltak som er testet ut i flere land innebærer at kvinnene selv tar en screeningprøve hjemme uten hjelp av helsepersonell og sender den til et laboratorium per post for videre undersøkelser. Denne celleprøve kan ikke vurderes cytologisk, men er velegnet for HPV-test. Ved en positiv HPV-prøve får kvinnen en sterk oppfordring til videre oppfølging hos lege. Hjemmeprøvetaking sparer kvinnen for tid og penger, kjente barrierer for screeningframmøte [18–20], samt psykologiske faktorer som en gynekologisk undersøkelse kan innebære. I flere internasjonale studier har hjemmeprøvetaking vist å gi økt oppslutning i land med organisert screeningprogram [21–23], og et pilotprosjekt i Oslo viste en økning i oppslutning fra 23 prosent i kontrollgruppen til 36 prosent i hjemmeprøvetakinggruppen [24]. I fremtiden kan det være aktuelt å tilby hjemmeprøvetaking for å øke deltakelsen i programmet, noe som vil gi bedre kreftforebygging.

Fremtidsperspektiver

Screening mot livmorhalskreft er i en spennende utvikling der HPV-testing ser ut til å få en sentral rolle. Primær HPV-test i screening har potensiale til å forebygge flere livmorhalskrefttilfeller og redusere dødeligheten av sykdommen sammenlignet med konvensjonell cytologi. Videre er forlenget tidsperiode mellom hver screeningprøve en av de antatte fordelene med primær HPV-testing, noe som reduserer antall legebesøk for kvinnene og kostnader for samfunnet. Primær HPV-testing er også fremtidsrettet med tanke på screening av HPV-vaksinerte kvinner. Fra 2022 vil jentene som har fått HPV-vaksinasjon som en del av barnevaksinasjonsprogrammet nå screeningalder. Antall kvinner med celleforandringer og forstadier av kreft er da forventet å bli redusert med minst 50 prosent i den vaksinerte kohorten [26]. Det er fortsatt uklart hvilken screeningstrategi som da er mest hensiktsmessig å bruke. For å høste fordelene av primær HPV-testing må involverte parter (fastleger, gynekologer, laboratoriene og Kreftregisteret med samarbeidspartnere) tilpasse seg og ta stilling til flere utfordringer: hvilken HPV-test skal brukes; bør screeningalder og/eller intervall endres; hvordan følge opp HPV-positive kvinner; hvordan få riktig og tilstrekkelig informasjon om HPV ut til involverte parter og hvordan sikres kvalitet og tilslutning i alle ledd av prosessen. Innsamling av erfaringer og viktig kunnskap er godt i gang gjennom implementeringen av primær HPV-test i fire prøvefylker, og resultatene vil være med å danne en grunnpilar for videre screeningarbeid i Norge med primær HPV-test i førersetet.

Mari Nygård og Stefan Lönnberg har deltatt i ekspertgrupper for utforming av nye rutiner for livmorhalskreftscreening. Stefan Lönnberg har hatt en aktiv rolle i de offentlige programmene for livmorhalsscreening både i Norge og Finland siden 2009. Birgit Engesæter har ikke meldt om særlige interessekonflikter i tilknytning til prosjektene.

Referanser

1. Walboomers JM, Jacobs MV, Manos MM, et al. Human papillomavirus is a necessary cause of invasive cervical cancer worldwide. J Pathol 1999;189:12-19.

2. Moscicki AB, Schiffman M, Burchell A, et al. Updating the natural history of human papillomavirus and anogenital cancers. Vaccine 2012;30 Suppl 5:F24-33.

3. Schiffman M, Castle PE, Jeronimo J, et al. Human papillomavirus and cervical cancer. Lancet 2007;370:890-907.

4. Papanicolaou GN. Cytological evaluation of smears prepared by the tampon method for the detection of carcinoma of the uterine cervix. Cancer 1954;7:1185-1190.

5. Laara E, Day NE, Hakama M. Trends in mortality from cervical cancer in the Nordic countries: association with organised screening programmes. Lancet 1987;1:1247-1249.

6. Magnus K, Langmark F, Andersen A. Mass screening for cervical cancer in Ostfold county of Norway 1959-77. Int J Cancer 1987;39(3):311-6.

7. Bjorge T, Gunbjorud AB, Haugen OA, et al. Mass screening for cervical cancer in Norway: evaluation of the pilot project. Cancer causes & control 1995;6:477-484.

8. Cancer in Norway 2014. Cancer incidence, mortality, survival and prevalence in Norway. Cancer Registry of Norway. 2015.

