Relative Survival of Cancer Patients

A Comparison between Denmark and the other Nordic Countries

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The results of a Nordic collaborative project revealed that Danish cancer patients had a poorer prognosis than patients in the other Nordic countries for some major cancer sites. The present study was undertaken to further explore the differences in survival between Denmark and the other Nordic countries. All cancer cases diagnosed in the Nordic countries during 1958 to 1991/92 were included in the analysis. Relative survival and excess mortality were calculated for intervals in the first five years after diagnosis. Since the 1950s, the prognosis of cancer patients has improved in all the countries, but more moderately in Denmark. For cancers of the stomach, colon, rectum, breast (female), and prostate, the Danish patients had a markedly lower relative survival than the patients in the other countries. They also had the lowest proportion of localized tumours. It appears that Danish cancer patients are diagnosed at a later stage of disease than patients in the other Nordic countries.

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As part of the Nordic collaborative project 'Cancer in the Nordic countries in the years 1990, 2000 and 2010' (CiN), predictions of cancer mortality, based on relative survival analysis in the Nordic countries up to the years 2000 and 2010, were constructed (1). This was the first time survival data for cancer patients throughout the Nordic countries were presented in a uniform way for major cancer sites, providing the opportunity to compare the level of, and the trends in survival in the five countries. Given the similarities in cancer incidence and health-care systems in the Nordic countries, it came as no surprise that the general impression after these comparisons was a similarity in survival between the Nordic countries. A major exception was the poorer survival for several cancer sites in Denmark. It seemed that Danish patients had the same survival as patients in the other countries in the 1950s and the 60s, but had not experienced the same level of improvement in prognosis during later decades. For example, female colon cancer patients in Denmark diagnosed in the period 1983–1987 had a 5-year relative survival of 40% while the average for the other countries was 50%, ranging from 46% to 51%.

The basic material was thoroughly checked and the computational routines verified to ensure that the observed differences in relative survival were real. No 'technical reasons' that could explain the observed differences were revealed.

In another part of the CiN project, dealing with the effects of giving all cancer patients the best prevailing diagnostic examinations and treatment on cancer mortality predictions, regional variation in cancer survival within each of the Nordic countries was analysed (2). In this analysis, regional variation in Denmark was no greater than that in the other countries. Thus, it did not seem likely that extreme regional heterogeneity in Denmark was a reasonable explanation for differences in survival rate.

The observed differences in survival could indicate that parts of the health-care system in Denmark were functioning differently from those in the other countries and that some cancer deaths could have been prevented. It re-

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mained open, after the CiN project, as to whether this was due to pre-diagnostic (late diagnosis) or post-diagnostic effects (differences in the pattern or system of cancer care).

The aim of the present study was to explore the differences in survival between Denmark and the other Nordic countries, using two well-established databases.

MATERIAL AND METHODS

Each of the Nordic countries has a population-based cancer registry. The Danish Registry, founded in 1942, is the oldest; the Norwegian, Finnish and Icelandic registries were founded in 1952–1954 and the Swedish Registry in 1958. At annual meetings, standardization of registration and classification are discussed and joint projects planned.

Notification is compulsory in all Nordic countries with the exception of Iceland. Reporting became compulsory for private physicians in Sweden in 1983 and for all medical doctors in Denmark in 1987. Almost 100% coverage is achieved in all the registries, which rely on reporting from multiple sources, including physicians, hospitals, institutions with hospital beds, and pathological and cytological laboratories. Information is also collected from death certificates, and cases based on death certificates only are registered in all countries with the exception of Sweden.

The unique personal identification number used in each of the Nordic countries makes identification of individuals easy and reliable. The registries collect, in accordance with international recommendations, a minimum set of data on each case of cancer, which is used for routine statistical reporting. The data are collected in different forms in the five countries. The following items are registered for each cancer case in every registry: patient identification, place of residence, primary site of the tumour, date of diagnosis, verification of diagnosis, histological type, and date and cause of death. In all five countries, deaths and emigrations are registered in population registries. Again, the personal identification number makes it possible to keep these registries as complete as possible. For a more detailed description of cancer registration practices in the Nordic countries, see Tulinius et al. (3).

The data material in this study included the two data files collected in the two subprojects of CiN (1, 2). These data sets are denoted as A and B, respectively.

A

Patient data

For all patients diagnosed with cancer between 1958 and 1987 in the Nordic countries (2.1 million cases), the following data were made available to the study: country, gender, date of birth, date of diagnosis, cancer site (20 sites/groups of sites for each gender), basis of diagnosis ('death certificate only' [with the exception of Sweden], 'incidental at autopsy' or 'other') and date of death, emigration or end of follow-up (patients followed to the end of 1990 in Denmark and Iceland and to the end of 1991 in the other countries).

Population data

Population figures and general mortality rates for the population in 1958–1990/1991 were obtained from the central statistics offices in each country.

B

The material consisted of the same patient information as in data set A for all patients diagnosed with cancer (12 of the cancer types in Engeland et al. (1)) between 1978 and 1991 (Denmark and Sweden) or 1992 (Finland and Norway) in all the Nordic countries with the exception of Iceland, with a follow-up to the end of 1991 (Denmark and Sweden), 1992 (Norway) or 1993 (Finland). The twelve sites were stomach, colon, rectum, larynx (males), lung, breast (females), cervix uteri, corpus uteri, prostate, kidney, urinary bladder and melanoma of the skin. In addition to the information in data set A, information on stage (localized/non-localized/unknown), morphology and a more detailed list of basis of diagnosis were included. Information on stage was available for Denmark, Finland, and Norway.

