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ORIGINAL ARTICLE

Cancer in the Faroe Islands from 1960-2019 – incidence, mortality, and comparisons with the other Nordic countries

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ABSTRACT

Purpose: In this paper, we present age-standardized cancer incidence and mortality rates in the Faroe Islands. We also compare with the Nordic rates and show incidence rate ratios (IRR) and mortality rate ratios (MRR).

Materials and methods: The Faroese cancer registry (FCR) was established in 1994, with incidence available from 1960 and mortality from 1983. The FCR is a part of the NORDCAN collaboration, where the different Nordic countries all report anonymized cancer data by standardized methods, ensuring comparability. Validation efforts revealed that 13% of cases had not been reported to the FCR from 2006 to 2019, emphasizing the need for continued validation efforts of cancer registries. After validation, we submitted the updated cancer cases to NORDCAN and now present this data, taken directly from the NORDCAN website (2019 data).

Results: We found that the incidence of the summary group *all cancers* in the Faroe Islands increased from 1960 to 2019, while cancer mortality decreased from 1983 to 2019. Comparisons with Nordic rates showed significantly lower IRRs for cancer in *all cancers*, *bladder and urinary tract*, and *skin cancer* for both sexes, while IRR was lower for *breast cancer* in women and *prostate cancer* in men. Contrary, IRR was higher for *rectum* and *kidney cancer* in women and *esophagus* and *testicular cancer* in men. There was an increased MRR for cancer in *female organs*, *bladder and urinary tract*, and *kidney cancer* in women, and *esophagus* and *pancreas* cancer in men. In contrast, *malignant hematopoietic diseases* and *melanoma* in women had a lower MRR.

Conclusions: Cancer incidence in the Faroe Islands was lower than in the other Nordic countries. Of particular interest, the incidence of testicular cancer saw a steep increase during the last 20 years, and an investigation into possible causes for this is needed.

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Cancer; cancer registry; Nordic; Faroe Islands; surveillance

Introduction

Cancer is one of the leading causes of mortality and morbidity globally [1], and valid data on cancer incidence, mortality, and survival is essential to guide policy in the management of cancer. Regular reports on cancer statistics can guide preventative actions, screening programs, early diagnosis, treatment, rehabilitation, and palliative care. In the Faroe Islands, data on cancer cases from 1960 and onwards is available in the Faroese Cancer Registry (FCR) and cancer mortality from 1983 onwards. Like all other health registries, continued validation efforts are needed to ensure reliable and relevant data [2,3].

The Faroe Islands are a self-governing nation in the North Atlantic and part of the Danish realm. The population of 53,752 inhabitants resides on 16 of the nation's 18 islands [4]. In many aspects, the Faroe Islands are comparable to the Nordic countries, although there are differences. The basic education level is similar; smoking is more common in the Faroe Islands, while alcohol consumption is less common in the Faroes compared to the Nordic countries [5]. The percentage of daily smokers has decreased in the later years but remains higher in the Faroes than in the other Nordic countries. Notably, the prevalence of lifetime use of cigarettes amongst young Faroese is also the highest in the Nordic countries [6]. The diet has traditionally relied on local foods, mainly seafood, sheep, and potatoes, but has recently shifted toward a more western-style diet [7]. Regarding demographic factors, average life expectancy is high in the Faroe Islands (84.8 years for women and 82.3 for men), and the fertility rate is the highest in the Nordic region at 2.5 children per woman [8]. Genetically, the Faroese population is a very homogenous group due to a history of isolation and few

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founders. This has resulted in some diseases being widespread in the Faroes, with some of the highest reported rates globally [9–13], while other illnesses are expected to be less common.

Similar to the other Nordic countries, the Faroe Islands have a universal welfare state with social and health care sectors financed through relatively high income taxes, which grants free access to general practitioners (GPs) and hospitals. As in the other Nordic countries, the Faroe Islands provides every inhabitant with a personal identification number, enabling linkage across several different registries, essentially transforming the entire population into a large registry-based cohort [14].

Faroese cancer patients mainly receive treatment in the Faroe Islands and Denmark, while some patients also receive treatment in Iceland. Radiation therapy and certain specialized chemotherapies are always performed overseas, but the proportion of medical cancer care provided in the Faroes is increasing [15]. Cancer surgeries are predominantly performed abroad. However, operations for colon cancer, breast cancer, testicular cancer, and some low-grade bladder cancers are offered in the Faroes. Guidelines for diagnosis and treatment of cancer are based on Danish guidelines, although without the accelerated cancer patient pathways used in Denmark [16]. Cancer screening programs were implemented for cervix cancer in 1995 and breast cancer in 2017 [15].

