

# Incidence of hip fracture in Western Sweden 1974-1982

## Comparison of rural and urban populations

Several epidemiological studies in northern Europe have shown that fractures in the elderly exceed the expected increase in the aging populations. We have compared the incidence of hip fracture in the rural county of Skaraborg and the city of Göteborg in Sweden. After adjustment for age changes in the population, the incidence of hip fracture in Skaraborg County was lower than in Göteborg during the period 1974-1984. The non-age-related increase in the incidence of fractures found in the city was not confirmed in the rural area.

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Several epidemiological studies have demonstrated a non-age-related progressive increase in the hip fracture incidence in northern Europe (Falch & Ilebekk 1978, Boyd et al. 1983, Swanson & Murdoch 1983, Wallace 1983, Johnell et al. 1984, Lühje 1984, Nilsson 1984, Zain Elabdien 1984, Zetterberg et al. 1984, Falch et al. 1985). Some of these studies have been extended over four decades.

In Gothenburg, Sweden, where the frequency of hip fractures more than doubled between 1965 and 1983, only 20 per cent of the cases can be explained on the basis of age factors. With the present trend, the incidence of hip fractures will double in the next 20 years (Zetterberg & Andersson 1982, Zetterberg et al. 1984). To date, a comparison between urban and rural areas has not been performed over a longer period. Our material may help to clarify the etiological factors affecting bone loss and hip fracture.

### Population and methods

Skaraborg County had 270,448 inhabitants in 1983. Twelve per cent of the residents were above aged 70 years. The county is situated in the southwestern part of Sweden between the two large lakes Vänern and Vättern. Characteristic for this county are municipalities with small populations (7 of 17 municipi-

ties have fewer than 9,000 inhabitants). The cities are small. The four largest cities have between 24,000 and 46,000 inhabitants. The county is predominantly rural, with 12 per cent of the population engaged in agricultural occupations as compared with 6.5 per cent for Sweden as a whole; finally migration has been small. Gothenburg is the second largest city in Sweden and has had a mean population of 440,000 during the last few decades.

The sources of this study were the computerized registers of the hospitals in the cities of Falköping, Lidköping, and Skövde in Skaraborg County for the period 1974-82. These hospitals take care of all hip fracture patients in the county. Exact information of day of accident, type of fracture, date of birth, operation code, period of hospitalization, and place of residence were listed in a special data base. This method permitted a control of all the patients with a recurrent admission within a year as regards new fractures. In these cases the medical records were reviewed. Patients admitted for reoperations of the same fracture were excluded from the material. In addition, data from the operation records were used to validate the computerized records. For every 2 years, all operation records were collected. Missing data were estimated to be maximally 2 per cent. Patients operated on in hospitals outside Skaraborg County were recorded by the computer without an operation code after returning to the hospital in the home district and are included in the material. Non-operative treatment of hip fractures may have been applied in some moribund patients. Totally, 3,030 patients with fresh hip fractures were included in the

study. The patients over aged 50 years were subdivided according to sex and age into both 1- and 5-year classes, and according to the type of fracture into cervical (ICD code 820.00) and trochanteric (ICD codes 821.01 and 820.02) fractures of the femur. During the same time period, data were selected using an identical method from Gothenburg (Zetterberg et al. 1984). This latter study was supplemented with data from 1974 and 1982 to cover a period identical to the Skaraborg population. Information on the base populations in 1-year age classes and genders were collected from the local population registers in Skaraborg County and Gothenburg.

### Statistical methods

Mantel's (1963) test was used for comparison of Skaraborg and Gothenburg with respect to risk of fractures of the proximal femur, taking sex and age distribution into account. The same test was used to analyze the trends over time with the two materials. To estimate the mean annual increase of risk, a special model was applied. It was assumed that the probability of fracture was  $a \times (A-1973) + b$  for a randomly chosen man (woman) of an age above or equal to 50 years during the years  $A$  ( $A = 1974, \dots, 1982$ ). The unknown constants  $a$  and  $b$  were estimated by the maximum likelihood method assuming a percentage change of the same size every year. All the tests were two-sided.