In the present study, a more thorough descriptive analysis was carried out for cancers of the stomach, colon, rectum, breast (females), corpus uteri, prostate, and melanoma of the skin using both data sets A and B.

In the calculation of relative survival rates, we assumed an additive hazard model, i.e. that cancer patients with covariate array $\mathbf{x}$ have an intensity of mortality of the form $\mu(\mathbf{x}, t) + \nu(\mathbf{x}, t, t - t_D)$ (4). Here, t_D is date of diagnosis, and hence, $t - t_D$ is time since diagnosis, and $\mu(\mathbf{x}, t)$ is the intensity of mortality at calendar time t for the general population with covariate array $\mathbf{x}$. The relative survival can then be written as:

$$r_y(\mathbf{x}, t_D) = \exp\left(- \int_{t_D}^{t_D + y} \nu(\mathbf{x}, t, t - t_D)\, dt \right)$$

The relative survival has been interpreted as the proportion of patients alive at the end of the interval compared with the patients alive at the beginning of the interval if the disease investigated is the only cause of death (5).

The relative survival was estimated for intervals of time since diagnosis, intervals of 3 months during the first year, intervals of 6 months in the second year and thereafter of 1 year. Owing to the small number of cases, intervals of 6 months in the first year and thereafter of 2 years were used for Iceland. The excess mortality intensity was assumed to be the same for all patients with the same covariates diagnosed in the same calendar period. The excess mortality intensity was also assumed to be constant within the intervals of time after diagnosis mentioned above, and

within broad age groups (for cancers of the stomach and prostate: 0–54, 55–74, 75–89 years; for cancers of the colon, rectum, breast, corpus uteri and melanoma of the skin: 0–44, 45–64, 65–74, 75–89 years).The excess mortality in interval j after diagnosis was estimated by

$$\tilde{v}_j(\mathbf{x}) = \frac{d_j(\mathbf{x}) - f_j(\mathbf{x})}{l_j(\mathbf{x})}$$

and the relative survival for the same interval j was estimated by

$$\tilde{r}_j(\mathbf{x}) = \exp(-x_j \cdot \tilde{v}_j(\mathbf{x}))$$

where x_j was the length of interval j, $l_j(\mathbf{x})$ was the lifetime of these patients in time interval j after diagnosis, $d_j(\mathbf{x})$ was the observed number of deaths in interval j after diagnosis among these patients, and $f_j(\mathbf{x})$ was the expected number of deaths in interval j after diagnosis among the patients still alive at the beginning of the interval, assuming that the patients had the same mortality rate as the general population in the same calendar period, gender and age group. The relative survival up to a certain point in time was calculated as the product of the relative survival in the intervals up to that point.

In all the calculations of relative survival, cases based on 'death certificate only' (DCO) or found 'incidentally at autopsy' (IA) were excluded. In 1983–1987, the proportion of DCO cases ranged from 0.3% of all cancer cases (Iceland) to 1.4% (Denmark) in the Nordic countries, while the proportion of IA cases ranged from 0.9% (Norway) to 7.1% (Sweden) (6). Patients over 90 years of age at diagnosis were also excluded.

The question of whether cancer cases in some countries were diagnosed at a later stage of disease than in the other countries was addressed by computing stage distribution (localized/non-localized) and stage-specific 5-year relative survival rates by site, country and age for the period 1978–1991/92. This analysis was restricted to patient data from Denmark, Finland and Norway, since information on stage was not available for Sweden and Iceland.

The proportion of cases with unknown stage varied among the three countries, as did the survival for those patients with unknown stage. This made it difficult to make comparisons between countries of stage distribution and stage-specific patient survival. For example, of the Norwegian patients diagnosed with cancer of the stomach, 3% had stage unknown and these patients had a 5-year relative survival rate of 6%, which was even lower than the survival rate for Norwegian patients with non-localized disease. In Denmark, however, 16% of stomach cancer patients had stage unknown, with a survival rate of 12%, which was intermediate to the survival rates for localized and non-localized cases. In Finland, 17% of stomach cancer patients had stage unknown, with a survival rate of 17%, which was intermediate to the survival rates for localized and non-localized cases.

The case for stomach cancer was typical of the situation for the other sites. Norway generally had the lowest proportion of cases with unknown stage and these cases generally had very poor survival. The percentages of cases with unknown stage across all sites were 3% in Norway, 16% in Finland, and 11% in Denmark. In order to enable more meaningful comparisons of the stage distribution, and of stage-specific survival, we distributed those patients with unknown stage into either the localized or non-localized groups. The grouping was based on the 5-year (age, gender and country-specific) relative survival in the following way:

- If the 5-year relative survival for those with unknown stage was higher than for those with localized tumours, all unknown stages were regarded as localized stages. New 5-year relative survival for localized stage was calculated as the weighted average of the survival rates for localized and unknown stages, with weights proportional to the size of the two groups.
- If the 5-year relative survival for those with unknown stage was lower than for those with non-localized tumours, all unknown stages were regarded as non-localized stages. New 5-year relative survival for non-localized stage was calculated as the weighted average of the survival rates for non-localized and unknown stages, with weights proportional to the size of the two groups.
- If the 5-year relative survival for those with unknown stage was intermediate to those with localized tumours and those with non-localized tumours, the proportion of the unknown stages that was regarded as localized and non-localized stages, respectively, was calculated on the basis of relative survival in the group with unknown stage and in the specified groups. This calculation was applied in order to estimate the proportion with localized stage and new relative survival rates were not estimated. The relative survival was adjusted for age in the following way:

$$\text{Age-adjusted RSR} = \sum_{i=1}^{A} a_{i+} \cdot R_i$$

where R_i = relative survival in age group i, and a_{i+} is the proportion of cases in the Nordic countries in age group i in 1978–1987.