The Faroese Cancer registry was formally established in 1994 and retrospectively included cases going back to 1960; however, according to previous reports, data completeness may be lower before 1978 [17]. The FCR includes all cancer patients with a permanent address in the Faroe Islands, including those who have received a cancer diagnosis abroad. Since 1994, cancer cases have been reported prospectively to the FCR from three primary data sources: clinician reports, pathology reports, and death certificates. From 2006 to 2007, the medical records were digitalized in a national electronic health system (EHS), adding International Classification of diseases version 10 (ICD-10) diagnoses codes from the EHS as a potential fourth data source for the FCR. There have been indications that the data in the FCR is incomplete [18], and the need for validation of the FCR is apparent to identify potential missing cases and revise the procedures for reporting cases, including changing clinician reports from paper-form to electronic registration.

Until the present study, no analysis of incidence and mortality rates with comparisons to international data has been carried out for all cancers in the Faroe Islands [17]. In this paper, we present incidence and mortality rates of total cancer and site-specific cancers over time and compare the rates from the last ten years with the corresponding rates in the Nordic countries after validating the FCR.

Methods

The FCR records all cancer cases in the Faroe Islands. The principal source for the FCR is clinician cancer reports. All cancer cases in the Faroe Islands are intended to be reported by doctors in the Faroese Health system using a standardized form, which is subsequently manually coded into the FCR. The other primary sources are pathology reports, death certificates, and recently ICD-10 diagnosis codes from the EHS.

Since 1994, when the FCR was formally established, all pathology reports have been collected and reviewed, picking out all malignant cases manually for coding to the FCR. The pathology reports have been saved as separate files on a hard disk at the National Hospital. Since 2007, SNOMED pathology codes have been used to code the pathology reports, and further all historic pathology reports back to 1978 have had SNOMED codes added retrospectively. For pathology performed in Denmark or Iceland, the reports are sent to the National Hospital, were they are kept with the pathology reports performed in the Faroes.

Death certificates have been collected systematically into the national death certificate registry, which goes back to 1983. However, this data has been collected without the personal identification number, making it impossible to identify individual cancer patients without manually processing single death certificates. The FCR has included the processing of death certificates by going through death certificates manually, but this has caused a significant delay in including cases identified through this source.

Finally, identifying cancer cases from EHS reports has been possible since the implementation of the EHS in 2006 and onward but has not been utilized until recently. This source is very dependent on to which extent the clinicians register the correct ICD-10 diagnoses in the EHS.

In 2019, we initiated an effort to validate the cases in the FCR and identify potential missing cases. The primary strategy for case-finding was to utilize the EHS. We reviewed the medical journals of all patients with an ICD-10 cancer diagnosis (Supplementary Table 1) in the EHS who were not already registered in the FCR. First, the diagnosis was confirmed, and subsequently, it was coded into the FCR. We performed further case ascertainment by going through data on all visits to the oncology and palliative units registered in the EHS.

We established a pathology database using the existing unstructured pathology reports to identify unreported malignant tumors for inclusion in the FCR. This database's data on morphology was also used to review and correct morphology data present in the FCR.

The Faroese Cancer Registry is a part of the NORDCAN collaboration [19]. The NORDCAN database is a collaboration between the Nordic countries (Denmark, Faroe Islands, Finland, Greenland, Iceland, Norway, and Sweden), where the national cancer registries provide aggregated data to the International Agency for Research of Cancer (IARC) for presentation on the NORDCAN website [20]. The data for this paper was obtained directly from the NORDCAN website.

The NORDCAN collaboration was established in 2002 [19], with a new and improved version of the website published online in 2020. Previously, each country delivered individual-level data to the NORDCAN secretariat for processing. However, the General Data Protection Regulation

implemented all over Europe has required this practice to be modernized [21]. This has been achieved by creating a shared R code to be used on the dataset in each country. This R code performs multiple checks, both for data quality and multiple primaries, and produces aggregated anonymized data calculated in the same way for each country. This way of processing data foregoes the barriers of sharing individual-level data, which is an increasing barrier for collaborative studies across different countries. The experiences from the NORDCAN collaboration can be an example for other registry-based cross-country collaborations [21,22].

We present incidence and mortality rates age-adjusted and standardized to the world standard for groupings of cancer in addition to selected single entities. We combined the rates into ten-year periods to reduce variability due to small numbers. Incidence is shown from 1960, while mortality is shown from 1983. We calculated incidence rate ratios (IRR) and mortality rate ratios (MRR) with corresponding 95% confidence intervals (CI) for the rates in the Faroe Islands compared with the rates in the Nordic countries during the last ten years [23].

