

A further prevalence study of multiple sclerosis in north-east Scotland

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SUMMARY A second epidemiological study of multiple sclerosis (MS) in north-east Scotland has confirmed that the area has the highest prevalence rate in the world for any population of comparable size. On 1 December 1973 the prevalence was 144 per 100 000 population. The age and sex specific prevalence rates are the highest ever recorded, one in every 306 of the population aged 40 to 59 years being affected. All patients have been tabulated in the National Health Service Central Register to facilitate future studies. The MS mortality rate in north-east Scotland is similar to the rate for the whole of Scotland. Throughout most of Scotland, therefore, MS probably is as prevalent as it is in the north-east.

We have previously reported that in north-east Scotland on 1 December 1970, the prevalence of MS was 127 cases per 100 000 population.¹ Thus the disease was more common than in any other surveyed area with a comparable population. We undertook a further study on 1 December 1973, to establish a new prevalence rate, to identify patients overlooked in the first study and to establish a register of MS patients tabulated at the General Register Office for Scotland. Patients were studied according to area in which they were living on 1 December 1973, according to birthplace and according to main residence during childhood.

Methods

The area studied consisted of the City of Aberdeen and counties of Aberdeen, Kincardine, Moray and Banff and was identical to that of the 1970 study. We used the same diagnostic categories of probable MS, early and latent probable MS and possible MS. The 1970 series formed the basis of the second study. Any patients diagnosed between 1970 and prevalence day 1 December 1973 were added and information on all these patients was arranged into appropriate practices and submitted to the individual general practitioners. Once again a complete response was achieved and on this

occasion the general practitioners were able to add a further 18 patients to the final total. Some patients in the first series had died, a few had left the area and the diagnosis of MS was now unacceptable in five. However, a formal diagnostic reappraisal of all patients surviving from the 1970 study was not undertaken. In the whole series 83% of patients had been examined by a neurologist and this included all patients added since 1970.

We used the same geographical units¹ for dividing the region into 28 areas for the study of prevalence by area of residence on prevalence day and the population figures from the 1971 Census.² The 1921 Census figures were again used for area of birthplace and the 1931 Census³ for main residence in childhood which was defined as domicile at one or more locations within a single county (City of Aberdeen as a single unit) for a minimum of eight years in the period up to 15 years of age. The same statistical methods were used as previously.

In order to tabulate all patients in the National Health Service (NHS) Central Register in Edinburgh it is necessary to know the individual's NHS number. These numbers are issued in Scotland at birth, or at later enumeration or entry to the country from abroad. Entries are routinely updated with changes in name and Health Board area provided that migrating patients register with a new general practitioner.⁴ Acheson⁵ indicated that there were few incentives for patients to retain a record of their NHS number. Since the number is on the medical record wallet

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Table 1 Prevalence of MS in north-east Scotland by diagnostic group and sex

	No of patients with MS	Prevalence/100 000 population*
Probable MS	324	74
Probable and early and latent probable MS	517	117
All men	232	110
All women	402	175
All patients	634	144

* Population in 1971 Census was 440 176: men 210 250, women 229 926.²

held by the general practitioner, we also asked for the NHS number, when we contacted them concerning the numbers of MS patients in their practice. Only about 40% of patients' NHS numbers obtained in this way and the rest by painstaking search through the nominal card index held by the NHS Local Medical Committees in each area. Eventually every patient in the current study was "flagged" in the NHS Central Register.

Results

A total of 472 patients remained from the 557 patients in the 1970 study (57 had died, 23 had left the area and the diagnosis was rejected in five). To these were added 144 new patients seen at hospital and 18 from general practitioner records. Fifty of these additional patients had been living in north-east Scotland on prevalence day in 1970 and at that time would have had suf-

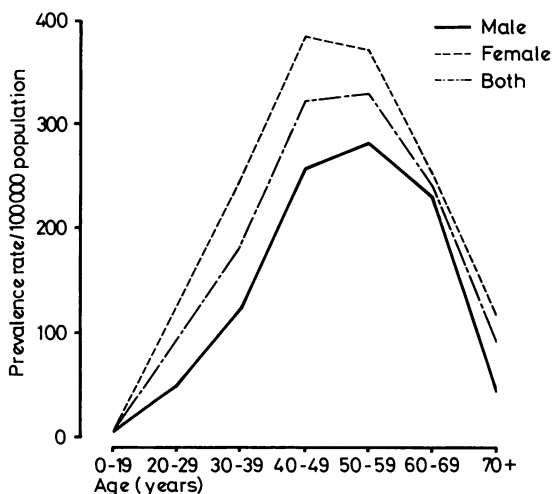


Fig 1 Age and sex specific prevalence of MS in north-east Scotland on 1 December 1973. Based on the age and sex distribution of the whole Scottish population in 1971 Census.²

