

Change in Incidence of Crohn's Disease and Ulcerative Colitis in Denmark. A Study Based on the National Registry of Patients, 1981–1992

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Background. The incidence of inflammatory bowel disease (IBD) in Denmark is considered to be among the highest in Europe. However, the diseases are relatively rare and therefore it would be useful if existing registers could replace ad hoc examination in the surveillance of IBD.

Methods. The present study used the Danish National Registry of Patients to estimate incidence rates, 1981–1992.

Results. A total of 2806 patients with Crohn's disease (CD) and 8125 with ulcerative colitis (UC) were identified. The mean incidence for CD was 4.6 (5.4 for women and 3.7 for men) per 100 000 per year, with a peak incidence in younger women. The incidence increased in most age groups with the highest increase in older women. The mean incidence for UC was 13.2 (13.4 for women and 13.0 for men) per 100 000 per year, with the highest incidence in older men. A decreasing tendency in the incidence was present in most age groups.

Conclusions. The present study found an increasing incidence for CD and a stable incidence with a tendency to decrease for UC. Comparison with ad hoc studies indicates that it is possible to use the Danish National Registry of Patients in the surveillance of IBD, especially for CD.

Keywords: ulcerative colitis, Crohn's disease, epidemiology, incidence, information systems

The inflammatory bowel diseases (IBD), Crohn's disease (CD) and ulcerative colitis (UC) are characterized by chronic intestinal inflammation with periodic exacerbation and a variety of local and systemic complications.¹ The incidence rates, particularly of CD, have probably increased in the last decades.² The incidence of IBD in the Scandinavian countries is considered to be among the highest in Europe, with peak incidence rates in younger adults.^{2–17} In the county of Copenhagen, which represents 10% of the Danish population, the estimated prevalence in 1987 for CD and UC was

54 and 160 per 100 000 inhabitants, respectively.^{2,3} The diseases are relatively rare, making it expensive and time consuming to estimate incidence in follow-up studies since they have to be large; furthermore it is difficult to continue prospective registration for many years, and surveillance bias may be a problem if attention varies from region to region and over time. Therefore it would be of value if existing registers could provide data of acceptable quality for surveillance of IBD.¹⁸ Updated incidence and prevalence data are not only needed in health care planning; they also serve to identify possible changes in putative causes over time and to put the disease in a proper public health perspective.

The aims of this study were (i) to estimate incidence rates of CD and UC by using the Danish National Registry of Patients from 1981 to 1992, and (ii) to compare the estimated rates with existing epidemiological data from primary data collection.

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TABLE 1 Number of patients and number of admissions in the National Registry of Patients (NRP), 1981–1992

Age at first admission		Crohn's disease			Ulcerative colitis		
		Male	Female	All	Male	Female	All
No. of patients	<30 years	433	646	1079	1031	1262	2293
	30–59 years	486	674	1160	1754	1217	3471
	≥60 years	208	359	567	1159	1202	2361
No. of admissions	<30 years	1822	3095	4917	3372	5162	8534
	30–59 years	1826	2605	4431	4829	4689	9518
	≥60 years	576	1029	1605	3006	2829	5835

MATERIALS AND METHODS

All inpatients with CD and UC are treated free of charge in public hospitals in Denmark. Since 1977, all patients are registered in the National Registry of Patients (NRP) when they are discharged from Danish public hospitals.¹⁹ Coding takes place at the department in charge of treatment when the discharge summaries are written. The registration includes the patient's personal identification number (given to all citizens in Denmark at birth), discharge diagnoses and operations performed. The population of Denmark was about 5.1 million inhabitants in the study period.

We used the Danish version of the Eighth Edition of the International Classification of Diseases (ICD-8) during the entire period.²⁰ All the patients who were discharged with affirmative CD (563.01) or UC (563.19 or 569.04) were identified in the Danish NRP from 1 January 1977 to 31 December 1992.

The annual incidence rates for each of the two diseases and for each sex were estimated as the number of patients entered in the NRP for the first time, divided by the number of inhabitants in the middle of the same calendar year.²¹ Some of the patients were registered as CD at one discharge and as UC at another. In order to compare changes in the incidence rate over time, patients registered as having both CD and UC were included under the first disease registration in the NRP. The incidence rates were directly standardized to the 1992 Danish population using 15-year age groups. Since prevalent cases would be registered for the first time in the years after the start of the registry in 1977, data from 1977 to 1980 were excluded. The disease may have been diagnosed in some patients before the start of the registry, and these cases would inflate the estimation of the incidence rate, especially for the first years.²²

The 95% confidence intervals (CI) of the estimated incidence rates were based on the assumption of Poisson distribution. The change in incidence rates in different

age groups and for different sex were estimated by a Poisson regression model.