Statistical analyses were made in R version 4.05 and Microsoft Excel version 2108.

Results

Through the study period, there were 7,903 cases of cancer in the Faroes, corresponding to an average of 132 cases each year. However, over the last ten years, there have been 2,411 new cases, an average of 241 cases every year. The age-standardized (W) incidence rates for the summary group of *all cancers* increased more than two-fold from 1960 to 2019 (Table 1), and increases were observed in incidence for almost all individual cancer sites. Most of the increase was seen during the first two decades, and from 1980 to 2019, the increase of *all cancers* was 34.9% for women and 26.3% for men. For women, there was a large increase in *lung*, and *breast cancer*, over the last 40 years. For men, there was a large increase in *colon*, *prostate*, and *testicular cancer*. The increase in *testicular cancer* during the last 20 years is particularly steep, going from an average of 2.2 cases a year from 1980 to 1999 to 3.8 cases a year from 2000 to 2019.

Age-standardized (W) mortality rates for the summary group of *all cancers* decreased from 1983 to 2019, whereas a few cancer sites showed increasing mortality, such as cancer in the *male organs* and *pancreatic cancer* in men, and while *lung cancer* mortality increased in women, it decreased in men (Table 2).

When comparing the Faroese incidence and mortality with the Nordic countries (Tables 3 and 4), incidence during 2010–2019 for *all cancers* combined was significantly lower in the Faroes for both men and women, while mortality did not differ significantly. *Bladder and urinary tract* cancer, cancer in *malignant hematopoietic diseases*, and *skin* cancer were lower in both sexes, while *breast* cancer and *other cancers* were lower in women and for men, cancer in *male organs* and *prostate* were lower. Higher *rectum* and *kidney* cancer were observed in women, while *esophagus* and *testicular* cancer were higher in men. For mortality, cancer in *female organs*, *urinary tract*, *cervix uteri*, *ovary and tubes*, and *kidney* cancer were higher in women, whereas cancer is *malignant hematopoietic diseases* and *melanoma* displayed lower mortality among women. For men, mortality was higher in the *esophagus* and *pancreatic* cancer. A comparison of incidence and mortality rates and IRR for each of the Nordic countries relative to NORDCAN countries during the last ten years is shown in Supplementary Tables 3–6. Our results point to several areas which could be investigated in more detail. To mention a few, Greenland has a far higher incidence of cancer in the lip, oral cavity, and pharynx, digestive organs, and respiratory organs, than any other Nordic country. Skin cancer incidence was lowest in Iceland, Greenland, and the Faroes. The Faroes had the lowest incidence of overall cancer and the highest incidence of testicular cancer.

A validation effort was made for the period 2006–2019 to validate the cases in the FCR. A total of 2,778 cases were initially reported to the FCR. The validation process revealed 411 additional cancer cases during this period constituting 13% of all cases in the cancer registry during this time, increasing the total number of cases to 3,189. The unreported cases were unequally distributed among different cancer diagnoses and were highest for cancer in the *brain and central nervous system (CNS)*, *kidney* and *ovary and tubes* (Supplementary Table 2).

The rates shown are age-standardized to the world standard. The NORDCAN countries are Denmark, Faroe Islands, Finland, Greenland, Iceland, Norway, and Sweden. Abbreviations: IRR – Incidence rate ratio. 95%CI – 95% Confidence interval.

Discussion

Here we report cancer incidence and mortality rates in the Faroe Islands after validation of the FCR. During the period 1960–2019, cancer incidence in the Faroes increased two-fold, while mortality rates did not increase from 1983 to 2019. The majority of the increase occurred during the first two decades, when underreporting and underdiagnosing are most likely, meaning that this increase might not entirely be ascribed to an actual increase of cases. The main findings, when comparing with Nordic rates in the last ten years, were that IRR was low for the summary group of *all cancers*, and *malignant hematopoietic diseases* in both sexes, *breast cancer* in women and *prostate cancer* in men, while IRR was increased for *rectum* and *kidney cancer* in women, and *esophagus* and *testicular cancer* in men.

In the present study, we show that some cancers were more common in the Faroe Islands compared to the Nordic countries. A graphical presentation of these trends can be on the NORDCAN website [20]. Among these cancers, *testicular cancer* stands out, with an especially steep increase in the Faroe Islands over the last 20 years, with rates more than doubling during this time. *Testicular cancer* is the most common cancer in young males, and the incidence of *testicular cancer* has increased elsewhere as well, as the incidence has doubled over the past 40 years, with the highest increases

Table 1. Cancer incidence in the Faroe Islands from 1960 to 2019 per 100,000.