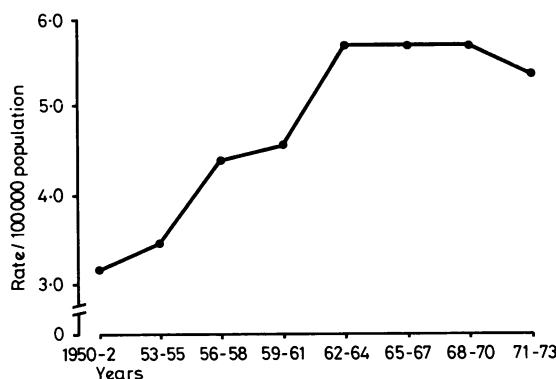


Fig 2 Incidence rates/100 000 population in three year periods for north-east Scotland 1950-1973.

ficient historical and clinical evidence to permit a diagnosis of MS but they were not located in the earlier study.

On 1 December 1973, 634 patients with MS were living in north-east Scotland. The overall prevalence was 144 per 100 000 population and even excluding possible MS patients the rate was greater than 1 per 1000 population (table 1). The mean age at onset of all patients was 33.8 years (range 11 to 61). The mean duration of disease was 15.3 years, and 12.2% had had the disease for more than 30 years and five patients for more than 50 years. The mean age of all patients on prevalence day was 48.6 years (range 14 to 87) and 95% of patients were aged 20 to 69 years. Using the age and sex distribution of the whole Scottish population,² the age and sex specific prevalence rates for north-east Scotland have been calculated (fig 1). The highest rate for men, 282 per 100 000, was recorded for those aged 50 to 59 years and for women a rate of 384 per 100 000 was obtained for those aged 40 to 49 years. The incidence rates per 100 000 population for three year periods from 1950 to 1973 have been calculated (fig 2). The mean incidence rate for the 15 year period 1959 to 1973 was 5.3 per 100 000 population.

Prevalence by area of residence on 1 December 1973

The prevalence of MS for all patients by county (fig 3) on prevalence day did not show a significant distribution but Aberdeen county had the highest rate (table 2). The distribution of all patients among the 28 area units (table 3; fig 4 and 5) is significantly different from expected ($p < 0.01$). Four areas had rates over 200 per 100 000 and the highest was again area 16. Four

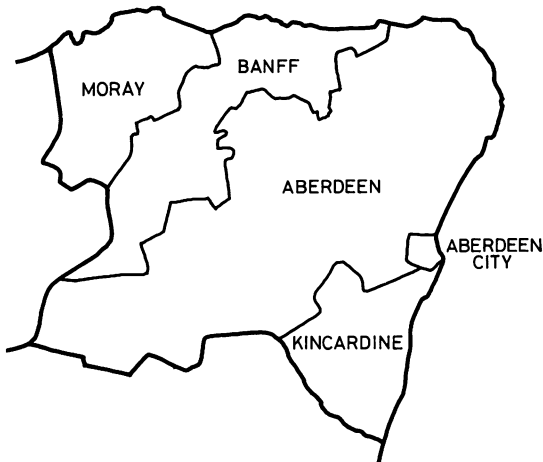


Fig 3 The counties of north-east Scotland.

adjacent wards of Aberdeen City (areas 7 to 10) had prevalence rates 50% above the overall mean, one in every 497 of the population being affected.

Prevalence by area of birthplace

Five hundred and one patients were born in north-east Scotland. Place of birth was unknown in 11 cases. Of the remaining 122 patients, nine were born in Orkney and Shetland, 69 elsewhere in Scotland, 32 elsewhere in the UK, and 12 abroad. The distribution by county showed a significant difference from expected (table 2). The highest rate was in Aberdeen county which had a significant excess compared to the rest of the region ($\chi^2=14.730$; $p<0.001$). Rather fewer than expected were born in Kincardine but this was not significant.

