

Hip fractures in northern Sweden 1973-1984

A comparison of rural and urban populations

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The hip-fracture incidence in persons aged 50 years and older in the two northernmost counties of Sweden was studied during three periods between 1973 and 1984. The mean age rose from 75 to 78 years, and the annual number of fractures increased from 511 to 754. Half of this increase could be attributed to demographic aging. For persons 80 years and older, the fracture incidence in 1983/84 was higher ($P < 0.01$) than the fracture incidence in 1973/74. The women/men ratio was approximately 2:1 during the survey, while the ratio cervical/trochanteric fracture type changed from 1.7:1 to 1.8:1. The crude fracture incidence rate rose from 4.4 to 5.8 fractures per 1,000 women 50 years and older; the corresponding figures for men were 2.3 and 3.4. Comparison of a rural mountain population with an urban population revealed a lower age-adjusted hip-fracture incidence rate in the rural area during the final part of the study ($P < 0.001$). In the rural population, there was no change in age-specific incidence during the survey, while in the urban area the age-specific incidence in person 75 years and older was higher in 1983/84 compared with 1973/74.

During the last three decades, several studies from Scandinavia (Alffram 1964, Frandsen and Kruse 1983, Johnell et al. 1984, Nilsson 1984, Zetterberg et al. 1984) and Great Britain (Stewart 1955, Swanson and Murdoch 1983, Wallace 1983) have revealed a substantial increase in the number of hip fractures, which has only partly been due to aging populations. The majority of the studies deal with urban populations.

Falch et al. (1985), comparing the hip-fracture incidence in different parts of Norway, reported a lower fracture incidence in the northern part of the country as compared with the incidence in Oslo. The reason for the geographic variations seen in Norway has not been explained.

We have studied the age- and sex-specific incidence rates of hip fractures in northern Sweden during the years 1973-1984, including a comparison of the incidence in the rural mountain districts with the incidence in the two largest cities in the two counties.

Population and methods

The study included all the cervical and trochanteric fractures in patients aged 50 years and above that occurred in two Swedish counties, Norrbotten and Västerbotten, during three periods 1973/74, 1978/79, and 1983/84. Subtrochanteric fractures, as well as fractures related to bone tumors, were excluded.

The two counties examined are the northernmost ones in Sweden, with the Arctic Circle (66° North) passing through the area. These large counties have a low population density (3.3 inh/km²). The total number of inhabitants increased from 490,690 (1973) to 509,700 (1984), with 30 and 32 percent, respectively, aged 50 years or older. The number of women 50 years and older was about 4 percent higher than the number of men of the same age. For persons 75 years and older, the number of female inhabitants in the two counties exceeded the number of men by 31 percent.

The majority of the inhabitants live in small villages and cities along the coast of the Baltic Sea. The two largest cities, Umeå and Luleå, together have approximately 150,000 inhabitants, with the majority of their working force engaged in white collar and other physically less demanding occupations. In the mountain districts (total population approx. 95,500 inhabitants) along the border to Norway, the population density is

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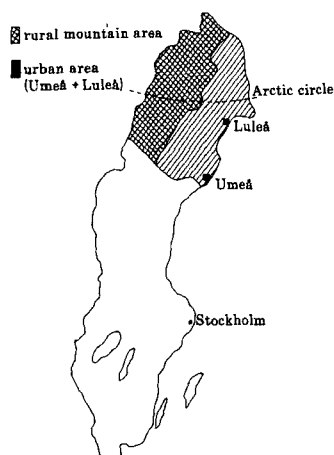


Figure 1. Sweden with the counties of Norrbotten and Västerbotten indicated. The lightly shaded area indicates the area between the urban and rural mountain areas.

especially low, and approximately one third of the working force is engaged in physically strenuous work, such as forestry, farming, and mining (Figure 1).

There are nine hospitals that care for all the hip fracture patients in the two counties.

The medical reports including radiography, referral notes, and operation records for all the patients admitted for a new hip fracture in 1973/74, 1978/79, or 1983/84 were reviewed. In every case where the type of fracture could not be fully clarified by the records, radiographs were studied.

Patients from either of the two counties who were operated on in hospitals in another county were included, this being possible because patients were discharged to their home county for aftercare. After exclusion of cases from other counties 3,644 fractures were included in the study. The cases were subdivided according to age, sex, fracture type (cervical or trochanteric), and place of residence.