	Women						Men					
Cancer groups	1960–1969	1970–1979	1980–1989	1990–1999	2000–2009	2010–2019	1960–1969	1970–1979	1980–1989	1990–1999	2000–2009	2010–2019
All cancers	121.2	159.2	184.1	199.7	232.1	248.3	105.9	159.8	228.2	221.1	220.4	288.2
Lip, oral cavity, and pharynx	3.2	2.7	0.93	5.6	3.3	4.1	4.8	5.6	6.7	4.7	7.4	7.6
Digestive organs	32.3	37.6	40.4	34.0	48.1	46.7	42.1	50.0	69.0	57.0	54.6	67.7
Respiratory system	4.0	5.1	9.5	17.0	16.5	20.9	11.8	28.3	43.6	38.5	27.1	31.7
Skin	3.1	4.0	8.0	12.2	21.6	13.7	4.9	4.2	8.1	10.0	13.4	13.2
Female organs	19.2	35.5	38.0	45.4	43.4	35.4						
Male organs							11.4	16.6	34.5	34.3	61.4	87.4
Urinary tract	7.8	7.6	12.1	6.9	8.2	11.6	8.3	17.8	22.2	28.8	19.3	27.2
Malignant hematopoietic diseases	0.55	4.1	8.1	11.8	13.1	17.8	2.4	6.4	14.7	14.5	18.1	27.3
Other cancers	16.4	19.2	21.7	25.0	18.3	26.2	16.3	30.9	29.2	32.2	18.6	24.3
Individual cancer entities												
Esophagus	2.9	3.4	2.0	1.9	2.3	1.8	5.4	3.7	2.3	5.6	5.6	9.4
Stomach	7.8	9.0	6.4	4.9	5.5	2.7	23.5	14.4	23.0	14.9	6.9	6.6
Colon	9.4	12.3	17.3	11.6	14.6	20.1	3.2	11.3	18.4	16.1	16.9	24.8
Rectum	5.6	4.4	5.9	6.6	16.3	12	2.8	8.8	8.1	8.9	11.1	12.6
Liver	0.0	1.3	0.84	1.5	1.5	1.9	0.0	1.9	4.0	3.0	3.2	3.2
Pancreas	6.1	6.2	5.6	5.8	6.8	6.0	6.6	9.0	8.5	7.6	8.9	10.4
Lung	3.0	5.1	8.1	16.2	15.6	20.1	10.3	24.6	37.7	34	21.2	27.5
Melanoma	0.52	0.56	2.6	2.1	17.9	8.8	0.0	1.4	1.5	2.3	6.7	6.7
Breast cancer	34.5	43.4	45.2	41.7	59.6	71.8	0.0	0.0	0.34	1.3	0.54	1.8
Cervix uteri	8.1	14.6	18.1	18.8	16.0	9.4						
Corpus uteri	4.2	8.1	6.9	10.9	15.6	11.7						
Ovary and tubes	5.1	11.8	11.3	13.7	9.7	11.6						
Prostate							8.7	13.9	25.0	26.3	46.8	70.6
Testicular							2.2	2.7	9.5	7.3	13.1	16.9
Kidney	7.3	4.6	7.2	4.1	5.1	8.1	7.0	8.4	11.4	8.7	6.5	12.2
Bladder and urinary tract	0.46	3.0	4.9	2.7	3.1	3.6	1.3	9.4	10.8	20.1	12.7	15.0
Brain and CNS including endocrine tumors	2.8	5.8	6.7	10.2	6.0	11.7	5.6	12.9	8.0	14.2	8.0	10.1

The rates shown are age-standardized to the world standard. Graphical presentations can be seen on https://nordcan.iarc.fr/en.

Table 2. Cancer mortality in the Faroe Islands from 1983 to 2019 per 100,000.