### Results

The total number of fractures of the proximal femur in Skaraborg County was 3,030 during the period 1974-82. The number of fractures per year increased from 286 in 1974 to 386 in 1982. The estimated mean annual increase was 3 per cent for women and men. The increase did not differ significantly from zero, neither for women nor for men. There were no significant changes in the incidence, although the material was subdivided into 1-year classes.

In Gothenburg, the mean annual increase was 6 per cent for women and 4 per cent for men. The increase was significant for women ( $P < 0.001$ ) but not for men (Figure 1). The only age class in men with a significant increase in hip fracture ( $P < 0.05$ ) was 50-55 years in Gothenburg. The increase in fractures in women  $\geq 50$  years was higher in Gothenburg than in Skaraborg ( $P < 0.01$ ). The in-

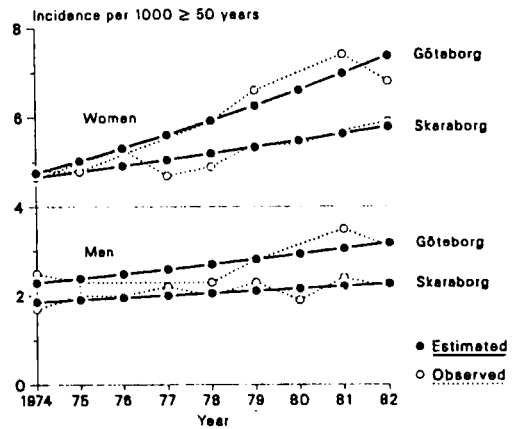


Figure 1. The secular trend of the incidence of hip fractures in women in Skaraborg County and Gothenburg between 1974 and 1982. The estimation was performed by the maximum likelihood method assuming a percentage change of the same size every year.

cidence rate in 1981 per 1,000 inhabitants was higher in 5-year classes in Gothenburg than in Skaraborg County ( $P < 0.001$ ) (Figure 2).

Adults under aged 50 years sustaining fractures of the proximal femur constituted 2.9 per cent of the total number in Skaraborg County and 2.7 per cent in Gothenburg. The ratio of female to male fractures over aged 50 years was 2.7:1 in Skaraborg County and the ratio below

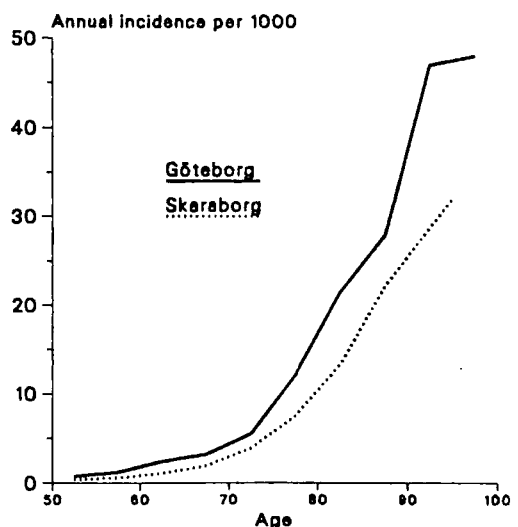


Figure 2. Comparison of the total hip fracture incidence in the city of Gothenburg and in Skaraborg County in 1981 ( $P < 0.001$ ).

