# 70 years of cancer transition in Norway:
## a comparison of registry incidence profiles 1953-1957 and 2016-2020

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**ABSTRACT**

The Cancer Registry of Norway is one of the oldest population-based cancer registries in the world. Registration commenced in 1952, with complete data on new cancer cases available for the whole country from 1953 onwards. On its seventieth anniversary, this short report highlights a few of the key transitions in cancer in Norway from the 1950s to the present day, comparing the ranking of incidence rates for the top 10 cancers in males and females in the registration periods 1953–1957 and 2016–2020. The analysis highlights both major transitions in the cancer distribution, as well as some degree of permanency with respect to the importance of major cancer types.



## INTRODUCTION

The Cancer Registry of Norway is one of the oldest population-based cancer registries in the world. Registration commenced in 1952, with complete data on new cancer cases available for the whole country from 1953 onwards. With data spanning up to and including the year 2021 at present, the registry incidence database allows an exposition of how the cancer landscape has evolved in the country over almost three-quarters of a century.

There have been relatively few investigations that focus on the long-term changes in the profile of cancer, not least given the general limitation of availability of quality-assured data. Such studies however can serve to elucidate how cancer control interventions have impacted on cancer against a backdrop of changing societal, economic, and lifestyle factors which define the underlying cancer risk in the community. This short report highlights a few of the key transitions in cancer in Norway from the 1950s to the present day.

## DATA SOURCES AND METHODS

The incidence and corresponding population data were obtained from the Cancer Registry of Norway for two 5-years periods, the first complete 5-year registration period (1953–1957) and the most recent (2016–2020) via the NORDCAN database[1]. NORDCAN, a collaboration of the Association of the Nordic Cancer Registries (ANCR) and the International Agency for Research on Cancer (IARC) from which data are delivered from each national cancer registry is financially supported by the Nordic Cancer Union (NCU). The project provides timely population-based cancer statistics for the Nordic countries in tables and figures for more than 50 cancer entities based on the International Statistical Classification of Diseases and Related Health Problems (ICD) codes, accessible through a powerful online platform. Different coding classification systems have been used in Norway over time, with ICD-7 used from 1953–1992 and ICD-10 from 1993 onwards. While this may result in certain comparability problems for some sites (e.g. liver cancer), it is not likely to materially affect the results presented here based on ICD-10. More details are available on the NORDCAN website (https://nordcan.iarc.fr/en/database).

To contrast the profiles of cancer incidence in Norway over 70 years, the age-standardised (world) incidence rates (ASR) of the 10 most common cancers in the first and the last periods are presented, respectively, in two bar charts for males and females separately. The red, green, and black lines, respectively, indicate either an increase, decrease, or no change in the ranking of the specific cancers between the mid-1950s and late-2010s. Where the ranking is within the top 10 in one period, but below the tenth position in the other, their relative position in the latter period is also noted. This is complemented by the inclusion of the mean number of cases annually, and age-standardised (world) incidence rates, as markers of scale and risk in the two periods.

## RESULTS

Figure 1 shows how the ranking of the top 10 ASR in males and females changed over time in Norway from 1953–1957 to 2016–2020. Tables 1a-b provide the corresponding mean annual number of cases, the proportion of all cancers combined, and the corresponding ASR and cumulative risk, by sex. The Norwegian population has increased in size by 55% over the timespan from 3.43 million (49.8% males) in the former period to 5.31 million (50.4% males) in the latter, yet the number of new cases has risen disproportionately in both sexes (Table 1). There has been a five-fold increase in the number of new cases in men from 1953–1957 (3596 cases) to 2016–2020 (18646 new cases), and a four-fold increase among women, from 3833 to 16 007 cases, respectively. This absolute increase in the total number of cancer cases reflects a complex mix of both increasing