	Women				Men			
Cancer groups	1983–1989	1990–1999	2000–2009	2010–2019	1983–1989	1990–1999	2000–2009	2010–2019
All cancers	98.6	100.1	91.1	82.3	136.6	139.8	117	108.3
Lip, oral cavity, and pharynx	0.0	1.3	0.57	1.0	1.7	2.8	2.2	2.5
Digestive organs	26.6	27.0	27.3	20.3	47.7	41.1	36.4	35.6
Respiratory system	7.2	11.2	13.5	15.3	37.7	31.6	22.7	21.8
Skin	0.0	0.91	0.57	0.88	0.31	0.82	0.76	2.0
Female organs	18.3	17.5	12.0	13.6				
Male organs					12.9	18	16.6	17.0
Urinary tract	7.3	3.8	3.3	5.7	9.1	15.2	9.5	7.6
Malignant hematopoietic diseases	5.2	8.2	6.8	3.1	11.1	9.6	11.5	10.4
Other cancers	11.9	13.5	12.0	11.1	16.2	20.5	16.9	11.0
Individual cancer entities								
Esophagus	1.6	1.3	1.9	1.2	3.1	4.7	4.3	6.6
Stomach	5.5	4.4	4.8	2.4	16.4	11.8	6.3	3.0
Colon	7.9	9.2	7.1	6.2	10.2	9.0	10.2	8.7
Rectum	4.2	2.8	3.1	2.7	3.8	3.2	4.0	2.7
Liver	0.65	2.1	1.0	1.1	3.2	3.3	1.6	2.7
Pancreas	4.3	5.9	8.1	5.4	6.8	8.5	9.3	11.1
Lung	7.2	11.0	13.2	14.8	36.2	30.1	20.1	20.8
Melanoma	0.0	0.91	0.48	0.54	0.0	0.41	0.59	1.8
Breast cancer	22.2	16.8	14.9	11.2	0.0	0.17	0.45	0.23
Cervix uteri	3.3	5.9	2.3	3.1				
Corpus uteri	3.7	1.9	2.3	1.4				
Ovary and tubes	9.3	8.6	5.8	7.6				
Prostate					11.9	17.3	16.1	16.6
Testicular					0.96	0.37	0.19	0.0
Kidney	6.3	2.1	2.9	3.7	5.3	5.7	5.8	3.3
Bladder and urinary tract	0.98	1.7	0.37	2.0	3.9	9.5	3.6	4.3
Brain and CNS including endocrine tumors	5.2	4.2	3.8	4.0	4.2	8.2	6.2	5.2

The rates shown are age-standardized to the world standard. Mortality data in the Faroe Islands is available from 1983. Graphical presentations can be seen on https://nordcan.iarc.fr/en.

observed in Western countries [24]. Luckily, *testicular cancer* has a very high survival, but treatment is not without risk or long-term consequences for the men who survive [25]. There are several known risk factors for *testicular cancer*, including cryptorchidism, decreased spermatogenesis, infections, and prenatal and postnatal exposure to chemicals [26–28].

Interestingly, studies in the Faroe Islands have shown that Faroese males have low semen quality and poor testicular function [29]. Additionally, a high rate of cryptorchidism has been observed in the Faroe Islands, where 19 cases of cryptorchidism (9.7%) were found among 196 fourteen-year-old boys from a representative birth cohort from 1986 to 1987 [30], compared with rates ranging from 1.8% to 8.4% for cryptorchidism reported in other countries [31]. It has been established that exposure to high levels of persistent organic pollutants (POPs), including polychlorinated biphenyls (PCBs) and perfluorinated, alkylate substances (PFAS), may potentially influence testicular cancer risk [32,33]. In the Faroe Islands, exposure to these substances has been reported to be high, mainly due to a traditional diet that includes whale meat and blubber containing high levels of POPs [34]. Studies have shown that PCB exposures in the Faroe Islands are much higher than in any other Western population [35]. Thus, it can be speculated that a high prenatal and postnatal exposure to environmental pollutants can in part explain the high rate of *testicular cancer*. The increased rate could also be an artifact of an increased focus on cancer, leading to an increased number of examinations and diagnoses. However, the steep increase is unlikely to be explained only by increased diagnostic activity. All cancer care for *testicular cancer* is provided in Denmark, feasibly increasing the risk of unreported cases to the FCR, which means that this high rate of *testicular cancer* could be even higher if there are any persisting unreported cases. The increasing rate of *testicular cancer* in the Faroe Islands is an area that requires further studies to investigate possible causes.

There were also cancers that had a lower incidence in the Faroe Islands compared to the Nordic rates. This could be because of protective factors, either genetic or otherwise. However, this should be interpreted carefully, as the lower incidence could also be explained by a persistent underreporting of these cancers. We observed that *breast cancer* was less common in the Faroe Islands than in the Nordic countries. It is worth mentioning that *breast cancer* screening did not start before 2017 in the Faroe Islands, and since we compare the years 2010–2019, the screening will only marginally affect the rates here. There are several other potential explanations for the lower incidence in the Faroes. Some of the known risk factors for breast cancer are increasing age, mutations in the BRCA1 and BRCA2 genes, reproductive factors such as the age at menarche and menopause, use of contraceptives, number of pregnancies, and maternal age at giving birth [36,37]. Faroese women have a low maternal age at first birth and the highest fertility rate in the Nordic countries [8]. Ongoing unpublished work has indicated that Faroese women have fewer mutations in the BRCA1 and BRCA2 genes than in most other countries. These are all factors that could lower the *breast cancer* incidence in the Faroes. The lower incidence could also be explained by persistent underreporting, but since

Table 3. Cancer incidence and mortality in the Faroe Islands and the NORDCAN countries and rate ratios from 2010 to 2019 – Women.