9. Lonnberg S, Hansen BT, Haldorsen T, et al. Cervical cancer prevented by screening: Long-term incidence trends by morphology in Norway. Int J Cancer 2015;137:1758-1764.

10. Skare GB, Lonnberg S. Masseundersøkelsen mot livmorhalskreft. Årsrapport 2013-2014. 2015.

11. Arbyn M, Ronco G, Anttila A, et al. Evidence regarding human papillomavirus testing in secondary prevention of cervical cancer. Vaccine 2012;30 Suppl 5:F88-99.

12. Nygard M, Roysland K, Campbell S, et al. Comparative effectiveness study on human papillomavirus detection methods used in the cervical cancer screening programme. BMJ open 2014;4:e003460.

13. Haldorsen T, Skare GB, Ursin G, et al. Results of delayed triage by HPV testing and cytology in the Norwegian Cervical Cancer Screening Programme. Acta oncologica 2015;54:200-209.

14. European guidelines for quality assurance in cervical cancer screening. In: Anttila A, Arbyn M, De Vuyst H, et al., eds., 2015.

15. Burger EA, Ortendahl JD, Sy S, et al. Cost-effectiveness of cervical cancer screening with primary human papillomavirus testing in Norway. Br J Cancer 2012;106:1571-1578.

16. Ronco G, Dillner J, Elfstrom KM, et al. Efficacy of HPV-based screening for prevention of invasive cervical cancer: follow-up of four European randomised controlled trials. Lancet 2014;383:524-532.

17. Vogt C, Eide ML, Hagmar B, et al. Fremtidig organisering av celleprøver i laboratorier. 2013.

18. Doescher MP, Jackson JE. Trends in cervical and breast cancer screening practices among women in rural and urban areas of the United States. Journal of public health management and practice : JPHMP 2009;15:200-209.

19. Eaker S, Adami HO, Sparen P. Reasons women do not attend screening for cervical cancer: a population-based study in Sweden. Prev Med 2001;32:482-491.

20. Harlan LC, Bernstein AB, Kessler LG. Cervical cancer screening: who is not screened and why? American journal of public health 1991;81:885-890.

21. Bais AG, van Kemenade FJ, Berkhof J, et al. Human papillomavirus testing on self-sampled cervicovaginal brushes: an effective alternative to protect nonresponders in cervical screening programs. Int J Cancer 2007;120:1505-1510.

22. Virtanen A, Nieminen P, Luostarinen T, et al. Self-sample HPV tests as an intervention for nonattendees of cervical cancer screening in Finland: a randomized trial. Cancer Epidemiol Biomarkers Prev 2011;20:1960-1969.

23. Wikstrom I, Lindell M, Sanner K, et al. Self-sampling and HPV testing or ordinary Pap-smear in women not regularly attending screening: a randomised study. Br J Cancer 2011;105:337-339.

24. Enerly E, Bonde J, Schee K, et al. Self-sampling for human papillomavirus testing among non-attenders to the Norwegian Cervical Cancer Screening Programme. (*Submitted)*.

25. Smith JS, Lindsay L, Hoots B, et al. Human papillomavirus type distribution in invasive cervical cancer and high-grade cervical lesions: a meta-analysis update. Int J Cancer 2007;121:621-632.

FightHPV: Et spill som skal øke bevisstheten rundt HPV, og «dulte» folk til å forebygge livmorhalskreft

Sagar Sen, PhD[1], Tomas Ruiz Lopez, PhD[2], Elisabeth Jakobsen, MSc[3], Mari Nygård, MD, PhD[2]
[1] Software Engineering Department, Simula Research Laboratory
[2] Forskningsavdelingen, Kreftregisteret
[3] Administrasjonsavdeling, Kreftregisteret

«Gjennom spill og lek blir mennesker trygge nok til å forsøke nye ting»

Kreftregisteret og Simula har utviklet mobilspillet FightHPV i et forsøk på å øke bevissthet og kunnskap om humant papillomavirus (HPV) og følgene av det, særlig livmorhalskreft. Økningen i smarttelefonbruk gjør det mulig å bruke spilltenkning for å øke bevisstheten om screening og HPV, men foreløpig dette en tilnærming som i liten grad er utforsket vitenskapelig. Det ønsker vi nå å endre på.