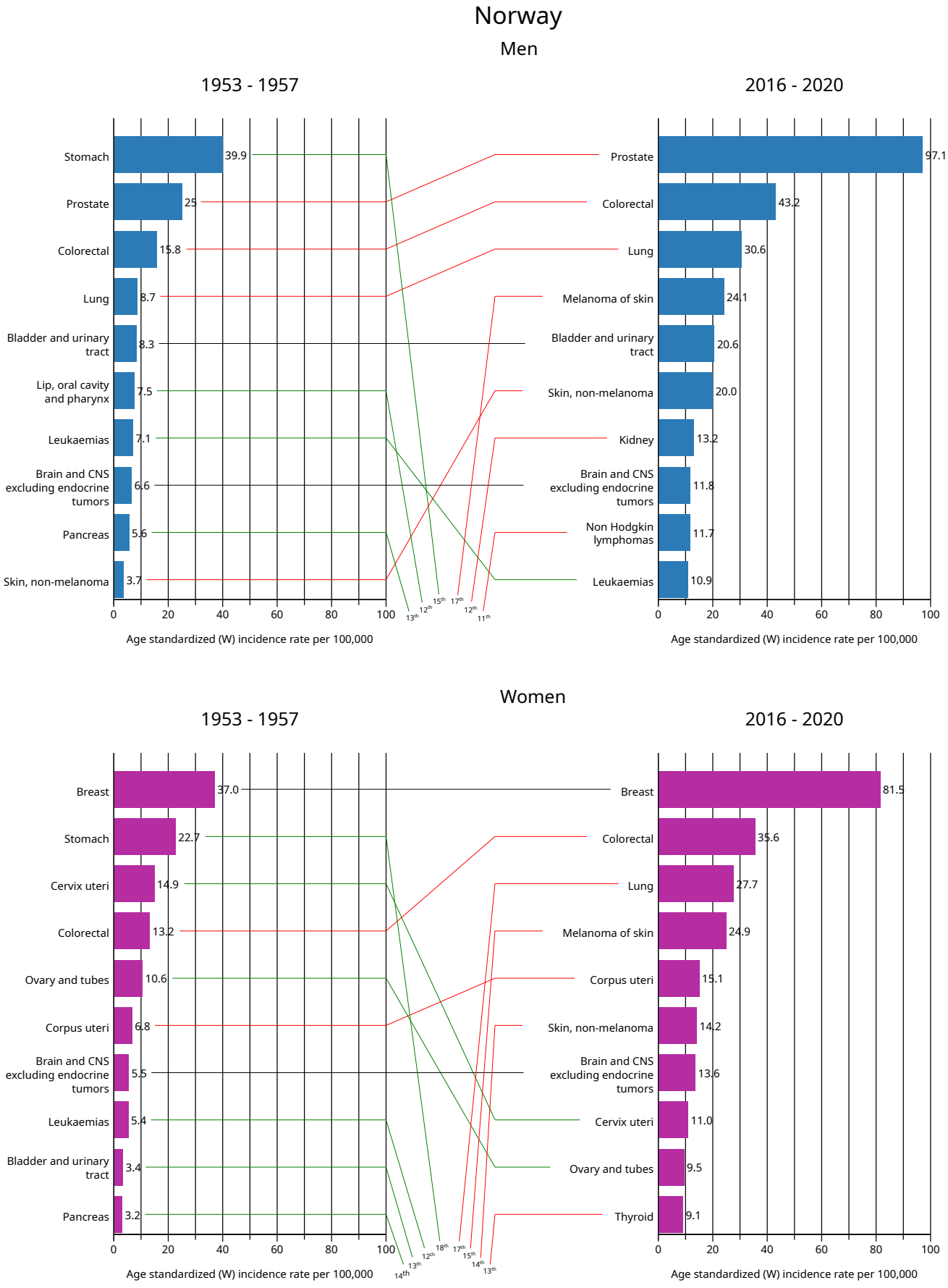


**Figure 1.** Profiles of cancer incidence in Norway over 70 years: ranking of the top 10 age-standardised (World) rates in males and females in 1953– 1957 and 2016– 2020. The red, green, and black lines, respectively, indicate either an increase, decrease, or no change in ranking. The relative position is noted if below top 10 in one of the two periods.

**Table 1a.** Number of cases (mean annual and % of all cancers combined), age-standardised (world) incidence rates and cumulative risk (ages 0-74), in Norway in 1953-1957 and 2016-2020, males; top 20 cancers are shown, sorted by ASR 2016-2020.