	Incidence			Mortality		
Cancer groups	Faroe Islands (*n*)	NORDCAN countries (*n*)	IRR (95% CI)	Faroe Islands (*n*)	NORDCAN countries (*n*)	MRR (95% CI)
All cancers	248.3 (1,072)	297.3 (788,139)	0.83 (0.79–0.89)	82.3 (452)	84.1 (297,091)	0.98 (0.89–1.07)
Lip, oral cavity, and pharynx	4.1 (16)	4.7 (12,395)	0.87 (0.53–1.42)	1.0 (5)	1.1 (3,584)	0.91 (0.38–2.19)
Digestive organs	46.7 (218)	44.1 (141,259)	1.06 (0.93–1.21)	20.3 (123)	22.2 (84,075)	0.91 (0.77–1.09)
Respiratory system	20.9 (96)	24.4 (73,172)	0.86 (0.7–1.05)	15.3 (79)	16.8 (55,555)	0.91 (0.73–1.14)
Skin	13.7 (58)	34.2 (99,013)	0.39 (0.3–0.51)	0.9 (5)	1.9 (6,303)	0.46 (0.19–1.11)
Female organs	35.4 (145)	33.9 (84,336)	1.06 (0.9–1.25)	13.6 (67)	9.8 (32,597)	1.39 (1.08–1.79)
Urinary tract	11.6 (53)	11.6 (35,190)	1.00 (0.76–1.31)	5.7 (30)	2.9 (12,346)	1.97 (1.37–2.81)
Malignant hematopoietic diseases	17.8 (76)	24.9 (65,803)	0.71 (0.57–0.89)	3.1 (24)	6.2 (25,520)	0.50 (0.34–0.75)
Other cancers	26.2 (105)	32.4 (72,776)	0.81 (0.67–0.98)	11.1 (58)	10.4 (36,404)	1.07 (0.82–1.38)
Individual cancer entities						
Esophagus	1.8 (10)	1.4 (4,446)	1.29 (0.69–2.39)	1.2 (8)	1.0 (3,634)	1.20 (0.6–2.4)
Stomach	2.7 (12)	3.1 (9,728)	0.87 (0.49–1.53)	2.4 (14)	2.1 (7,222)	1.14 (0.68–1.93)
Colon	20.1 (93)	19.3 (64,055)	1.05 (0.85–1.28)	6.2 (42)	6.6 (26,855)	0.94 (0.69–1.27)
Rectum	12.0 (56)	8.4 (24,703)	1.43 (1.1–1.86)	2.7 (16)	2.3 (8,817)	1.17 (0.72–1.92)
Liver	1.9 (8)	2.1 (6,494)	0.90 (0.45–1.81)	1.1 (7)	1.8 (6,571)	0.61 (0.29–1.28)
Pancreas	6.0 (31)	6.7 (21,901)	0.90 (0.63–1.27)	5.4 (30)	6.4 (23,606)	0.84 (0.59–1.21)
Lung	20.1 (92)	23.3 (70,266)	0.86 (0.7–1.06)	14.8 (76)	16.3 (54,126)	0.91 (0.73–1.14)
Melanoma	8.8 (30)	21.9 (47,818)	0.39 (0.27–0.57)	0.5 (3)	1.7 (5,327)	0.32 (0.1–0.99)
Breast	71.8 (305)	87.1 (204,195)	0.82 (0.74–0.92)	11.2 (60)	12.9 (40,705)	0.87 (0.67–1.12)
Cervix uteri	9.4 (31)	8.3 (14,247)	1.13 (0.8–1.61)	3.1 (12)	1.5 (3,795)	2.07 (1.17–3.64)
Corpus uteri	11.7 (58)	13.6 (38,301)	0.86 (0.66–1.11)	1.4 (9)	1.4 (5,438)	1.00 (0.52–1.92)
Ovary and tubes	11.6 (45)	9.2 (23,052)	1.26 (0.94–1.69)	7.6 (36)	5.3 (16,601)	1.43 (1.03–1.99)
Kidney	8.1 (34)	5.4 (14,266)	1.50 (1.07–2.1)	3.7 (16)	1.4 (5,675)	2.64 (1.62–4.32)
Bladder and urinary tract	3.6 (19)	6.3 (20,924)	0.57 (0.36–0.9)	2.0 (14)	1.5 (6,671)	1.33 (0.79–2.25)
Brain and CNS including endocrine tumors	11.7 (38)	14.0 (28,596)	0.84 (0.61–1.15)	4.0 (18)	3.6 (9,812)	1.11 (0.7–1.76)

The rates shown are age-standardized to the world standard. The NORDCAN countries are Denmark, Faroe Islands, Finland, Greenland, Iceland, Norway, and Sweden. Abbreviations: IRR – Incidence rate ratio. 95%CI – 95% Confidence interval.

the mortality rates are similar to those in the Nordic countries, underreporting alone seems unlikely to explain the difference.