Information about the population of the two counties with regard to number of inhabitants—rural or urban, as well as age and sex distribution—was obtained from the National Central Bureau of Statistics (SCB). Two different incidence rates were calculated, crude rate (CR) and age-adjusted rate (AR). The crude rate (CR) was defined as the number of fractures divided by the number of inhabitants 50 years or older in the district or county being studied. For calculation of the age-adjusted incidence rate (AR), the age structure of the population studied was standardized (Armitage

Table 1. Number of cervical (C) and trochanteric (T) fracture cases during each year of the study

Year	Male		Female		Total
	C	T	C	T	
1973/74	203	123	418	248	992
1978/79	229	156	452	300	1137
1983/84	319	201	653	342	1515
Total	751	480	1523	890	3644

Table 2. Annual incidence rate per 1,000 persons 50 years of age or older

Year	Male		Female		Total	
	CR	AR	CR	AR	CR	AR
1973/74	2.2	2.5	4.4	4.3	3.3	3.5
1978/79	2.5	2.7	4.6	4.2	3.6	3.5
1983/84	3.3	3.3	5.9	4.7	4.7	4.1
Total	2.7	2.8	5.0	4.4	3.8	3.7

CR crude incidence rate.

AR age-adjusted incidence rate.

1987) to the age distribution of the Swedish population in 1970. By calculating the AR incidence, it was possible to compare different subpopulations.

The statistical probability was calculated with the chi-square test with Yates' correction and the Student's *t*-test. The chosen level of significance was $P < 0.05$. The mean and standard deviation are given.

Results

The annual number of fractures increased by 65 percent from 1973/74 to 1983/84 (Table 1). Of this increase, only a half could be attributed to aging. In women 50 years of age or older, the crude incidence rose from 4.4 to 5.9 ($P < 0.01$) fractures per 1,000, while the corresponding figures for men were 2.2 and 3.3 ($P < 0.01$). The AR incidence did not change in women, but did increase in men during the final part of the study ($P < 0.05$; Table 2). There was an exponential increase with age in fracture incidence (Table 3), with higher values in 1983/84 than in 1973/74 ($P < 0.01$) for men over 75 and women over 80 years of age.

The women/men ratio for the total material was ap-

Table 3. Total number of cases and incidence rates per 1,000 person years in cervical (C) and trochanteric (T) fracture cases in 5-year age groups

Age	Male				Female			
	C		T		C		T	
	Number	Incidence	Number	Incidence	Number	Incidence	Number	Incidence
50-	15	0.16	9	0.10	36	0.41	9	0.10
55-	34	0.39	30	0.35	67	0.78	20	0.23
60-	53	0.63	36	0.43	105	1.26	42	0.51
65-	104	1.42	53	0.72	170	2.28	95	1.27
70-	129	2.25	68	1.19	242	3.82	132	2.10
75-	137	3.61	104	2.72	292	6.36	166	3.60
80-	143	7.23	85	4.26	305	11.69	221	8.08
85-	136	13.67	95	9.32	305	18.69	205	12.95
Total	751	1.63	401	1.09	1 523	3.13	890	1.62

Table 4. The age-specific incidence rates of hip fractures per 1,000 inhabitants in urban and rural populations

Age	Year					
	1973/74		1978/79		1983/84	
	Urban	Rural	Urban	Rural	Urban	Rural
50-	0.39	0.63	0.25	0.28	0.32	0.10
55-	1.35	0.60	0.60	0.67	1.13	0.79
60-	1.74	1.75	1.95	1.25	1.20	1.45
65-	3.43	2.10	2.76	3.39	3.64	2.95
70-	5.95	3.81	4.57	3.53	6.20	3.43
75-	7.89	7.61	7.79	9.97	8.57	6.70
80-	15.13	16.97	14.09	11.51	22.18	14.82
85-	22.78	24.76	31.95	28.63	37.50	29.07
Total	3.40	3.23	3.41	3.56	4.76	3.68

proximately 2:1 throughout the survey. For patients under 75 years, this ratio dropped from 1.80 to 1.65, and in patients over 75 years from 2.30 to 2.10 (NS).

The ratio cervical/trochanteric fracture type for the entire material did not change, but in women this ratio decreased with age from 4.0 at 50 years to 1.5 at 85 years ($P < 0.05$).

The mean age of patients with cervical fractures increased from 74 ± 10 years to 78 ± 9 years ($P < 0.001$), with no difference between sexes. During the same period the mean age of patients with trochanteric fractures increased from 76 ± 10 years to 78 ± 9 years ($P < 0.05$) with women, on an average, 3 years older than men at the time of injury ($P < 0.01$). There was no difference in mean age between the rural and urban populations at the time of fracture.