Innledning

Den nederlandske kulturhistorikeren Johan Huizinga mente at trangen til lek og spill er et av menneskets grunnleggende trekk. Slik har det vært gjennom alle tider i kulturhistorien, skriver han i sin bok *Homo Ludens* [1] (Det lekende menneske) fra 1938. Han skriver at selv dyrene leker, og de venter ikke på at menneskene skal lære dem det.

Selv om fenomenet med spill er tidløst av natur, har spillkulturen utviklet seg kontinuerlig, og de ulike tidsepokene har satt sine særpreg på spillene vi spiller. Gjennom de siste årene har dataspillet blitt et kulturfenomen, samtidig som digitale medier har blitt den nærmeste kulturarena for mange. Påvirkningskraften som dataspill har øker stadig etter hvert som teknologisk utvikling gir enklere tilgang til spill gjennom smarttelefoner og kobling opp mot internett. Slik utvikling har utvilsomt påvirket og fortsetter å påvirke populærkulturen i vår samtid [2]. Det er verdt å merke seg at på verdensbasis ligger antallet mobilspillere på rundt 1,5 milliarder mennesker [3]. I 2013 brukte 68 prosent av befolkningen i Norge smarttelefon, og 67 prosent har brukt telefonen til å spille spill [4].

Den dramatiske økningen i smarttelefonbruk gjør det mulig å bruke engasjerende spilltenkning og -metoder for å øke bevisstheten rundt ulike temaer innen folkehelse. Dette kan bli en viktig kommunikasjonskanal, som ikke er fullt utnyttet ennå [5].

Livmorhalskreft, for eksempel, er en sykdom som teoretisk sett kan forebygges. Denne forebyggingen blir enklere dersom flest mulig skjønner hvordan sykdommen oppstår. I hvor stor grad er folk klar over at humant papillomavirus (HPV) er en forutsetning for å utvikle livmorhalskreft? Er alle i befolkningen klar over at HPV-smitte er veldig vanlig, men for de fleste ufarlig? Har vi samtidig en felles forståelse av at hos noen få utvikler viruset seg til den dødelige sykdommen livmorhalskreft? Vet alle at det er avgjørende å delta regelmessig i screening for å unngå kreft?

Denne innsikten er avgjørende for at befolkningen skal godta brede folkehelsetiltak som masseundersøkelser, eller screening, og i siste årene vaksinasjon mot HPV. Det å formidle helseinformasjon og kompleks medisinsk kunnskap bør være et viktig mål for helsesektoren i arbeidet med å fremme god helse i befolkningen.

Vi har utviklet en mobil app, mobilspillet FightHPV, for å øke bevissthet og kunnskap om HPV, de forskjellige virustypene og sykdommer som kan oppstå etter smitte, da spesielt livmorhalskreft. (Figur 1)

I løpet av seks episoder introduserer vi karakterene i spillet. De har navn løst basert på medisinske begreper, som den kvinnelige karakteren som heter Epithel, etter epitelvev – cellelaget som kler en utvendig eller innvendig kroppsoverflate. I spillet finner vi også lavrisiko HPV, høyrisiko HPV, kjønnsvorter, kreftceller, konisering, vaksinasjon og screening (Figur 2).

Reglene i spillet gjenspeiler hvordan karakterene påvirker hverandre i den virkelige verden. Når en epitelcelle blir angrepet av høyrisiko HPV, for eksempel, dukker en ny karakter opp, kreftcellen.

Spillerne kan publisere resultatene sine i nettsamfunnet gjennom plassering på et scoreboard. Å dele egen utvikling med hverandre trigger konkurranseinstinktene og fører til nye mål og ny kunnskap. Derfor er FightHPV ikke bare et spill, men også et nyttig verktøy som skal oppfordre folk til å ta vare på seg selv, og til og med redde liv ved å påvirke andre i sin sosiale sirkel. Vi håper FightHPV skal finne veien til mange smarttelefoner, spre budskapet om HPV, og gi oss nyttig kunnskap om hvordan vi kan utnytte spillifisering i folkehelseperspektivet. Det er nemlig ikke påvist at bruk av sosiale medier i helserettede kampanjer eller spill fører til bedre helse. Derfor er det viktig å evaluere påvirkningskraften i FightHPV i en vitenskapelig studie.

I den første utgaven av spillet har vi inkludert en funksjon som oppmuntrer spillerne å delta i en studie. Ved hjelp av BankID og kobling til personnummer indentifiserer spilleren seg selv og får fullsteding informasjon om studien. Spørsmålene er lagt opp slik at de ikke skal være tidkrevende eller kompliserte å svare på. Ved å takke ja, gir spilleren også tillatelse til at forskerne kan hente inn informasjon om dem fra ulike registre som Statistisk Sentralbyrå og Kreftregisteret. På den måten får vi vite mer om spillerne, og vi kan karakterisere den typiske spiller; kjønn, alder, utdannelse og så videre.