Malignant hematopoietic diseases were another group of cancers with lower incidence in both sexes and lower mortality amongst women in the Faroes. These malignancies are a very heterogeneous group of cancers, and risk factors are diverse and difficult to specify. Familial clustering of hematological malignancies has previously been reported [38], and the low genetic diversity in the Faroe Islands may play a role in the lower incidence found here. Recently, a study was published based on Norwegian, Danish, and Faroese patients, speculating on a model of transgenerationally inherited susceptibility to malignant blood disorders, supporting the possibility of a link between the lower incidence and the low genetic diversity in the Faroe Islands [39]. Skin cancers, both melanoma and non-melanoma were less common in the Faroes. Known risk factors for melanoma include exposure to sun and familial history [40], both factors which are expected to be relatively low for the Faroese population. Prostate cancer was also less common in the Faroe Islands. Known risk factors for prostate cancer include increasing age, genetics, and specific types of diet [41]. Further, as in other cancers with lower incidence, there is a possibility of persistent underreporting, and as the diagnostic procedure for hematological cancers does not always include pathology, the risk might be exacerbated.

Collaboration between the Nordic countries has proven essential for cancer reporting in the Faroe Islands, as this provides the possibility to compare rates aggregated in a

Table 4. Cancer incidence and mortality in the Faroe Islands and the NORDCAN countries and rate ratios from 2010 to 2019 – Men.

	Incidence			Mortality		
Cancer groups	Faroe Islands (*n*)	NORDCAN countries (*n*)	IRR (95%CI)	Faroe Islands (*n*)	NORDCAN countries (*n*)	MRR (95%CI)
All cancers	288.2 (1,339)	336.3 (882,799)	0.86 (0.81–0.9)	108.3 (596)	108.6 (330,276)	1.00 (0.92–1.08)
Lip, oral cavity, and pharynx	7.6 (34)	9.2 (21,657)	0.83 (0.59–1.16)	2.5 (11)	2.6 (6,828)	0.96 (0.53–1.74)
Digestive organs	67.7 (339)	63.2 (172,878)	1.07 (0.96–1.19)	35.6 (193)	33.8 (99,340)	1.05 (0.91–1.21)
Respiratory system	31.7 (160)	31.6 (89,148)	1.00 (0.86–1.17)	15.3 (116)	16.8 (70,476)	0.92 (0.77–1.1)
Skin	13.2 (63)	38.9 (110,130)	0.34 (0.27–0.43)	2.0 (9)	3.3 (9,272)	0.61 (0.32–1.17)
Male organs	87.4 (391)	101.0 (264,495)	0.87 (0.78–0.96)	17.0 (110)	15.3 (56,134)	1.11 (0.92–1.34)
Urinary tract	27.2 (129)	31.2 (85,463)	0.87 (0.73–1.04)	7.6 (45)	7.3 (23,506)	1.04 (0.78–1.39)
Malignant hematopoietic diseases	27.3 (113)	34.9 (83,147)	0.78 (0.65–0.94)	10.4 (54)	10.1 (31,509)	1.03 (0.79–1.34)
Other cancers	24.3 (103)	25.7 (54,402)	0.95 (0.78–1.15)	11.0 (56)	12.3 (32,934)	0.89 (0.69–1.16)
Individual cancer entities						
Esophagus	9.4 (47)	4.6 (12,168)	2.04 (1.53–2.72)	6.6 (34)	3.7 (10,266)	1.78 (1.27–2.5)
Stomach	6.6 (34)	5.8 (15,970)	1.14 (0.81–1.59)	3.0 (16)	3.8 (10,869)	0.79 (0.48–1.29)
Colon	24.8 (124)	22.1 (62,372)	1.12 (0.94–1.34)	8.7 (50)	8.2 (25,514)	1.06 (0.8–1.4)
Rectum	12.6 (62)	13.9 (37,222)	0.91 (0.71–1.16)	3.2 (18)	4.3 (12,707)	0.74 (0.47–1.18)
Liver	3.2 (16)	5.1 (13,454)	0.63 (0.38–1.02)	2.7 (15)	4.1 (11,724)	0.66 (0.4–1.09)
Pancreas	10.4 (53)	8.1 (22,218)	1.28 (0.98–1.68)	11.1 (58)	7.9 (22,903)	1.41 (1.09–1.82)
Lung	27.5 (141)	27.7 (78,626)	0.99 (0.84–1.17)	20.8 (110)	21.9 (64,966)	0.95 (0.79–1.15)
Melanoma	6.7 (28)	20.3 (47,986)	0.33 (0.23–0.48)	1.8 (8)	2.9 (7,927)	0.62 (0.31–1.24)
Prostate	70.6 (349)	91.7 (250,246)	0.77 (0.69–0.86)	16.6 (109)	14.9 (55,149)	1.11 (0.92–1.35)
Testicular	16.9 (42)	8.2 (11,333)	2.06 (1.52–2.79)	0.0 (0)	0.2 (341)	NA
Kidney	12.2 (56)	10.7 (25,544)	1.14 (0.88–1.48)	3.3 (19)	3.0 (8,805)	1.10 (0.7–1.73)
Bladder and urinary tract	15.0 (73)	20.5 (59,919)	0.73 (0.58–0.92)	4.3 (26)	4.3 (14,701)	1.00 (0.68–1.47)
Brain and CNS including endocrine tumors	10.1 (36)	12.2 (23,280)	0.83 (0.6–1.15)	5.2 (23)	5.2 (11,939)	1.00 (0.66–1.51)