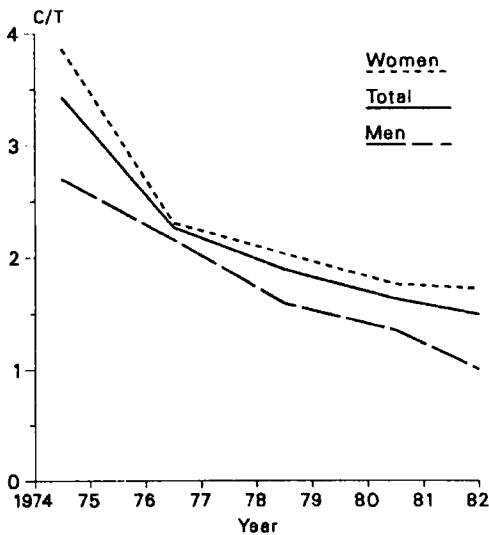


Figure 3. Time trend for the ratio cervical/trochanteric fractures in Skaraborg County between 1974 and 1982 (N = 3,030, 817 men and 2,213 women).

this age was 1:1.7. These figures were the same in Gothenburg.

The ratio of cervical to trochanteric fractures in Skaraborg County changed during the period studied, with a relative increase in trochanteric fractures ( $P < 0.001$  both in women and men using Mantel's test taking age distribution into account) (Figure 3). The data from

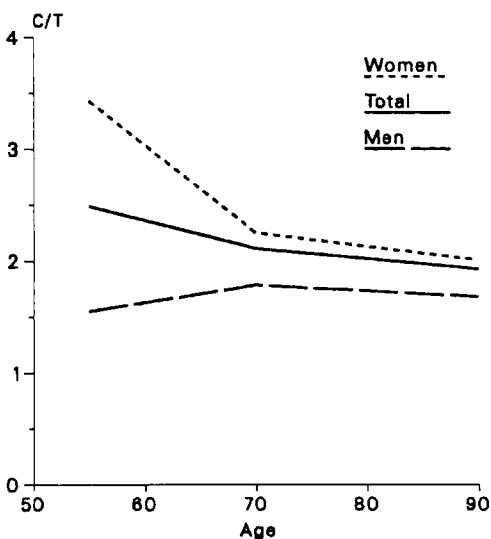


Figure 4. The ratio of cervical/trochanteric fractures in relation to age in Skaraborg County between 1974 and 1982.

Gothenburg showed no trend, with a ratio constantly close to 1.0 during the same period. Trochanteric fractures in Skaraborg County were relatively more frequent in older age groups in women, using Mantel's test keeping calendar year constant, but there was no significant correlation in men (Figure 4).

The seasonal variation in the fracture rate was the same in Skaraborg County and Gothenburg, with an increase during the winter months of 26 per cent compared with the three summer months.

## Discussion

The incidence rates of fractures of the proximal end of the femur in Skaraborg County and Gothenburg were higher than during the 1950s in Malmö (Alffram 1964), Gothenburg (Mårtensson 1962), and Dundee (Stewart 1955). The rather dramatic secular increase in fracture incidence observed in Gothenburg did not prevail in Skaraborg County, with the result that there was an increased difference between these two populations. Crude incidence rates for parts of populations, e.g., for persons aged 50 years or more, are not comparable if an exact comparison of the age distributions over time in the populations is not made. In our study, comparison was made in 1-year classes of the base and fracture populations.

The 9-year period covered by the study in Skaraborg County is rather short for determining age-related changes, but our data show that the incidence is increasing faster over time in the urban area when compared with the rural area. Falch et al. (1985) showed in a questionnaire study during a 2-year period a similar pattern in Norway, with a much higher incidence of hip fractures in Oslo than in the rest of the country. However, this study did not examine the secular trend. By comparing the incidence of hip fractures, which is heavily age dependent, between different geographic areas and populations over time, standardization in 1-year classes is necessary.

The reason for the rural/urban difference is not known, but some factors influencing both the bone mineral content and the tendency to fall may differ between the two areas. Among

others, Suominen et al. (1984) showed a positive correlation between physical activity and skeletal mass. In the rural areas, where 20-30 per cent of the population has been engaged in agricultural work during the last few decades, the physical activity probably has been higher than in the cities. People living in the rural county are more likely to be more physically active even during their leisure time. Whereas patients with hip fractures are usually lean, the inhabitants of Skaraborg County have a higher body mass index than the remaining Swedish population (Haglund et al. 1983).