| | 1953-1957 | | | | 2000-2016 | | | |
|---|---|---|---|---|---|---|---|---|
| Cancer site | Number* | % of total | ASR (World) | Cum. risk [0-74] (%) | Number* | % of total | ASR (World) | Cum. risk [0-74] (%) |
| Prostate | 582 | 16.2% | 25.0 | 2.9 | 5082 | 27.3% | 97.1 | 12.2 |
| Colorectal | 348 | 9.7% | 15.8 | 1.9 | 2296 | 12.3% | 43.2 | 4.9 |
| Lung | 180 | 5.0% | 8.7 | 1.1 | 1700 | 9.1% | 30.6 | 3.8 |
| Melanoma of skin | 38 | 1.1% | 1.8 | 0.19 | 1162 | 6.2% | 24.1 | 2.7 |
| Bladder and urinary tract | 180 | 5.0% | 8.3 | 1.00 | 1182 | 6.3% | 20.6 | 2.3 |
| Skin, non-melanoma | 83 | 2.3% | 3.7 | 0.37 | 1311 | 7.0% | 20.0 | 1.7 |
| Kidney | 70 | 2.0% | 3.4 | 0.42 | 616 | 3.3% | 13.2 | 1.6 |
| Brain and CNS excluding endocrine tumors | 125 | 3.5% | 6.6 | 0.62 | 446 | 2.4% | 11.8 | 1.1 |
| Non Hodgkin lymphomas | 72 | 2.0% | 3.6 | 0.39 | 551 | 3.0% | 11.7 | 1.3 |
| Leukaemias | 138 | 3.8% | 7.1 | 0.72 | 467 | 2.5% | 10.8 | 1.1 |
| Testis | 51 | 1.4% | 2.8 | 0.22 | 297 | 1.6% | 10.3 | 0.81 |
| Lip, oral cavity and pharynx | 165 | 4.6% | 7.5 | 0.86 | 419 | 2.2% | 8.9 | 1.1 |
| Pancreas | 120 | 3.3% | 5.6 | 0.72 | 442 | 2.4% | 8.1 | 0.95 |
| Multiple myelomas | 49 | 1.4% | 2.3 | 0.31 | 297 | 1.6% | 5.6 | 0.67 |
| Stomach | 880 | 24.5% | 39.9 | 4.7 | 283 | 1.5% | 5.2 | 0.60 |
| Oesophagus | 73 | 2.0% | 3.3 | 0.40 | 238 | 1.3% | 4.6 | 0.59 |
| Liver | 15 | 0.4% | 0.75 | 0.08 | 220 | 1.2% | 4.3 | 0.51 |
| Thyroid | 17 | 0.5% | 0.79 | 0.09 | 135 | 0.7% | 3.4 | 0.36 |
| Hodgkin lymphomas | 40 | 1.1% | 2.2 | 0.20 | 88 | 0.5% | 2.7 | 0.24 |
| All sites | 3596 | 100.0% | 166.8 | 17.5 | 18646 | 100.0% | 364.6 | 34.8 |

*The Norwegian population was 3.43 million (49.8% males) 1953-57 and 5.31 million (50.4% males) in 2016-20.

**Table 1b.** Number of cases (mean annual and % of all cancers combined), age-standardised (world) incidence rates and cumulative risk (ages 0-74), in Norway in 1953-1957 and 2016-2020, females; top 20 cancers are shown, sorted by ASR 2016-2020.

| | 1953-1957 | | | | 2000-2016 | | | |
|---|---|---|---|---|---|---|---|---|
| Cancer site | Number* | % of total | ASR (World) | Cum. risk [0-74] (%) | Number* | % of total | ASR (World) | Cum. risk [0-74] (%) |
| Breast | 855 | 22.3% | 37.0 | 4.0 | 3545 | 22.1% | 81.5 | 8.8 |
| Colorectal | 341 | 8.9% | 13.2 | 1.6 | 2143 | 13.4% | 35.5 | 3.9 |
| Lung | 43 | 1.1% | 1.8 | 0.22 | 1611 | 10.1% | 27.7 | 3.6 |
| Melanoma of skin | 46 | 1.2% | 2.1 | 0.21 | 1114 | 7.0% | 24.9 | 2.6 |
| Corpus uteri | 154 | 4.0% | 6.8 | 0.78 | 781 | 4.9% | 15.1 | 1.8 |
| Skin, non-melanoma | 56 | 1.5% | 2.1 | 0.20 | 1126 | 7.0% | 14.2 | 1.3 |
| Brain and CNS excluding endocrine tumors | 110 | 2.9% | 5.5 | 0.51 | 533 | 3.3% | 13.6 | 1.4 |
| Cervix uteri | 322 | 8.4% | 14.9 | 1.5 | 364 | 2.3% | 11.0 | 1.0 |
| Ovary and tubes | 235 | 6.1% | 10.6 | 1.2 | 454 | 2.8% | 9.5 | 1.1 |
| Thyroid | 50 | 1.3% | 2.1 | 0.24 | 324 | 2.0% | 9.1 | 0.90 |
| Non Hodgkin lymphoma | 45 | 1.2% | 2.1 | 0.22 | 419 | 2.6% | 8.1 | 0.91 |
| Leukaemia | 108 | 2.8% | 5.4 | 0.52 | 319 | 2.0% | 7.2 | 0.69 |
| Bladder and urinary tract | 89 | 2.3% | 3.4 | 0.43 | 391 | 2.4% | 6.1 | 0.71 |
| Pancreas | 82 | 2.1% | 3.2 | 0.39 | 385 | 2.4% | 6.0 | 0.70 |
| Kidney | 63 | 1.6% | 2.8 | 0.32 | 289 | 1.8% | 5.9 | 0.69 |
| Lip, oral cavity and pharynx | 57 | 1.5% | 2.3 | 0.24 | 237 | 1.5% | 4.5 | 0.52 |
| Multiple myelomas | 36 | 0.9% | 1.5 | 0.19 | 211 | 1.3% | 3.6 | 0.42 |
| Stomach | 608 | 15.9% | 22.7 | 2.4 | 170 | 1.1% | 2.9 | 0.32 |
| Liver | 10 | 0.3% | 0.40 | 0.04 | 124 | 0.8% | 2.2 | 0.25 |
| All sites | 3833 | 100.0% | 161.1 | 16.2 | 16007 | 100.0% | 316.6 | 29.7 |