The excess mortality of the cancer patients was calculated as a function of time since diagnosis by country, site, period of diagnosis, age group and gender. These calculations were intended to give information on whether differences in excess mortality were confined to specific periods; for example, the first period after diagnosis. The excess mortality was age-adjusted with the same method as the RSR and with the same weights.

Table 1

Number of cases included in the study and median age at diagnosis

Site	Data set A (1958–1987)				Data set B (1978–1991/92)			
Country	Males	Females	Total	Median age	Males	Females	Total	Median age
Stomach								
Denmark	18 331	11 492	29 823	71	6 408	4 113	10 521	72
Finland	21 814	17 618	39 432	68	8 834	7 909	16 743	70
Iceland	1 311	667	1 978	69	0	0	0	
Norway	19 954	13 089	33 043	70	8 044	5 278	13 322	72
Sweden	36 097	22 262	58 359	71	0	0	0	
Colon								
Denmark	19 547	24 182	43 729	70	11 575	14 372	25 947	71
Finland	6 827	10 464	17 291	68	5 194	7 655	12 849	70
Iceland	514	580	1 094	71	0	0	0	
Norway	13 582	16 036	29 618	70	10 791	12 410	23 201	71
Sweden	30 676	33 484	64 160	70	0	0	0	
Rectum								
Denmark	17 309	12 686	29 995	69	8 482	6 483	14 965	70
Finland	5 853	6 547	12 400	68	4 667	4 728	9 395	70
Iceland	243	200	443	69	0	0	0	
Norway	8 892	6 901	15 793	69	6 899	5 380	12 279	70
Sweden	21 182	15 677	36 859	69	0	0	0	
Breast								
Denmark		60 919	60 919	61		36 663	36 663	61
Finland		38 117	38 117	59		31 658	31 658	60
Iceland		1 797	1 797	58		0	0	
Norway		39 816	39 816	62		26 685	26 685	65
Sweden		101 210	101 210	63		0	0	
Corpus uteri								
Denmark		15 174	15 174	62		8 695	8 695	64
Finland		10 637	10 637	61		7 249	7 249	64
Iceland		394	394	60		0	0	
Norway		8 950	8 950	60		5 893	5 893	63
Sweden		25 229	25 229	61		0	0	
Prostate								
Denmark	27 996		27 996	73	17 795		17 795	73
Finland	20 092		20 092	72	17 358		17 358	73
Iceland	1 182		1 182	74	0		0	
Norway	34 803		34 803	73	25 195		25 195	74
Sweden	86 729		86 729	73	0		0	
Melanoma								
Denmark	4 213	6 359	10 572	54	3 408	4 862	8 270	55
Finland	3 094	3 676	6 770	55	2 879	3 190	6 069	56
Iceland	66	146	212	57	0	0	0	
Norway	4 693	5 793	10 486	53	4 600	5 646	10 246	55
Sweden	9 049	10 159	19 208	56	0	0	0	
TOTAL	414 049	520 261	934 310		142 129	198 869	340 998	

RESULTS

Altogether, about 934 000 cases diagnosed in 1958–1987 were included in the analyses based on data set A, and 341 000 cases diagnosed in 1978–1992 in the analyses based on data set B (Table 1).

In patients with *colon cancer* diagnosed in 1978–1992, clearly the lowest proportion of localized tumours was observed in Denmark (Table 2). Danish patients with localized tumours had a poorer prognosis than patients with localized tumours in Finland and Norway. Among patients with non-localized tumours, Finnish patients had the poorest prognosis. In Fig. 1, the relative excess mortality for male colon cancer patients, by time since diagnosis, is plotted for three time periods. The excess mortality in Denmark was set as unity. The excess mortality in Finland, Iceland, Norway and Sweden decreased for each successive calendar period compared with the excess mortality in Denmark. The difference in excess mortality be-

Table 2

Proportion of cases with localized tumours and age-adjusted 5-year relative survival for patients aged 0–89 years with localized and non-localized tumours diagnosed in 1978–1991/92

	Males				Females			
Site	Age-adj. 5-year relative survival				Age-adj. 5-year relative survival			
Country	Localized (%)	Localized	Non-localized	Total	Localized (%)	Localized	Non-localized	Total
Stomach								
Denmark	25	31	3	10	24	42	4	13
Finland	29	49	5	18	29	51	5	18
Norway	32	37	8	16	34	43	9	19
Colon								
Denmark	21	62	31	37	19	69	34	41
Finland	48	78	18	46	47	80	19	47
Norway	33	75	33	46	32	77	36	49
Rectum								
Denmark	30	61	25	36	30	66	28	40
Finland	57	66	14	43	56	68	15	45
Norway	45	63	27	43	47	70	28	47
Breast								
Denmark					54	85	51	69
Finland					58	91	56	76
Norway					57	87	56	74
Corpus uteri								
Denmark					74	88	43	76
Finland					79	88	33	76
Norway					76	85	44	75
Prostate								
Denmark	59	58	16	41				
Finland	64	79	24	59				
Norway	69	71	24	56				
Melanoma								
Denmark	88	81	18	73	92	89	30	84
Finland	84	83	21	73	89	89	29	83
Norway	85	79	21	70	92	90	35	85

tween Denmark and the other Nordic countries was particularly large in the first year after diagnosis, when the excess mortality was clearly the highest in absolute terms. A similar picture was seen in female patients.