Vi skal også se på deltagelse i livmorhalsprogrammet både før og etter bruk av spillet. Ingen data er identifiserbare etter koblingene og vi håper på at så mange som mulig takker ja, og deltar i denne studien.

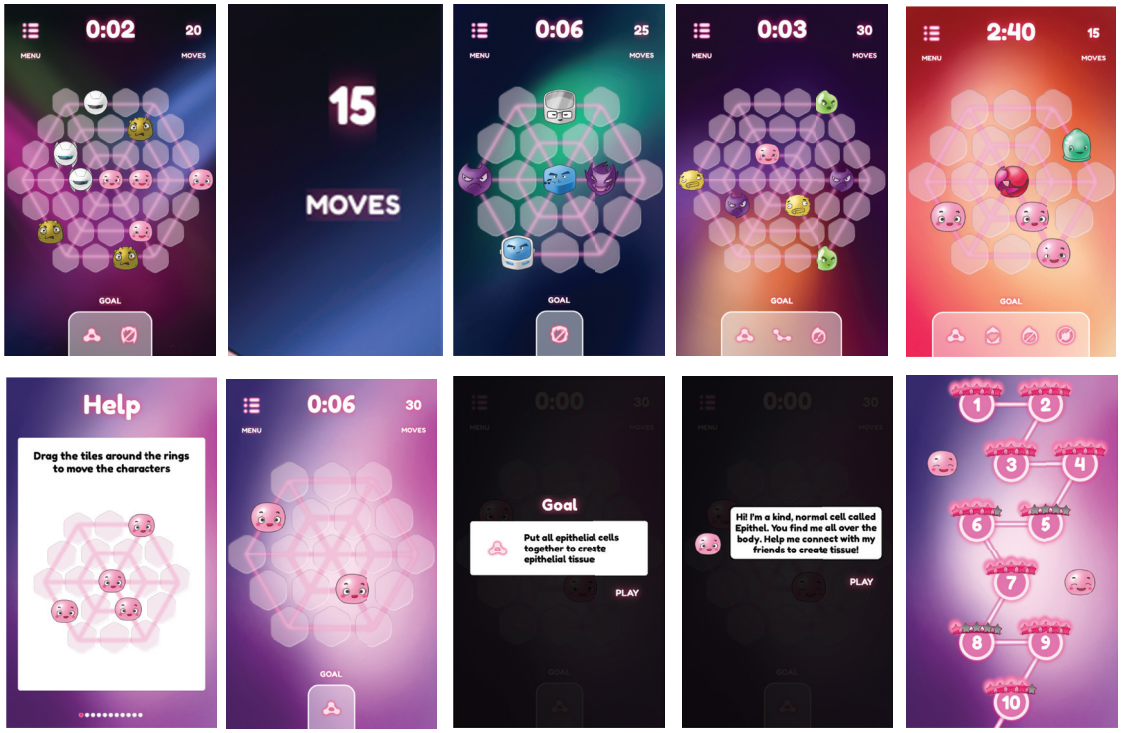


Figure 1. Skjermbilder av FightHPV

Kommunikasjon om livmorhalskreft i Norge

Livmorhalskreft er en kreftform som det er mulig å forebygge, men kun dersom kvinner velger å delta regelmessig i screening. I så å si alle land med et effektivt screeningprogram, deriblant Norge og Island, er det en del av befolkningen, gjerne om lag 20 prosent, som velger å stå utenfor programmet. Vi vet at kvinner som aldri har blitt screenet, må ta en høyere del av belastningen med livmorhalskreft enn de som deltar i screeningen.

I en undersøkelse med 12 000 kvinner mellom 25 og 45 år, bosatt i Norge, viste det seg at den sterkeste indikatoren for om en kvinne deltok i screeningprogrammet, var hvor bevisst hun var på hvorfor det var nødvendig å ta celleprøve hvert tredje år [6]. I en annen studie med 3 800 kvinner mellom 25 og 69 år, skjønte færre enn halvparten informasjonen i et brev som skulle informere kvinnene om konsekvensene av en positiv screeningprøve [7]. Kampanjer med presseoppslag, der målet er å øke oppmøtet i et screeningprogram er viktige, men har vist seg kun å ha midlertidig effekt [8]. Selv om disse funnene viser at bevissthet i befolkningen rundt livmorhalskreft og screening er viktig for å øke oppmøtet, er det også tydelig at vi trenger enda mer effektive og varige former for kommunikasjon rundt helserelaterte spørsmål.