*The Norwegian population was 3.43 million (49.8% males) 1953-57 and 5.31 million (50.4% males) in 2016-20.

and decreasing cancer-specific trends, an ageing and growing population in Norway, as well as the increased capacity and accuracy of diagnostic workup.

The major mover is stomach cancer, with incidence rates falling markedly over time in both sexes. From being the most frequent male cancer in the period 1953–1957 (responsible for one in four cancers), the disease ranked 15th (corresponding to one in 20 cancers) by 2016–2020 (Figure 1). In women, it is now the 18th most common cancer, despite ranking second in the mid-

1950s. Cancers of the lip, oral cavity and pharynx have also fallen out of the top 10 in men over the 70-year period, as has leukaemia and bladder cancer in females (the latter contrasts with males where the neoplasm ranks fifth in both periods), alongside pancreatic cancer in both males and females.

Among men, prostate, lung, and colorectal incidence rates have had consistently high rankings over time, being the second, third and fourth leading cancers in 1953–1957 (Figure 1). With the rapid declines in stomach cancer, these cancers now, respectively, constitute the top three in 2016–2020, and responsible for almost half (48.7%) of all male cancer diagnoses (Table 1a), with prostate cancer rates almost four times higher today than in the mid-1950s. Both melanoma and non-melanoma have risen in their ranking in men from 17th and 12th in 1953–1957, to 4th and 6th, respectively in 2016–2020.

Breast cancer remains the leading cancer in women, responsible for around 22% of new cases today, very similar to the proportion observed in 1953–1957 (Table 1b), although rates have more than doubled over the period (Figure 1). As with men, colorectal cancer incidence rates now rank as the second leading cancer in women, with cervical cancer rates having fallen from 2nd to 8th, with current rates one-quarter of those seen in the 1950s.

Lung cancer is however the biggest mover among women, reaching third position by 2016–2020 from its low ranking of 17th in 1953–1957, corresponding to a 15-fold rate increase in 70 years, with the disease constituting 1 in 10 cancer cases diagnosed among women today. As is the case among males, non-melanoma and melanoma incidence rates have rapidly risen in females. The latter now ranks as the 4th leading cancer in women, with some 1,100 new cases annually today, as compared to less than 50 on average in 1953–1957. Lastly, of note is the rise in prominence of thyroid cancer incidence, which is now among the top 10 leading cancers in women (from 13th to 10th), with a quadrupling of the rates observed.

## DISCUSSION

For multiple decades, spanning 60–80 years, the Nordic population-based cancer registries have provided comparable and timely data to serve the needs of policymakers, cancer societies, the public, and media outlets, as well as the clinical and research community[2]. The Cancer Registry of Norway has been doing so since the early-1950s, through an extensive research programme, a comprehensive and informative annual report, *Cancer in Norway* – currently available for the registration year 2021[3] – and through the work of the ANCR, via the NORDCAN database and descriptive epidemiology tools[1]. A few comments on the findings are provided below.

Breast cancer incidence rates have doubled in Norway over the period 1953–2020. A uniform increase in the rate up to the 1990s, with a steeper rise in the mid-1990s followed by a slight decline between 2005 and 2009 has been noted[4]. While the underlying changes in incidence rates likely reflect an array of transitions in reproductive and hormonal risk factors including declining age at menarche, later age at first birth, fewer children, less breastfeeding, as well as lifestyle risk factors (alcohol intake, excess body weight, physical inactivity)[5], more recent trends in certain age bands have also been linked to the launch of the Norwegian Breast Cancer Screening Programme in 1996[4]. The organized programme invites women aged 50–69 years to biennial mammography, and progressively expanded to become national in 2005. The moderate rise in incidence rates subsequently, is mainly confined to ages 60–79 years[4].