The age-adjusted 5-year relative survival for colon cancer patients was similar in Denmark and the other Nordic countries from 1958 to 1970–1975, with the exception of Finland, which had a lower relative survival in this period (Fig. 2). Denmark has had the lowest relative survival among the Nordic countries since the beginning of the 1970s.

In patients with *rectal cancer* diagnosed in 1978–1992, Finland and Norway had a much higher proportion of localized tumours compared with Denmark (Table 2). Within stages, Danish and Norwegian patients had quite similar prognoses, while Finnish patients with non-localized tumours had poorer prognosis than patients with non-localized tumours in the other two countries. Overall relative survival was lower in Denmark than in Finland and Norway. As was the case with colon cancer patients, the excess mortality in rectal cancer patients in Finland, Iceland, Norway and Sweden improved for each successive calendar period compared with the excess mortality in Denmark (Fig. 1). Since 1977 (males) and 1973 (females), Denmark had the lowest relative survival among the Nordic countries (Fig. 2).

In patients with *stomach cancer* diagnosed in 1978–1992, the proportion of patients with localized tumours was lowest in Denmark and the stage-specific survival was poorest in Danish patients (Table 2). The total age-adjusted 5-year relative survival was 10% in males in Denmark compared with 18% in Finland and 16% in Norway. Similar differences were seen in females.

As with colon cancer, the age-adjusted 5-year relative survival was similar in Denmark and the other Nordic countries from 1958 to 1972–1974, with the exception of Finland, which had a lower relative survival in this period (Fig. 2). From 1972 (males) and 1974 (females) onwards, Denmark had the lowest relative survival among the Nordic countries. In patients diagnosed in 1978–1987, the

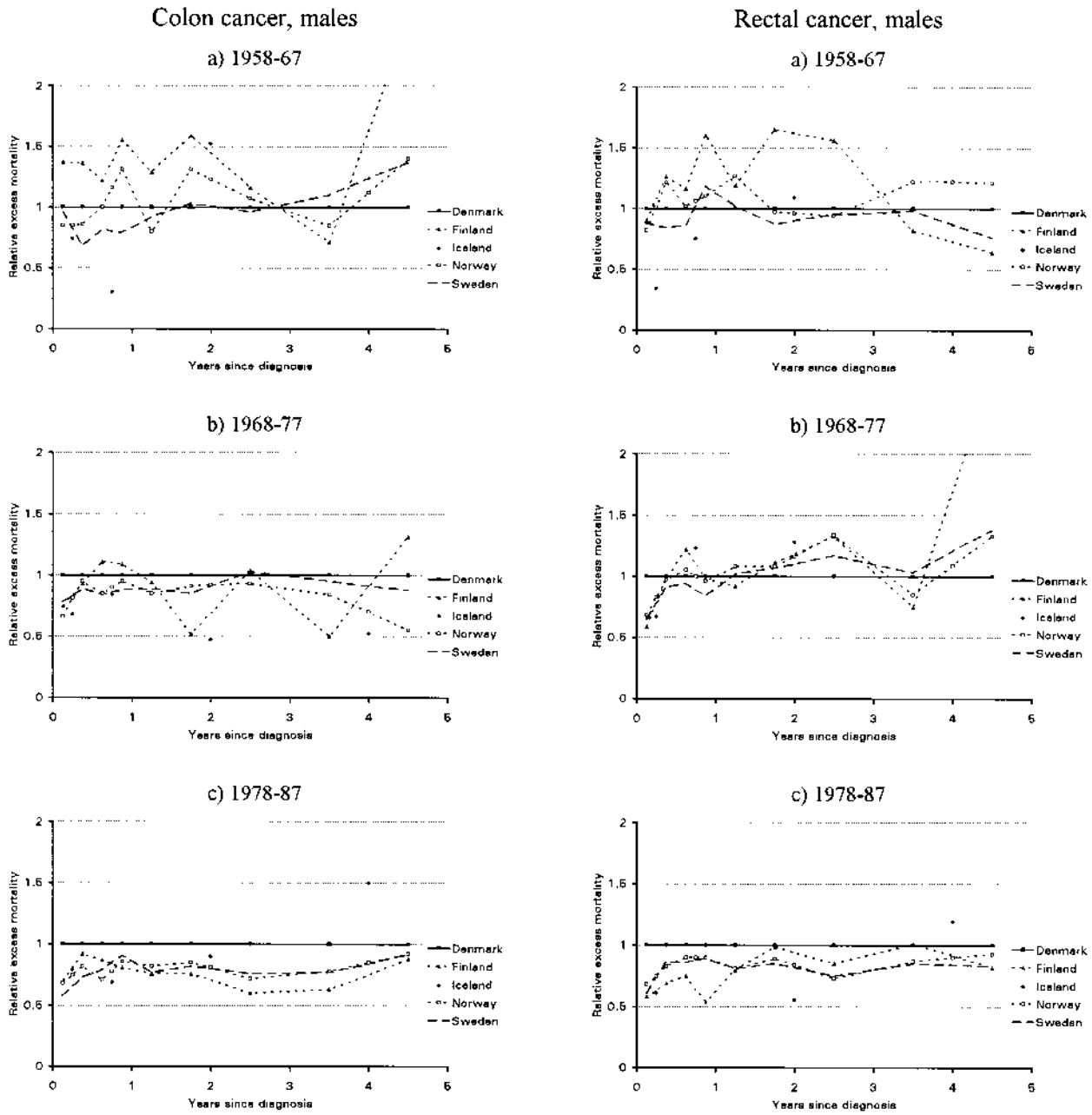

Fig. 1. Age-adjusted relative excess mortality of males colon and rectal cancer patients by time since diagnosis in three calendar periods: (a) 1958–1967, (b) 1968–1977 and (c) 1978–1987.