De tradisjonelle strategiene for å øke screeningdeltakelsen, som for eksempel personlige invitasjonsbrev, har ikke vært nok til å motivere ikke-screenede kvinner til å delta. Av de som ikke har møtt opp til screening i løpet av de siste fire årene og har fått påminnelse nummer to fra Kreftregisteret, er det fortsatt bare 18 prosent som møter opp i løpet av et halvt år [9]. Dette viser at det er et sterkt behov for en alternativ framgangsmåte, tilpasset og skreddersydd dem som ellers velger å ikke delta.

Ved siden av screening er det nå mulig å vaksinere seg mot HPV, og i Norge får alle jenter på 7. trinn tilbud om vaksinen gjennom barnevaksinasjonsprogrammet. Etter hvert som flere blir vaksinert, kommer også dette til å føre til at færre får livmorhalskreft. Igjen er bevissthet og kunnskap rundt virusene og sammenhengen med kreft viktig for at vaksinasjonsdekningen skal bli best mulig [10]. I Norge har dekningen av vaksinen økt fra 68 prosent for de første kullene som fikk tilbud om vaksinen i 2009 til over 80 prosent i 2014 [11]. Forskere har studert sammenhengen mellom hvilke jenter som får vaksinen og demografiske og sosioøkonomiske trekk hos foreldrene. Studien viser en sammenheng mellom vaksinasjonsdekning og foreldrenes alder, inntekt, utdannelse og sysselsetting [11]. Dekningen av HPV-vaksinen er imidlertid lavere enn for vaksinen som beskytter mot meslinger, kusma, røde hunder (MMR) – noe som skulle tilsi at det fortsatt er stort potensial for å bedre dekningen for HPV-vaksinen.

Spillifisering og sosial dulting

En rekke publikasjoner viser at spillifisering kan øke brukernes vilje til å utføre oppgaver som ellers opplevdes som kjedelige ved at oppgaven framstår som mer interessant. For eksempel har Meder et al [12] vist at spillifisering kan påvirke brukere til å bidra til en dokumentasjons-wiki for et foretak. Noe av grunnen til at spill fungerer slik, er at mennesker liker å konkurrere og dele spillopplevelsen eller resultatene sine med venner eller andre spillere [13–14]. Forskere har også diskutert hvilke muligheter det er for å bruke mekanismene i spillifisering i helserelaterte applikasjoner for å bedre pasienters medvirkning [5–15].

Det er lek som gjør at folk ikke er redde for å feile, men blir trygge nok til å prøve seg på nye ting. Det er lek som hjelper oss til å gjøre de viktige tingene bedre - fordi vi liker det, og opplever gleden ved mestring.
– Jake Orlowitz, leder for Wikipedia-biblioteket, Wikimedia Foundation.

FightHPV kombinerer formidlingen av kunnskap om HPV, spillifisering og sosial dulting. Gjennom dulting skapes en sterkere ramme rundt den enkeltes valg når det gjelder forebygging av livmorhalskreft.

Å skape en sosial holdning rundt det personlige valget om å ta HPV-vaksine eller delta i screening, er ingen lett oppgave, men verdt å prøve ettersom en slik norm er en viktig påvirkningskraft for at en person skal ta det valget som er framstilt som "riktig".

Sosial dulting er en del av menneskets grunnleggende natur, ettersom vi alle er aktivt tilstede i livene til våre venner og slektninger, og deltar i diskusjoner med hverandre rundt blant annet helse og livsstil. FightHPV er bygget opp slik at insentivene i spillet, basert på spillerens meritter, gjør spilleren i stand til å dele kvalitetssikret informasjon, dulte andre i retning av screening ved hjelp av sosiale nettverk som Facebook, Google+ og til og med sms. FightHPV kan bli en del av denne dultingen, ved å bidra med kunnskap og vitenskap som i sin tur blir en del av utviklingen i overordnet, samfunnsmessig helse, forbedrede legebesøk og bedre livsstilvalg.

Så vidt vi vet har effekten av sosial nudging og spillifisering aldri før blitt prøvd ut som en metode for å øke deltakelsen for den under-screenede/underbehandlede delen av kvinner i forbindelse med livmorhalskreft.