Alcohol consumption and smoking are important risk factors leading to osteoporosis (Nilsson 1970, Daniell 1972, Rundgren et al. 1984). These life-style factors are more commonly present in the urban area of Gothenburg than in Skaraborg County, with a much higher risk of mortality from lung cancer and cirrhosis of the liver in Gothenburg (National Central Bureau of Statistics, Sweden, 1981) (Figure 5). The mortality from accidental falls is greater for females than for males in Skaraborg County, whereas the opposite is true in Gothenburg. The most common injury among accidental falls in Sweden is hip fracture.

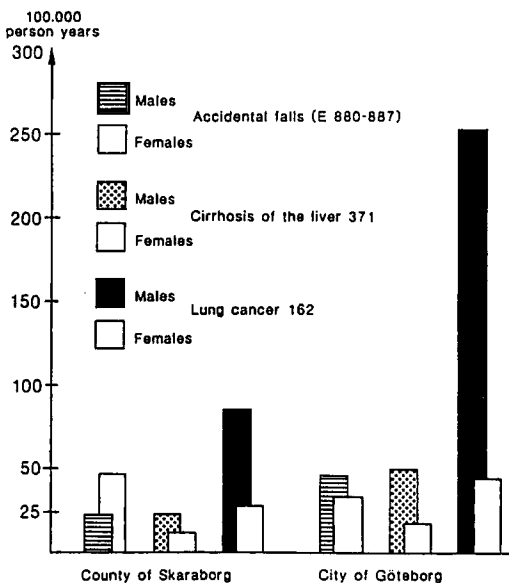


Figure 5. Regional cause-specific death rates in the age-group 70-74 years in the city of Gothenburg and in Skaraborg County between 1974 and 1978. ICD 8. (Regional mortality, National Central Bureau of Statistics 1981)

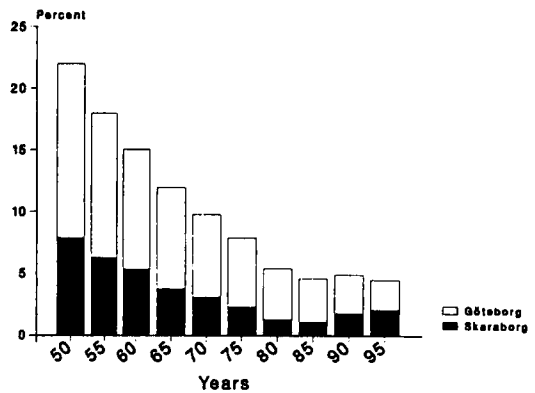


Figure 6. The proportion of divorced men in the city of Gothenburg and in Skaraborg County in 1982 (from local population registers in Skaraborg County and Gothenburg between 1974 and 1982).

It is also well known that a sparse social network is a risk factor for falls in the elderly (Lucht 1971). The lower prevalence of divorce in the rural district may have a preventive effect and is indicative of a better social network in the rural area among the elderly than in the urban area (Figure 6). A change in the ratio of cervical to trochanteric fractures has been shown in Skaraborg County during the period 1974-82, with a relative increase of trochanteric fractures. In the early 1970s, this ratio was greater in Gothenburg (Zetterberg et al. 1982), indicating a similar, but earlier development in the urban area. Because the trochanteric fractures are more common in older age groups, the change is perhaps associated with the aging population.

We conclude that the age-standardized incidence of hip fracture in the rural area was significantly lower than in the city of Gothenburg. The main reason for this is probably a difference in bone quality caused by life-style factors, but differences in the social structure may also play a role.

This study may give some implications for further preventive measures against hip fractures, for it emphasizes the importance of environmental factors in their genesis.

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