excess mortality was higher in Denmark than in the other countries in the first 5 years after diagnosis in males and at least in the first year in females (Fig. 3).

The proportion of patients with localized *breast cancer* was lower in Denmark than in Finland and Norway. Denmark had the poorest prognosis in patients with both localized and non-localized tumours. From 1958 to 1972, Finnish and Danish patients had a poorer prognosis than Norwegian and Swedish patients (Fig. 2). Since 1972, Finnish patients had about the same relative survival as patients in Norway and Sweden, whereas Danish patients still had a poorer prognosis than patients in the other countries. In patients diagnosed in 1978–1987, the excess mortality was markedly higher in Denmark than in the other countries in the first 5 years after diagnosis (Fig. 3).

In patients with *cancer of the corpus uteri* only small differences were observed in relative survival between the Nordic countries (Fig. 2). In patients diagnosed in 1978–1987, the excess mortality was higher in Denmark than in Finland, Norway or Sweden in the first year after diagnosis, but from 1 to 5 years after diagnosis the Danish patients had a lower excess mortality than the other countries (Fig. 3).

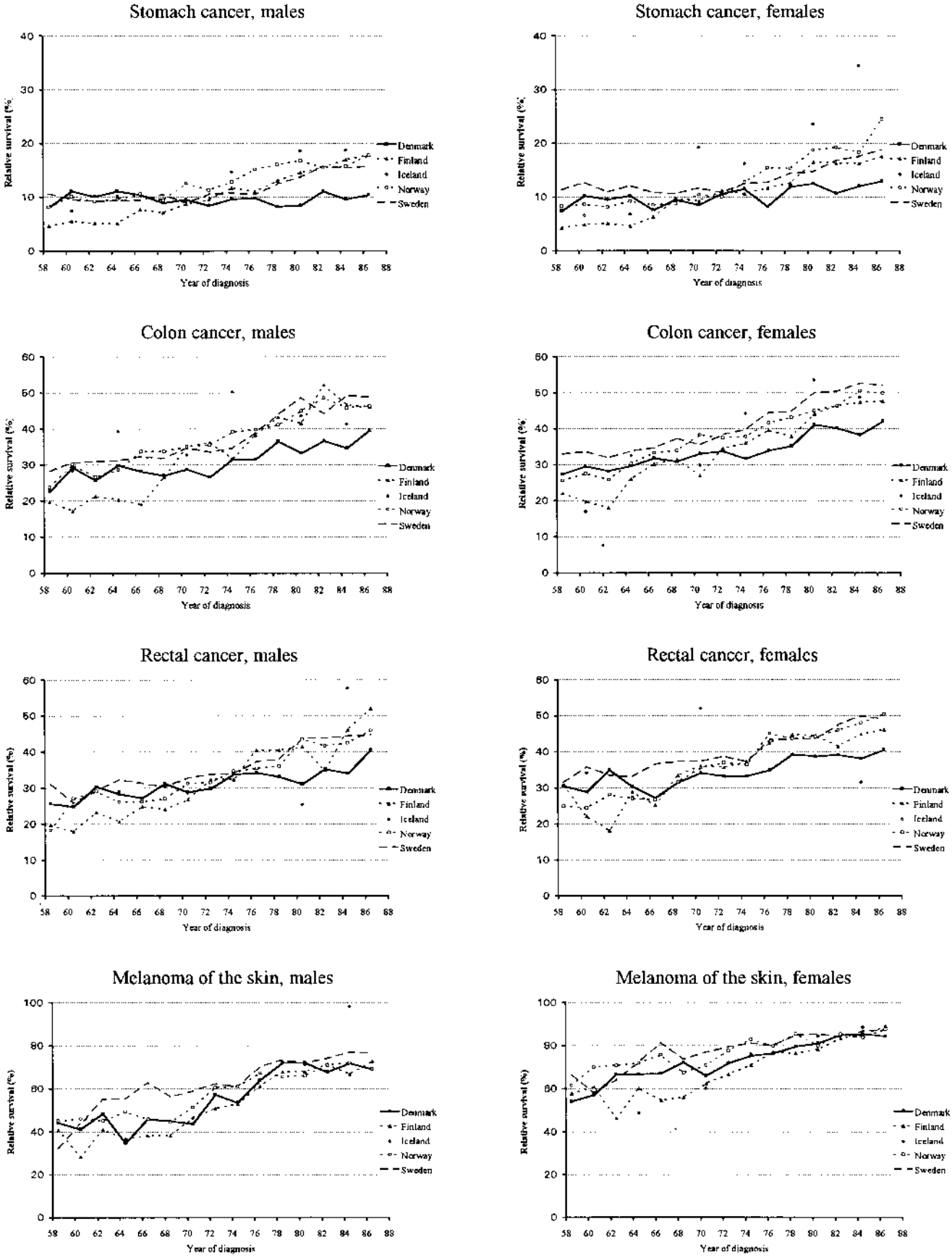
Stomach cancer, males
Stomach cancer, females
Colon cancer, males
Colon cancer, females
Rectal cancer, males
Rectal cancer, females
Melanoma of the skin, males
Melanoma of the skin, females
Relative survival (%)
Year of diagnosis
Denmark
Finland
Iceland
Norway
Sweden

Fig. 2.