Prevalence by area of main residence in childhood

There were 497 patients who had spent at least eight years of their childhood up to the age of 15 in one of the counties, but 21 patients did not fit these criteria. Childhood addresses were unknown in 11 patients and the remaining 105 were elsewhere in Britain or abroad. The distribution of area of residence in childhood by county was significant at the 1% level (table 2). The figures differed little from area of birthplace and again Aberdeen county had a significant excess compared to the rest of the region ($\chi^2=16.217$; $p<0.001$).

Discussion

This second prevalence study of MS in north-east Scotland has confirmed that the disease

Table 2 Distribution by county

Area	Area of residence on 1 December 1973			Prevalence 100 000 population	χ^2	Area of birthplace			Prevalence/ 100 000 population	χ^2	Area of main residence in childhood			Prevalence/ 100 000 population	χ^2
	No of patients with MS	Expected no of patients	Expected no of patients with MS			No of patients with MS	Expected no of patients	Expected no of patients with MS			No of patients with MS	Expected no of patients	Expected no of patients with MS		
Aberdeen City	257	260.9	172	141.9	0.058	182.9	106.7	170	193.6	0.650	100.1	2.877			
Aberdeen County	226	198.8	213	163.8	3.722	172.2	140.3	206	163.8	9.667	143.3	10.872			
Banff County	59	62.6	53	135.6	0.207	65.0	92.5	51	62.6	2.215	92.9	2.150			
Kincardine County	31	37.5	21	119.0	1.127	33.8	70.5	25	30.5	4.476	93.4	0.992			
Moray County	61	74.2	42	118.4	2.348	47.1	101.1	45	46.5	0.552	110.3	0.048			
Total	634	634.0	501	144.0	7.462	501.0	113.4	497	497.0	17.560	114.0	16.939			

df = 4; p not significant

df = 4; $p<0.01$

df = 4; $p<0.01$

A further prevalence study of multiple sclerosis in north-east Scotland

Table 3 Prevalence of MS by area of residence on 1 December 1973

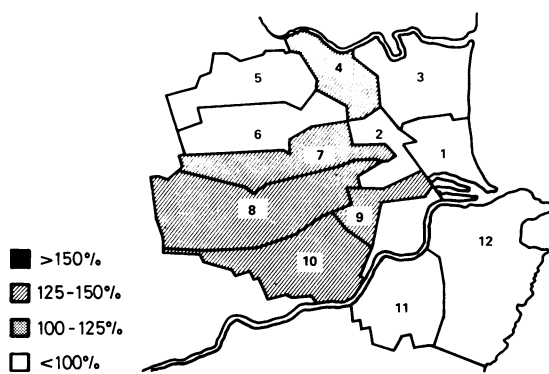
Area no	Population*	No of patients with MS	Expected no of patients	Prevalence/100 000 population	χ^2
1	9 623	13	13.9	135.1	0.012
2	9 923	10	14.3	100.8	1.010
3	18 121	14	26.1	77.3	5.156
4	11 768	22	16.9	186.9†	1.252
5	17 392	21	25.0	120.7	0.490
6	21 439	18	30.9	84.0	4.976
7	15 748	33	22.7	209.6†	4.231
8	14 507	31	20.9	213.7†	4.410
9	11 160	22	16.1	197.1†	1.811
10	16 248	30	23.4	184.6†	1.590
11	19 875	27	28.6	135.8†	0.042
12	15 349	16	22.1	104.2	1.419
13	14 160	15	20.4	105.9	1.177
14	10 606	23	15.3	216.9†	3.388
15	20 415	19	29.4	93.1	3.334
16	10 768	26	15.5	241.5†	6.452
17	17 027	27	24.5	158.6	0.163
18	14 635	23	21.1	157.2	0.093
19	14 220	28	20.5	196.9†	2.390
20	36 130	55	52.0	152.2	0.173
21	15 242	23	22.0	150.9	0.011
22	16 537	16	23.8	96.8	2.239
23	11 724	20	16.9	170.6	0.400
24	11 913	21	17.2	176.3	0.633
25	14 146	20	20.4	141.4	
26	20 050	30	28.9	149.6	0.012
27	16 343	20	23.5	122.4	0.383
28	15 107	11	21.7	72.8	4.794
Total	440 176	634	634.0	144.0	52.041

* 1971 Census figures.²

† More than 25% above mean prevalence. $df = 27$; $p < 0.01$.