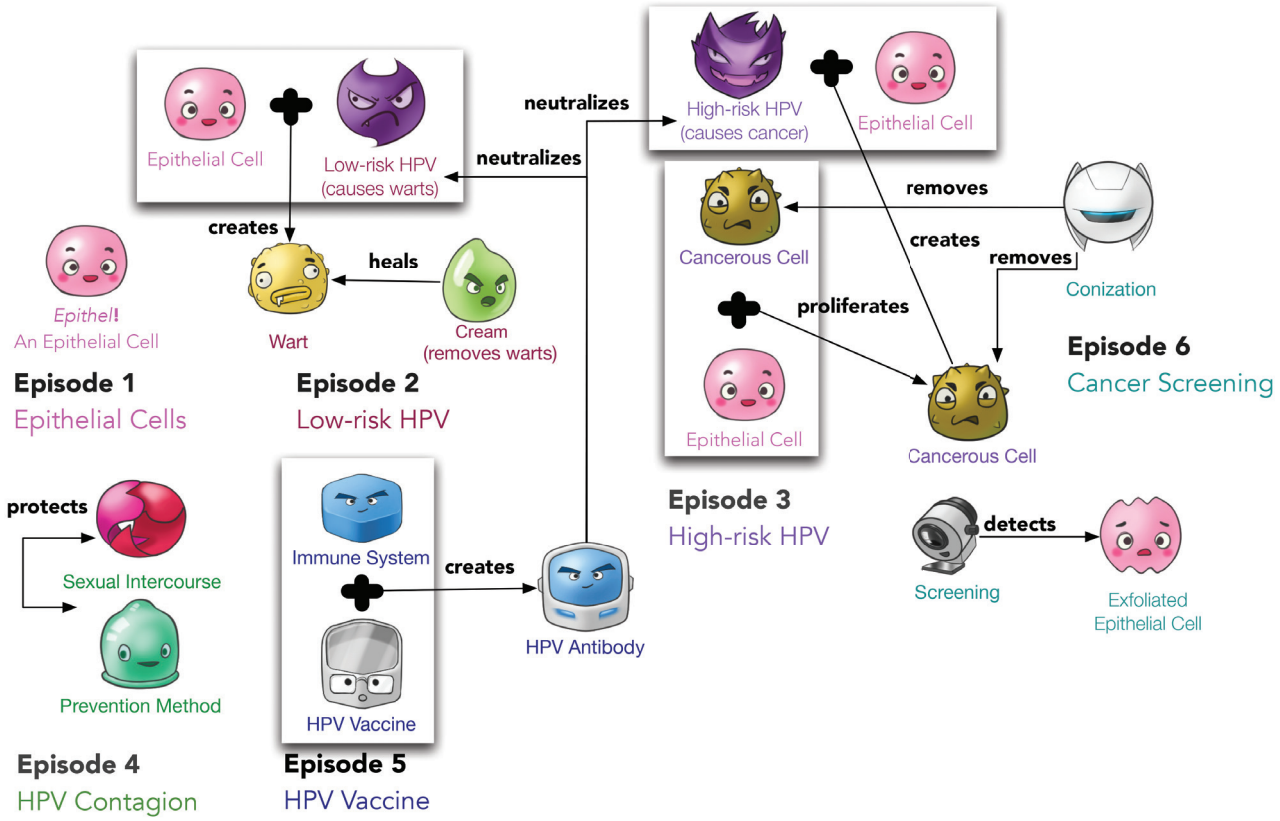


Figure 2. Karakterene i mobilspillet FightHPV

Konklusjon

FightHPV bidrar med utfyllende informasjon om personlig helse, HPV, screening og vaksinasjon – kunnskap som er nyttig også utenom spillsammenheng.

Innebygget i FightHPV ligger det teknologi som gjør at vi kan hente inn informert samtykke på en sikker måte, og gjennomføre epidemiologiske studier. FightHPV skal etter planen lette tilgjengeligheten til offentlige og private helsetjenester, ved å tilby et kart over steder i nærheten der det finnes muligheter for å få vaksine, ta celleprøve og få tak i kondomer eller annen prevensjon.

Spillet FightHPV slippes i desember 2015 i Google Play Store (Android) og senere i Apple Store (iOS). Spillet finnes i startfasen på engelsk og norsk, men kan enkelt oversettes til flere språk.

Spillet tilpasses i så fall til de ulike landene, og kultur, adferd og folkehelseforskning legger grunnlag for lokale justeringer.