The crude hip-fracture incidence per 1,000 inhabitants 50 years of age or older increased from 3.2 to 3.7

($P < 0.05$) in the rural population and from 3.4 to 4.8 ($P < 0.01$) in the urban population. The increase in the rural incidence occurred entirely among men, whereas in the urban population the increase occurred in both sexes.

The age-adjusted incidence decreased from 3.7 to 3.2 ($P < 0.05$) in the rural population, but it increased from 3.8 to 4.5 in the urban population ($P < 0.01$), with a marked difference between urban and rural populations during the final part of the study ($P < 0.001$).

In the rural population the changes in incidence in each age group were small during the survey, whereas in the urban population the fracture incidence in persons 80 years of age and older was higher ($P < 0.01$) in 1983/84 compared with 1973/74 (Table 4). The women/men ratio in the rural population decreased from 2.3 to 1.3 ($P < 0.05$), while in the urban population a not significant adverse change from 2.1 to 2.6 occurred.

Discussion

Approximately half the incidence increase observed during the period 1973-84 could be attributed to demographic aging, but the reason for the remaining increase was obscure. In a similar study including the period 1965-1983 in Gothenburg, only 20 percent of an observed increase in the annual number of fractures could be attributed to aging in the population (Zetterberg et al. 1984), whereas Lewis (1981) found that 70 percent of the increase in hip-fracture incidence in England and Wales in 1968-77 could be attributed to aging.

The crude incidence rate in the present study was similar to incidences in Stockholm (Nilsson 1984, Hedlund et al. 1986) and in Denmark (Frandsen and Kruse 1983), but it was lower than in Oslo (Falch et al. 1985). The increase in crude incidence rate during the present survey was not as dramatic as it was in Stockholm (Nilsson 1984) and Gothenburg (Zetterberg et al. 1984). A comparison of populations from different geographic areas is, however, hazardous, because any difference in age distribution will influence the crude rate, as hip-fracture incidence is highly age-dependent. A standardization in age classes or age correction according to the age distribution in the entire country will reduce the risk of such an error (Armitage 1987). In the present study the age-adjusted hip-fracture incidence rate did not change during the period 1973-79, whereas the increase in crude incidence rate during the final part of the study was reduced by half after age standardization. This was due to a larger proportion of older persons in northern Sweden compared with the Swedish standard population.

The women/men ratio, with an almost constant 2:1, was comparable with Copenhagen (Jensen 1980), but lower than the Stockholm 2.8:1 (Hedlund et al. 1986) and the Oslo 3.3:1 (Falch et al. 1985).

An increasing proportion of the trochanteric fracture type has been reported during the last few decades. For instance, Jensen (1980) found that trochanteric fractures were more common than cervical fractures in

Copenhagen during the late 1970s; also the same tendency was reported from Stockholm (Nilsson 1984) and Uppsala (Zain Elabdien et al. 1984). However, in our material, there was an almost constant excess of cervical fractures of 1.8:1 as compared with trochanteric fractures. A finding agreeing with other studies (Jensen 1980, Falch et al. 1985, Hedlund et al. 1986, Mannius et al. 1987) was that the C/T ratio decreased with age in women, while in men there was no relation between age and fracture type.

We found no sex difference in age at the time of fracture, whereas in Gothenburg the women were almost 7 years older than the men (Zetterberg et al. 1984).

The crude incidence rate was lower in the rural area than in the urban area. The crude incidence increase in the urban population during the final part of our study did not occur in the rural population. The difference in age-adjusted incidence rate was even more pronounced. In the rural mountain area, the small increase in crude incidence rate was attributed to aging, whereas in the urban population the increase observed during the final part of the survey could not solely be attributed to aging. A lower fracture incidence in a rural population compared with an urban population, as well as a greater increase in incidence in the urban population, accorded with findings from western Sweden (Mannius et al. 1987). In central Norway a lower incidence in a rural versus an urban population was also demonstrated, although there was no difference in incidence increase with time between the populations (Finsen and Benum 1987).

Falch et al. (1985) reported a substantially higher hip fracture incidence in Oslo than in the northern part of Norway. However, the results from different counties were not age-adjusted. The present results with incidence rates close to the incidence in Stockholm (Hedlund et al. 1986) and Denmark (Frandsen and Kruse 1983) imply no definite differences in hip-fracture incidence according to latitude. It seems that differences in hip-fracture incidence are more pronounced between urban and rural populations than between north and south.

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