The study was approved by the Regional Scientific Ethics Committee (j.no. 94/103) of North Jutland and the Danish Registry Board.

RESULTS

There were 10 953 discharges with CD and 23 887 with UC during the study period (1 January 1981 to 31 December 1992). When the analyses were restricted to patients who were registered in the NRP for the first time, 2806 patients with CD were identified, of whom 143 (5.1%) at a later discharge were registered as UC cases as well. The corresponding figure for UC was 8125, of whom 340 (4.2%) at a later discharge were registered as CD as well. Table 1 shows the number of patients and number of admissions in different age groups.

Figure 1 shows the age-standardized rates of the first registered admission for CD. When the registry started in 1977, the estimated rate was about 9 per 100 000 person years for women and 5 per 100 000 person years for men, decreasing rapidly during the following years to 5.0 per 100 000 person years for women and 3.5 per 100 000 person years for men. From 1983 and up to 1992 the rate for both men and women tended to increase. The mean incidence rate during the study period was 4.6 per 100 000 per year (5.4 per 100 000 per year for women and 3.7 per 100 000 per year for men). Table 2 summarizes the age-adjusted incidence rates in three time periods and shows an increasing incidence.

Table 3 gives the mean incidence rate and the relative change in incidence rate per year. There was a peak incidence rate in the 15–29 year olds. The incidence rate increased in most age groups, with the highest increase in women between 15 and 29 and women older than 75. For the last group the relative change in incidence rate

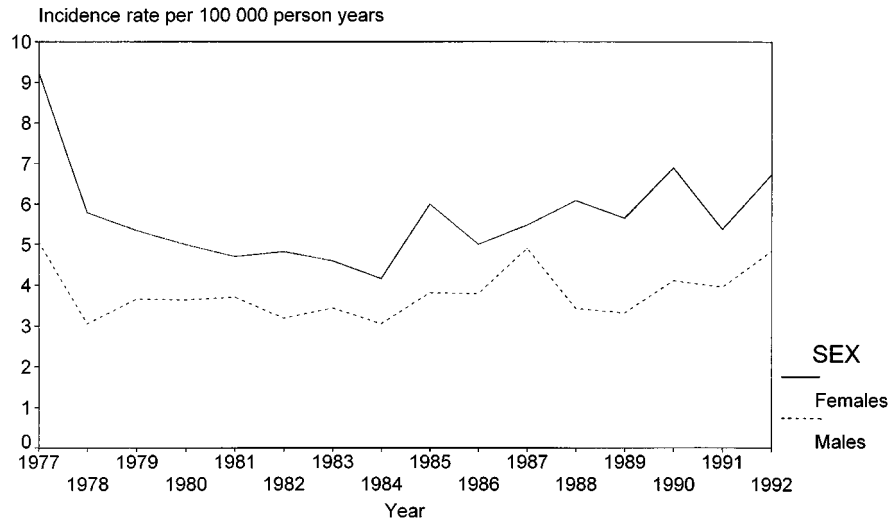


FIGURE 1 The incidence rate of Crohn's disease using the first admission in the National Registry of Patients, 1977–1992

The incidence rate was directly standardized to the 1992 Danish population by 15-year age groups.

TABLE 2 Mean incidence rate for Crohn's disease in three time periods using the National Registry of Patients (NRP), 1981–1992

Time period	Total number of patients		Mean incidence rate per 100 000 person years (95% confidence interval [CI]) ^a			
	Female	Male	Female	(95% CI)	Male	(95% CI)
1981–1984	453	321	4.6	(4.1–5.0)	3.3	(3.0–3.7)
1985–1988	581	395	5.6	(5.2–6.1)	4.0	(3.6–4.4)
1989–1992	645	411	6.2	(5.7–6.7)	4.1	(3.7–4.5)

^a The incidence rate was directly standardized to the 1992 population by 15-year age groups. The 95% confidence intervals were based on assumption of the Poisson distribution.