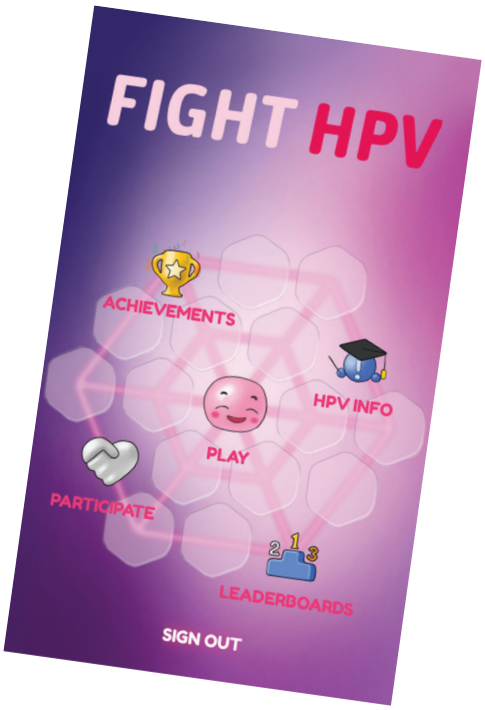
Vi håper å se at spillet skal utvikle seg videre etter at vi har publisert det, at det kommer regelmessige oppdateringer i Play/App store, og at oppdateringene gjenspeiler tilbakemeldinger fra spillere.

Kreftregisteret i Norge skal evaluere effekten av spillet, og følge med på hvilken innvirkning det har på screeningadferden blant spillerne i en periode på tre år etter lanseringen.

Takk til:

Vi er takknemlige for at NIASC-konsortiet av kreft-registre har bidratt med finansiering av dette prosjektet. Vi vil takke Yuanrui Li fra Oslo for designet av karakterene, animasjonene og bakgrunnene i FightHPV. Vi takker Kristina Schee, Maarit Leinonen, Ragnhild Flingtorp, Ameli Tropé, Michael Riegler, Philip E. Castle og Mathias Lux for nyttige kommentarer og innspill. Takk til Madleen Orumaa for hjelp med referansene.

Mari Nygård har mottatt finansiell støtte fra MSD Norge til forskningsprosjekter gjennom sin tilknyttede forskningsinstitusjon. Prosjektene ledes av Nygård som også leder ekspertgrupper for utforming av nye rutiner for livmorhalskreftscreening. Sagar Sen, Tomas Ruiz Lopez og Elisabeth Jakobsen har ikke meldt om interessekonflikter.



GOD SPILLOPPLEVELSE!

Referanser

1. Huizinga J. Homo Ludens Ils 86. Routledge 2014.

2. Castells M, Fernandez-Ardevol M, Qiu JL, et al. Mobile Communication and Society: A Global Perspective. The MIT Press 2009.

3. Mobile gamers world-wide. Date accessed: 26.10.2015. http://www.statista.com/statistics/297874/number-mobile-gamers-region/.

4. Google. Our Mobile Planet Report. Date accessed: 26.10.2015. http://think.withgoogle.com/mobileplanet/en/.

5. Papastergiou M. Exploring the potential of computer and video games for health and physical education: A literature review. Computers & Education 2009;53:603-622.

6. Hansen BT, Hukkelberg SS, Haldorsen T, et al. Factors associated with non-attendance, opportunistic attendance and reminded attendance to cervical screening in an organized screening program: a cross-sectional study of 12,058 Norwegian women. BMC Public Health 2011;11:264.

7. Burger EA, Nygard M, Gyrd-Hansen D, et al. Does the primary screening test influence women's anxiety and intention to screen for cervical cancer? A randomized survey of Norwegian women. BMC Public Health 2014;14:360.

8. Anderson JO, Mullins RM, Siahpush M, et al. Mass media campaign improves cervical screening across all socio-economic groups. Health Educ Res 2009;24:867-875.

9. Lönnberg S, Skare G. Masseundersøkelsen mot livmorhalskreft. Årsrapport 2012. Kreftregisteret 2014.

10. Dahlstrom LA, Tran TN, Lundholm C, et al. Attitudes to HPV vaccination among parents of children aged 12-15 years-a population-based survey in Sweden. Int J Cancer 2010;126:500-507.

11. Hansen BT, Campbell S, Burger E, et al. Correlates of HPV vaccine uptake in school-based routine vaccination of preadolescent girls in Norway: A register-based study of 90,000 girls and their parents. Prev Med 2015;77:4-10.

12. Meder, M., Plumbaum, T., and Hopfgartner, F., DAIknow: A Gamified Enterprise Bookmarking System. Advances in Information Retriveal. 2014.