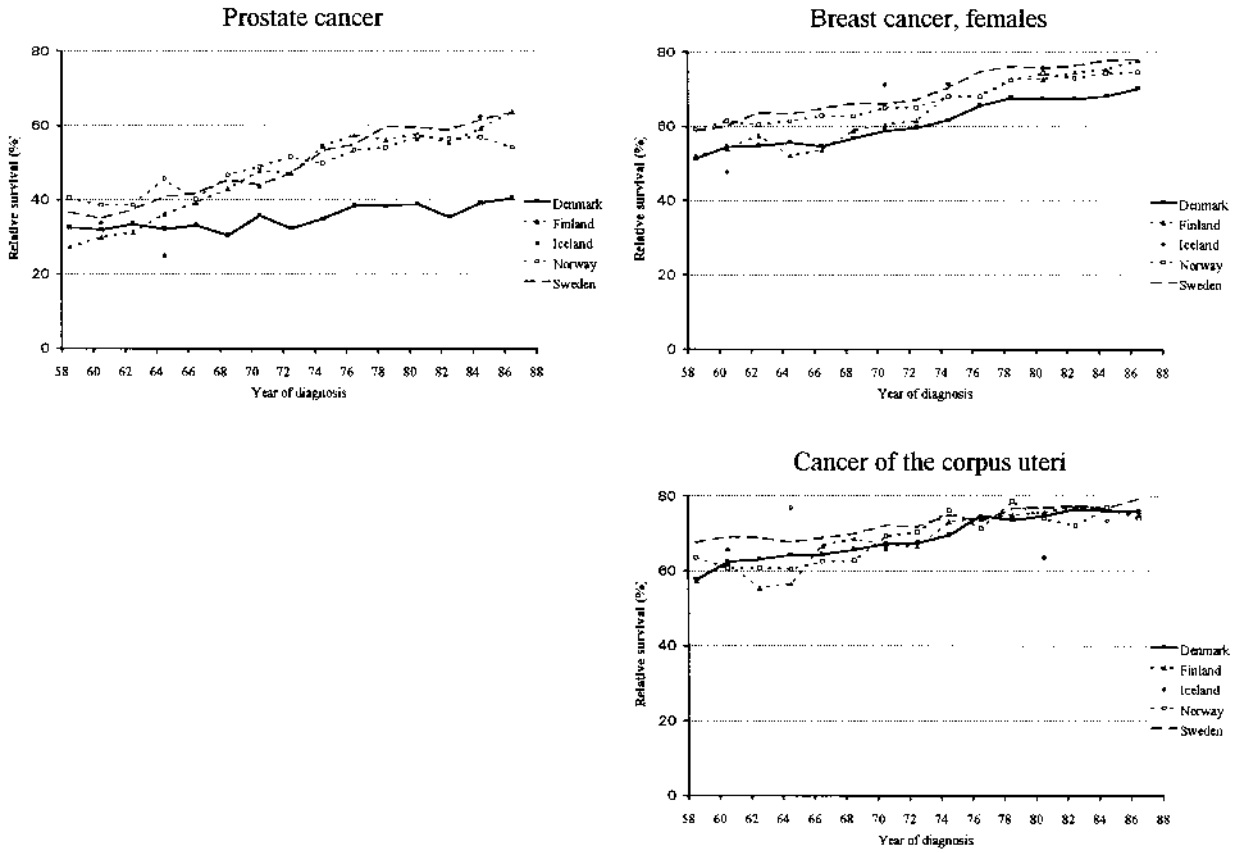

Fig. 2. Age-adjusted 5-year relative survival in patients diagnosed in the Nordic countries in 1958–1986, calculated for 2-year periods. (Owing to the low number of cases, 5-year relative survival for Icelandic patients was calculated for 5-year periods only.)

In patients with *cancer of the prostate*, the proportion with localized tumours was lowest in Denmark and the stage-specific survival was poorest in the Danish patients (Table 2). Since 1965, the age-adjusted 5-year relative survival was lower in Denmark than in the other Nordic countries (Fig. 2). While the prognosis of prostate cancer patients has improved substantially in the other countries, the prognosis of Danish patients has improved only slightly. In patients diagnosed in 1978–1987, the excess mortality was markedly higher in Denmark than in the other countries in the first 5 years after diagnosis (Fig. 3).

In Denmark, Finland and Norway, about 90% of the patients with *melanoma of the skin* had localized tumours (Table 2). Small differences were seen in relative survival between the Nordic countries (Fig. 2). In patients diagnosed in 1978–1987, no marked difference was seen in the excess mortality between the countries in the first 5 years after diagnosis (Fig. 3).

DISCUSSION

In the present study, information on approximately one million cancer cases, diagnosed in the Nordic countries during 1958–1992, were used to examine the differences in survival between Denmark and the other Nordic countries observed in an earlier study (1). For cancers of the stomach, colon, rectum, breast (female), and prostate, for which the Danish patients had a markedly lower relative survival than the patients in the other countries, they also had the lowest proportion of localized tumours. This was seen most clearly for cancers of the colon and rectum. However, this did not completely explain the inferior survival rates for Danish patients.