TABLE 3 Mean incidence rates of Crohn's disease in different age groups and the changes in incidence over time, 1981–1992, estimated by the Poisson regression model

Age group ^a	Total no. of patients		Mean incidence rate per 100 000 person years		Relative change in incidence rate per year			
	Female	Male	Female	Male	Female	(95% CI)	Male	(95% CI)
<15 years	31	52	0.6	0.9	1.02	(0.92–1.13)	1.05	(0.97–1.13)
15–29 years	615	381	9.1	5.3	1.06	(1.04–1.08)	1.04	(1.01–1.07)
30–44 years	419	294	6.2	4.2	1.02	(0.99–1.05)	0.99	(0.96–1.03)
45–59 years	255	192	5.0	3.8	0.98	(0.95–1.02)	1.03	(0.99–1.07)
60–74 years	242	156	5.3	4.0	1.03	(0.99–1.07)	1.05	(1.00–1.09)
≥75 years	117	52	4.6	3.6	1.08	(1.02–1.14)	0.97	(0.90–1.05)

^a Age at first admission.

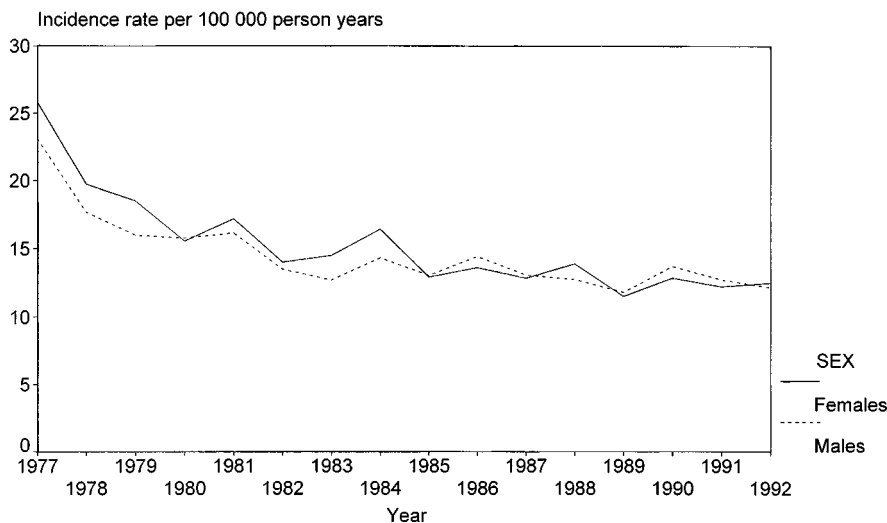


FIGURE 2 The incidence rate of ulcerative colitis using the first admission in the National Registry of Patients, 1977–1992

The incidence rate was directly standardized to the 1992 Danish population by 15-year age groups.

TABLE 4 Mean incidence rate for ulcerative colitis in three time periods using the National Registry of Patients (NRP), 1981–1992

Time period	Total no. of patients		Mean incidence rate per 100 000 person years (95% confidence interval [CI]) ^a			
	Female	Male	Female	(95% CI)	Male	(95% CI)
1981–1984	1539	1348	15.4	(14.7–16.2)	14.1	(13.4–14.8)
1985–1988	1360	1320	13.3	(12.6–14.2)	13.2	(12.5–14.0)
1989–1992	1282	1276	12.3	(11.6–13.0)	12.6	(11.9–13.3)

^a The incidence rate was directly standardized to the 1992 population by 15-year age groups. The 95% confidence intervals were based on assumption of the Poisson distribution.

was 1.08 per year, resulting in a doubling of the incidence rate in 10 years.

Figure 2 shows the age-standardized rates of the first registered admission for UC. In 1977 the estimated rates were 25 per 100 000 person years for women and 23 per 100 000 person years for men, but decreased to about 15 per 100 000 person years for both women and men in 1980. From 1981 to 1992 a slower decrease was found. The mean incidence rate in the study period was 13.2 per 100 000 per year (13.4 per 100 000 per year for women and 13.0 per 100 000 per year for men). Table 4 summarizes the age-adjusted incidence rates in three time periods and a decreasing tendency was found.

Table 5 shows the mean incidence rate and relative change in incidence rate per year. The incidence rate was low in children, higher in younger adults, and especially high in men over 60. The rate decreased in most age groups.

DISCUSSION

Hospital discharge data were used to estimate incidence rates over a 12-year time span. The incidence rate increased for CD but was rather stable, with a tendency to decrease, for UC.