The rates shown are age-standardized to the world standard. The NORDCAN countries are Denmark, Faroe Islands, Finland, Greenland, Iceland, Norway, and Sweden. Abbreviations: IRR – Incidence rate ratio. 95%CI – 95% Confidence interval.

unanimously standardized manner, essentially transforming the whole Nordic area into a large, shared cohort. The larger number of cases from the combination of the Nordic countries leads to greater possibilities for investigating different research questions. The IRRs for each of the Nordic countries compared to the NORDCAN countries are shown in the Supplementary Tables and show several interesting trends which warrant further investigation.

The validation of the FCR revealed that 13% of cancer cases from 2006 to 2019 were not reported. This underreporting underlines the importance of vigilance and continued monitoring of cancer registries to ensure the validity of the reported statistics. There may be several potential explanations for the underreporting observed. One may be the lack of standardized and electronic modernized reporting to the FCR, which precludes automated checks and thus increases the risk of missing. Another obstacle to obtaining complete cancer data in the Faroe Islands is that often the treatment, and sometimes the diagnosis as well, is carried out in two countries, with neither having access to the complete medical journal. There are currently efforts ongoing to ensure that all data on cancer treatment from other countries will be available within the Faroe Islands, both regarding access to individual medical records and registry data. Still, even after validation, some unreported cases may be missing from the FCR, and continued work is needed to ensure the completeness of the registry.

Thus, the FCR needs further improvements for cancer registration, but some are already underway. Among the ongoing improvements is a modernization of clinician reports to avoid manual handling of paper reports and providing tools to ensure that the clinicians systematically fill out the

reports. Pathology reports and death certificate reports are also under modernization to ensure that all necessary data is reported in a systematic and timely manner. One area of continued concern is the historical coding of pathology in the FCR. Pathology reports are used to adjust for registration of multiple primary tumors, and if previously imputed SNOMED pathology codes are incomplete or wrong, the incidence drawn from the registry might be skewed as well. Further validation efforts, specifically looking at correcting pathology using original pathology reports, might slightly affect the incidence in some cancer sites but are unlikely to lead to any great differences from the rates reported.

There are limitations to the present study. Systematic case ascertainment was limited to the period after 2006 when the medical journal was digitalized as a part of the EHS. Thus, the rates prior to 2006 should be interpreted with caution. Further, because of the small population size, the absolute numbers in the Faroe Islands will naturally be low, and small fluctuations due to chance can considerably affect the results, making comparisons between countries difficult. However, by performing the analysis for ten years cumulatively, as presented here, we can reasonably investigate differences over time and across countries.

Conclusion

The cancer incidence rate in the Faroe Islands has increased over the last 60 years, while the cancer mortality rate has remained at a consistent level. Compared with rates in the Nordic countries, the incidence differed for some cancer in the Faroes, with lower rates overall and for breast cancer in women and prostate in men, while rates were high for testicular cancer.

Validation efforts revealed that 13% of cases had not been reported to the FCR from 2006 to 2009, emphasizing the need for continued validation efforts of cancer registries to secure the reliability of cancer reports.

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Data availability statement

The data in this report are freely available on https://nordcan.iarc.fr/en (2019 data).

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