Generally, it is difficult to interpret differences in survival between populations or trends in survival. Any factor affecting either the definition of illness, the date of diagnosis or the date of death, can influence survival (7). The close relationship between the Nordic Cancer Registries and the social and cultural similarities between the Nordic countries should reduce such difficulties. Differences in the background mortality in the populations were accounted for, in this study, by comparing the relative survival rates instead of the crude survival.

Owing to the close relationship between the Nordic cancer registries, we felt that the classification of localized/non-localized tumours was quite similar in these countries

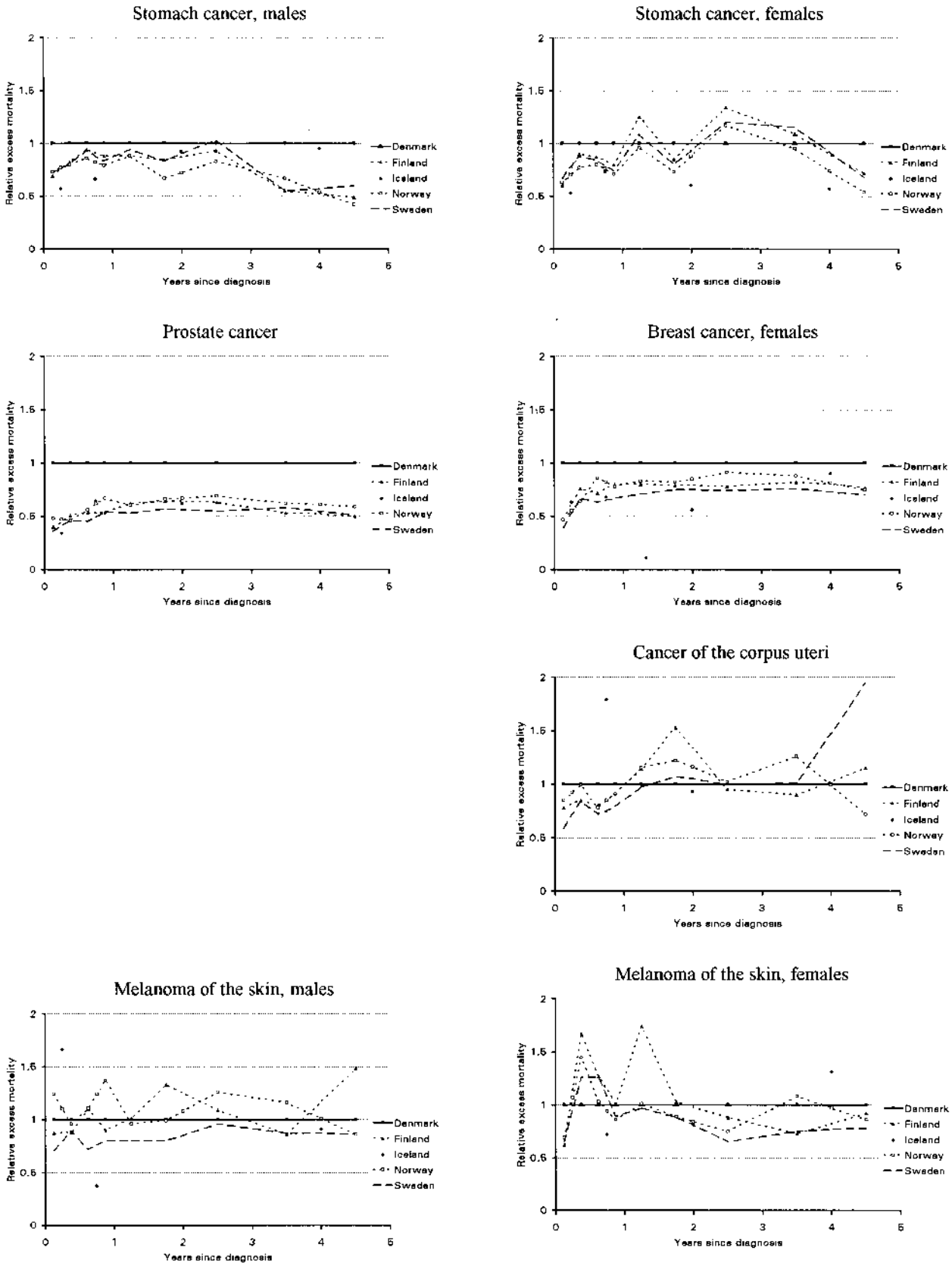

Fig. 3. Age-adjusted relative excess mortality of cancer patients by time since diagnosis in 1978–1987.