The present study supports previous findings of high incidence rates for both CD and UC in Denmark.^{2,3}

TABLE 5 Mean incidence rates of ulcerative colitis in different age groups and the changes in incidence over time, 1981–1992, estimated by the Poisson regression model

Age group ^a	Total no. of patients		Mean incidence rate per 100 000 person years		Relative change in incidence rate per year (95% confidence intervals [CI])			
	Female	Male	Female	Male	Female	(95% CI)	Male	(95% CI)
<15 years	159	123	2.9	2.1	0.98	(0.93–1.02)	1.01	(0.96–1.07)
15–29 years	1103	908	16.3	12.7	0.99	(0.97–1.00)	1.01	(0.99–1.03)
30–44 years	1043	1010	15.6	14.4	0.97	(0.95–0.99)	0.99	(0.97–1.00)
45–59 years	674	744	13.1	14.7	0.98	(0.95–1.00)	0.97	(0.95–0.99)
60–74 years	751	783	16.5	20.1	0.97	(0.95–0.99)	0.96	(0.94–0.98)
≥75 years	451	376	18.1	25.8	0.97	(0.94–1.00)	0.99	(0.96–1.02)

^a Age at first admission.

There are genetic factors in the aetiology of IBD, but environmental causes are probably more important.^{2,23,24} The rapid and continuing increase in the incidence of CD points to an increase in an environmental factor or lack of comparability over time.

Various aspects must be considered when evaluating the results. The study was based on discharge diagnoses which may vary in quality between different hospitals and over time. If discharge diagnoses have reduced validity (i.e. the predictive value of a positive registration is low) the incidence rate would be overestimated, and if the completeness (an estimate of the sensitivity) is reduced this would give an underestimation of the underlying incidence rate. Even with misclassification it may still be possible to detect variations in the incidence rates, given that the type and magnitude of the misclassification do not change over time.¹⁸

We validated the diagnoses of CD and UC in the NRP in the County of North Jutland in order to estimate the magnitude of misclassification. The completeness of the NRP, using a pathology information system as a reference standard, was 94% for both diseases, and the validities (i.e. the percentage of patients registered under the disease code fulfilling the criteria of CD and UC) were 97% and 90% for CD and UC, respectively.²⁵ This could indicate that the incidence rate for CD is slightly underestimated and for UC slightly overestimated, but nothing is known about changes in the misclassification over time. In Copenhagen County, which represents 10% of the Danish population, all patients with IBD have been registered over a long period and a mean incidence of CD at 4.1 per 100 000 per year in the period from 1979 to 1987 has been found.² The incidence for UC in the period from 1980 to 1987 was 9.2 per 100 000 per year.³ Our similar incidence rates for CD, together with the validation study, indicate that

the data quality is acceptable for epidemiological surveillance. The incidence rate for UC was higher in this study compared with the incidence rate estimated in Copenhagen County. The difference was found especially for older patients and it may be due to a different age-specific threshold for hospitalization.²⁶ Furthermore, the validity of the registered information could depend on the age of the patients. The proportion of false positive recordings could be greater for older patients since they are hospitalized more often, but a second peak in the incidence rates for patients over 60 years has also been described.^{3,10,12,15} Another explanation for the difference in incidence rates for UC, but not for CD, compared with incidence rates found in the population-based study in Copenhagen County may be that patients with CD are hospitalized more often. Patients with UC are perhaps treated as outpatients which could inflate the first admission cases with prevalent patients after 1980. The difference could also lead to regional differences in incidence rate in Denmark, as are seen in Norway.¹⁰ Moreover it is possible that patients, especially with distal UC, are more often treated in outpatients and general practitioners' clinics because of an improvement in medical treatment facilities during the study period. This mechanism does not explain the differences with the incidence from Copenhagen County but could explain the decreasing tendency of UC found in this study.

The present study found an increasing incidence of CD and a stable incidence with a decreasing tendency for UC. The study indicates that it is possible to get reliable estimates of the incidence rates, especially for CD. The estimates of the incidence rates based on the Danish NRP will probably be even more complete in the future because from 1994 outpatients are also included. By using the personal registration number it is possible

to make links to several data sources, e.g. registers of cancer, births, and causes of deaths making clinical and epidemiological research based on the whole population possible. It will be important to follow the development of IBD, especially to see if the differences in Europe persist.

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