13. Eickhoff C, Harris CG, Vries APd, et al. Quality through flow and immersion: gamifying crowdsourced relevance assessments. International ACM SIGIR conference on Research and development in Information Retrieval, 2012.

14. Riegler M, Eg R, Lux M, et al. A Crowdsourced Serious Game for Simulating Human Perception. 3rd Workshop on Social Media for Crowdsourcing and Human Computation ad SocInfo, 2014.

15. Lister C, West JH, Cannon B, et al. Just a fad? Gamification in health and fitness apps. JMIR Serious Games 2014;2:e9.

FightHPV – spilldesign og hvordan man spiller

FightHPV foregår på et sekskantet brett på mobiltelefonen, som vist på skjermdumpen i Figur 1 (Side 138). Spillet består av seks episoder, med ti nivåer i hver episode. Spillet blir stadig mer komplekst, og underveis øker spillerens kunnskap, etter hvert som nye karakterer og regler kommer til. Figurene og reglene informerer spilleren om biologi, karaktertrekk ved ulike organismer og medisinske hjelpemidler mot HPV-smitte og –risiko, se Figur 2 (Side 140).

Episode 1: Epitelcellene presenterer karakteren Epithel, en epitelcelle. Poenget med brettene i Episode 1 er å koble sammen epitelceller, enten ved å rotere lagene i hexagonen, eller flytte felter langs diagonalen, som vist i Figur 1. Spilleren må legge en strategi for å klare brettet på færrest mulig trekk, og samtidig få mest mulig poeng. Vanskelighetsgraden øker fra nivå 1 til nivå 10.

Episode 2: Lavrisiko HPV presenterer en karakter som representerer typer av HPV med lav risiko, for eksempel HPV-typene 6/11, som forårsaker kjønnsvorter. Hvis et lav-risiko HPV havner ved siden av en epitelcelle, forvandler cellen seg til en vorte, og spillet er over. Senere i spillet dukker imidlertid den nye karakteren Cream opp. Denne kan fjerne vorter og reversere effekten av infeksjonen.

Episode 3: Høyrisiko HPV presenterer høy-risiko HPV-typer; for eksempel HPV 16/18 – en karakter som omformer nærliggende epitelceller til kreftceller. Kreftcellene kan i sin tur påvirke friske epitelceller andre steder. Spilleren må koble sammen celler uten at de kommer i kontakt med høy-risikotype HPV.

Episode 4: HPV-smitte illustrerer spredning av virus blant ubeskyttede epitelceller, for å poengtere hvordan ubeskyttet seksuell kontakt kan føre til spredning av både lav-risiko og høy-risiko HPV. Spilleren må koble sammen epitelceller for å unngå at infeksjoner sprer seg på brettet på grunn av virusene. Prevensjonsmidler som kondom dukker opp som karakterer i et av brettene for å visualisere at kondom beskytter ved samleie. Spilleren får imidlertid beskjed om at kondomer ikke er fullgod beskyttelse, men at risikoen for infeksjon blir betydelig redusert.

Episode 5: HPV-vaksine har som mål å forklare på en enkel måte hvordan HPV-vaksinen fungerer. Vaksinasjonen presenteres som en virus-liknende partikkel som ikke inneholder noe arvestoff fra viruset og derfor ikke er smittefarlig. Denne karakteren påvirker immunsystemet til å danne antistoffer som så kan nøytralisere både lav-risiko HPV, som danner vorter, og høy-risiko HPV, som danner kreftceller. Tilleggsinformasjon i spillet viser enkle forklaringer og illustrasjoner om viruset og den DNA-løse vaksinen.

Episode 6: Livmorhalskreft screening spillifiserer forståelsen av screening mot livmorhalskreft for spilleren. Karakteren som representerer screening hjelper til med å finne og fjerne syke celler, og koniserings-karakteren fjerner kreftceller, dersom de blir oppdaget i tide.

Mobilspillet FightHPV vil være tilgjengelig i app-store og Google Play i løpet av 2016.

Return address:
Kreftregisteret
P.O. box 5313 Majorstuen
N-0304 Oslo
Norway

2014

Cancer in Norway

Cancer Registry of Norway
Institute of Population-based Cancer Research

Postal address:
P.O. box 5313 Majorstuen
N-0304 Oslo
Norway

Office address:
Ullernchausseen 64, Oslo

Telephone: +47 22 45 13 00

E-mail: kreftregisteret@kreftregisteret.no
Internet: www.kreftregisteret.no