Table 3

Age-adjusted incidence (I) and mortality (M) rates in 1983–87 in the Nordic countries (1, 9)

	Stomach cancer			Colon cancer			Rectal cancer			Prostate cancer			Melanoma of the skin		
Males	I	M	I/M	I	M	I/M	I	M	I/M	I	M	I/M	I	M	I/M
Denmark	12.4	10.6	1.2	21.8	12.6	1.7	15.7	9.5	1.7	30.0	17.4	1.7	7.5	2.1	3.6
Finland	20.3	15.6	1.3	13.3	6.5	2.0	9.4	5.0	1.9	37.6	15.4	2.4	7.1	1.8	3.9
Iceland	28.2	21.8	1.3	20.0	9.5	2.1	7.8	3.9	2.0	52.7	17.4	3.0	3.4	0.8	4.3
Norway	15.8	12.8	1.2	20.9	10.1	2.1	14.3	7.3	2.0	44.1	19.3	2.3	10.6	3.2	3.3
Sweden	12.7	9.6	1.3	17.6	8.1	2.2	11.6	5.8	2.0	50.4	18.2	2.8	9.5	2.3	4.1

	Stomach cancer			Colon cancer			Rectal cancer			Breast cancer			Cancer of the corpus uteri			Melanoma of the skin		
Females	I	M	I/M	I	M	I/M	I	M	I/M	I	M	I/M	I	M	I/M	I	M	I/M
Denmark	5.7	4.8	1.2	20.4	11.1	1.8	9.4	5.7	1.6	68.6	26.6	2.6	15.2	3.2	4.8	9.8	1.7	5.8
Finland	11.0	8.6	1.3	11.6	5.6	2.1	6.2	3.2	1.9	54.7	16.6	3.3	12.0	2.5	4.8	6.3	1.1	5.7
Iceland	10.0	6.6	1.5	15.7	7.6	2.1	5.4	2.4	2.3	67.7	20.2	3.4	10.9	2.5	4.4	5.9	0.7	8.4
Norway	8.1	6.2	1.3	18.7	9.1	2.1	8.7	4.3	2.0	52.6	17.5	3.0	12.3	2.7	4.6	13.6	1.9	7.2
Sweden	6.5	4.8	1.4	15.9	6.6	2.4	7.7	3.7	2.1	59.0	18.4	3.2	13.2	2.5	5.3	9.6	1.3	7.4

and hence that the stage-specific relative survival rates presented here were comparable. However, we cannot exclude the possibility that some of the stage-specific differences observed in the present study may be due to differences in classification.

Stage migration did not seem to be an important issue in the comparison between Denmark, Finland and Norway, since the differences in relative survival were also seen for patients with localized and non-localized tumours combined (8). In addition, Denmark generally had the lowest proportion of localized tumours but did not have a better stage-specific survival.

In the Nordic cancer registries, with the exception of the Swedish registry, attempts are made to obtain more information on cases first notified from death certificates. Unfortunately, comparable estimates of the number of death certificate initiated (DCI) cases are not available for each of the Nordic countries. However, as far as we know, there are no major differences between the Danish, Finnish, Icelandic and Norwegian cancer registries in this issue.

The absolute excess mortality is highest in the first year after diagnosis in all types of cancer included in the present study. Therefore, differences in excess mortality between the Nordic countries during the first year after diagnosis are important for the 5-year relative survival. However, for the types of cancer for which the Danish patients had a markedly lower relative survival than the patients in the other countries, Danish patients also had the highest excess mortality from 1 to 5 years after diagnosis.

Differences in relative survival between the Nordic countries will be discussed here in light of the incidence and mortality rates presented in two earlier publications (1, 9). The age-adjusted (World Standard Population (10)) incidence and mortality rates for the period 1983–1987 are presented in Table 3. The mortality rates were estimated based on incidence and relative survival figures, not on official mortality statistics.

The incidence of prostate cancer varies considerably between the Nordic countries, with age-adjusted incidence rates ranging from 30 (Denmark) to 53 (Iceland) per 100 000 person-years (Table 3). As noted earlier, Denmark also has the lowest relative survival in prostate cancer patients, while relatively small differences have been observed in prostate cancer mortality between Denmark and the other Nordic countries (11). The differences in incidence and survival may be caused by differences between Denmark and the other countries in diagnosing small, latent tumours of the prostate that do not cause severe symptoms. Aggressive diagnostic practices will increase the incidence and usually advance the date of diagnosis. In the present study, it was only possible to calculate the proportion of patients with localized tumours. Patients in Denmark had a smaller proportion of localized tumours than patients in Finland and Norway, and the Danish patients with localized tumours had a much poorer prognosis than patients with localized tumours in Finland and Norway. This is indicative of a more aggressive diagnostic activity outside Denmark. However, we would need more detailed information in order to verify that the differences in survival were actually due to different diagnostic practices.

For cancers of the colon, rectum, and breast (female), Danish patients had a lower proportion of localized tumours than Finnish and Norwegian patients. The differences observed were smaller for breast cancer than for the other two cancer types, but the high incidence of breast cancer in females makes this difference important. For rectal cancer, patients with both localized and non-local-

ized tumours had similar prognoses in Denmark and Norway. However, the much lower proportion of patients with localized tumours in Denmark led to a lower overall relative survival in Danish patients compared with that in Finnish and Norwegian patients. Unlike the situation for prostate cancer, Denmark has both the highest incidence and mortality for these types of cancer among the Nordic countries. In addition, Denmark has the lowest incidence/mortality ratio in both colon and rectal cancer in both genders and for female breast cancer. It seems that colon and rectal cancers were diagnosed at a later point in time in Denmark than in Finland and Norway, giving a poorer prognosis. The difference between Denmark and the other Nordic countries has increased gradually since the mid-1970s. The prognosis of patients has improved in all the countries, but more moderately in Denmark.

In summary, it seems that for important cancers such as cancer of the stomach, colon, rectum, breast (female), and prostate, Danish cancer patients are diagnosed at a later stage of the disease than cancer patients in the other Nordic countries. On the other hand, no difference was seen between the Nordic countries in prognosis of patients with cancer of the corpus uteri or melanoma of the skin.

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