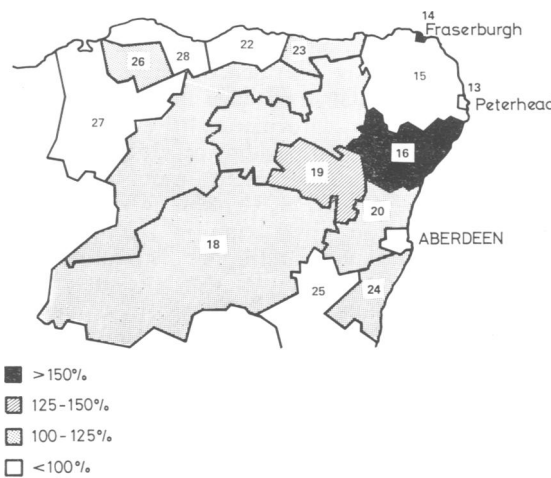
occurs there more frequently than in any other surveyed area with a comparable population. In Europe the only higher rate has been that found in Orkney and Shetland in a substantially smaller population.⁶ Whenever the prevalence of MS has been recorded in an area on two occasions the second study has revealed a higher rate.⁷⁻¹⁵ In north-east Scotland 50 patients were omitted in

1970 who would have been eligible for inclusion. The revised prevalence in 1970 in retrospect is 138 per 100 000 population. We suspect, therefore, that our 1973 rate of 144 per 100 000 popu-



Mean rate for region 144/100 000

Fig 4 Prevalence of MS in the City of Aberdeen according to area of residence on 1 December 1973.



Mean rate for region 144/100 000

Fig 5 Prevalence of MS in north-east Scotland according to area of residence on 1 December 1973.

lation more accurately reflects the occurrence of MS in north-east Scotland than the figure we previously found in 1970.¹

The mean duration of disease on prevalence day is longer than in any other study, the nearest being that of 12.9 years in Turku, Finland.¹⁶ Poskanzer *et al*¹⁷ have suggested that the mean life expectancy is twice the disease duration from onset to prevalence day. For the present study this period would be 30.4 years which approaches the predicted mean duration of at least 35 years found in the study of male US Veterans.¹⁸ The incidence of MS in north-east Scotland is also exceptionally high and has been stable for at least 15 years. A higher rate has only been recorded in the small Massachusetts community of Duxbury.¹⁹ The exceptional age specific prevalence rates indicate that among the 104 000 people aged 40 to 59 years in north-east Scotland one in every 306 had MS on prevalence day.

The county of Aberdeen had the highest prevalence rate for area of residence on prevalence day, birthplace and main residence in childhood. This county also included area 16 which had the greatest prevalence in this and the earlier study. Since an environmental factor may be implicated in the aetiology of MS many years before clinical onset^{12 20} it seemed worthwhile studying area of main residence in childhood. However, the distribution was similar to that of area of birthplace, but more patients did spend their childhood in Kincardine and Moray than were born there, reflecting the fact that in the 1961 Census³ only 38% of the Kincardine population and 52% of the Moray population had been born in these areas. If north-east Scotland is typical, in future prevalence studies examination of area of main residence in childhood will not add significant information to that obtained from studying area of birthplace alone.

All patients in the present study have been tabulated in the NHS Central Register. We receive automatic notification in the event of subsequent death or emigration. This procedure will facilitate the study of MS prevalence in north-east Scotland in the future, it will allow accurate survival rates to be determined and it will help assess the accuracy of the mortality data from the Registrar General for Scotland.

As long ago as 1950 Limburg²¹ noted that Scotland had the highest death rate from MS in the world and this was confirmed in the subsequent period 1951 to 60.²² Our studies^{1 23} and those of Sutherland²⁴ and Poskanzer *et al*⁶ have confirmed the high prevalence of MS in several geographical areas of Scotland. In both 1970 and

Table 4 Mean annual MS death rate 1939-1972

Area	Rate/100 000 population*
Scotland	2.9
North-east Scotland	2.8
Aberdeen City	2.6
Aberdeen County	2.8
Banff County	2.6
Kincardine County	3.0
Moray County	3.1

* Obtained from 1951 Census.³

1973 in north-east Scotland the distribution of patients by area unit was significantly different from expected but of perhaps greater importance was the overall high prevalence rate. The question remains whether MS is more prevalent in north-east Scotland than elsewhere in Scotland. We think this is unlikely since the MS death rates for the whole of north-east Scotland and the individual counties are similar to the Scottish rate (table 4). With the possible exception of the outer Hebrides (Dean and Downie, personal communication) it seems likely that MS is common throughout Scotland.

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