Prostate cancer has been the most common cancer in men for many decades in Norway, and incidence rates have quadrupled from the early-1950s. For such a common disease, relatively little is known about its underlying aetiology, beyond established risk factors such as advancing age, family history, and certain heritable mutations. A sharp increase in incidence rates came around 1990 following the introduction and widespread use of the Prostate Specific Antigen (PSA) test[6]; rates have been more stable in Norway the last 10 years, with a moderate decline in observed in the last five-year period[4].

Lung cancer is now the third leading form of cancer among females in Norway, with contemporary rates ten times those observed in the 1950s. While there are increasing trends in the all-ages rates, rates among younger women appear more stable or show signs of decline over the last two decades, while in men, the incidence has been levelling off in recent years, and a slight overall decline in all-ages rates is already seen[4]. The favourable trends among men may be anticipated in the future among women, assuming that the successive decreases in risk among female cohorts born after the Second World War reflect recent changes in smoking habits[7]. In the Norwegian Women and Cancer (NOWAC) study, it has been estimated that at least 8 in 10 female lung cancer cases could have been avoided in Norway, if women did not smoke[8].

Colorectal cancer incidence has remained a highly frequent cancer in Norway over the last 70 years, with the disease positioned in second place in both men and women today, after prostate and breast cancer. While combined in this analysis, trends in colon and rectal cancer incidence rates diverge somewhat[4], with the incidence of colon cancer uniformly rising over the last decades in both sexes (although some stability is observed in the last 5-year period), while corresponding rectal cancer rates have remained relatively stable over the last three decades. There is compelling evidence that alcohol, tobacco smoking, the consumption of red/processed meat, alongside body fatness increase the risk of colorectal cancer, whereas the consumption of wholegrains, fibre, and dairy products, calcium supple-

ments, as well as physical activity may decrease risk, especially for colon cancer[9].

Of concern is the rise of melanoma and non-melanoma skin cancer in both men and women in recent decades in Norway, from a position of relative rarity in the 1950s. Such adverse trends are linked to suntanning habits, and influenced by other related factors, including awareness of the need for sun protection and diagnostic intensity[4]. Just as emphatic however has been the extent to which stomach cancer has fallen in its importance over time from being the most common cancer in men (and second in women) in the early-1950s. The steadily declining rates in Norway follow those of non-cardia gastric cancer rates in many populations around the world over the last half century, an observation attributed to the "unplanned triumph" of prevention, including a decreased prevalence of *Helicobacter pylori* and improvements in the preservation and storage of foods[10].

This brief report has some inherent weaknesses. The study draws upon the cancer distribution in Norway based on case counts and summary rates in two quinquennia that are multiple decades apart and should be interpreted with some caution as a result. It has not taken into consideration the secular trends in the cancer-specific rates available in Norway. A more detailed and meaningful temporal analysis would examine age-specific patterns and attempt to evaluate the importance of calendar period versus birth cohort, given their importance in explaining the incidence trend for most common cancer types. In addition, coding and classification at the Registry have changed over time. The NORDCAN incidence database accommodates this by converting older classifications to ICD-10 according to international rules[1]. While, some differences may be due to such artefactual variations, the impact on the interpretation here is expected to be minimal. Finally, given delays in reporting because of the Covid-19 pandemic, cancer counts may have been affected. The impact in Norway, however, has been reported as rather moderate, with the relatively fewer pathology reports obtained during the first nine months of 2020, apparently later offset by increased diagnostic activity towards the end of the year[4]. Indeed, the most recent annual report reveals that the declining lung cancer cases observed among women during the pandemic was likely artefactual, with numbers again on the rise[3].

The aim of this study was to illustrate the changing profiles of cancer over 70 years in Norway, and in so doing, give some insight into how epidemiologic changes and cancer control interventions have altered the cancer landscape in the country. This analysis has highlighted both major transition in the cancer distribution, as well as some degree of permanency with respect to the position of major cancer types. Indeed, many of the leading cancers observed in the mid-1950s remained within the top 10 rankings by 2020, with prostate and breast cancer consistently ranking first in men and women, respectively. The changing profiles documentted for Norway are not too dissimilar to those of the other Nordic countries, as can be readily viewed on the NORDCAN platform[1].

At its 70th anniversary, the Cancer Registry of Norway can be considered an exemplar of the value of descriptive epidemiology as the toolkit of the community specialist[11], and one that fully embodies the "expanded role" of a Cancer Registry beyond its core functions[12]. The Registry continues to excel in the dissemination of information on cancer to a wide audience, in research that elucidates the underlying causes of cancer, in managing the national breast and cervical cancer screening programmes that aims to prevent cancer deaths, and in instigating clinical registries that guides improvements in cancer treatment.

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