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# Rate of proximal humeral fractures in older Finnish women between 1970 and 2007

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ABSTRACT

Low-trauma fractures of older women are a major public health problem. Nevertheless, nationwide information on recent trends of proximal humeral fractures is sparse.

We assessed the current trend in the number and rate (per 100,000 persons) of low-trauma fractures of the proximal humerus among 80-year-old or older women in Finland, a European Union country with a well-defined white population of 5.3 million, by taking into account all women who were admitted to our hospitals for primary treatment of such fracture in 1970–2007.

The number of low-trauma fractures of the proximal humerus among 80-year-old or older Finnish women rose continuously between 1970 (32 fractures) and 2007 (478 fractures), but because of a simultaneous, sharper rise in population at risk, the age-adjusted fracture rate (showing a clear rise from 88 fractures per 100,000 persons in 1970 to 304 fractures in 1995) became stabilized between 1995 and 2007 (298 fractures per 100,000 persons in 2007).

In conclusion, the clear rise in the rate of low-trauma fractures of the proximal humerus in Finnish elderly women from early 1970s until mid 1990s has been followed by stabilized fracture rates. Reasons for this are largely unknown, but a cohort effect toward a healthier aging population with improved functional ability and reduced risk of injurious falls cannot be ruled out.



## Introduction

Proximal humeral fractures are the third most frequent fracture in elderly people after hip fracture and distal forearm fracture [1,2]. More than 70% of patients with a proximal humeral fracture are older than 60 years, about 75% are women, and from 40 years of age the incidence of fracture begins to increase exponentially [1,3–5].

Treatment of proximal humeral fractures is demanding, time consuming, and expensive [1–9]. Therefore, exact knowledge on fracture epidemiology is essential for planning prevention methods and projecting the number of future fractures. However, epidemiologic information on proximal humeral fractures is scarce, especially concerning their recent secular trends [1,6,10–12].

Previously we reported that the number and age-adjusted incidence of proximal humeral fracture among Finnish persons 60 years of age or older clearly increased from the early 1970s to the late 1990s [13,14]. We have now been able to follow the highest risk group of fracture, women 80 years of age or older, to the end of 2007 to see the fracture development in the new millennium. In other words, our aim was to assess the most recent secular trends of proximal humeral fractures among elderly Finnish women.

## Materials and methods

In accord with other epidemiologic studies [1,10,14–16], we defined a low-trauma fracture of the proximal humerus as a fracture occurring as a consequence of low or moderate energy trauma (typically a fall from standing height or less) and collected from the National Hospital Discharge Register (NHDR) all Finnish women 80 years and older who were admitted to our hospitals from 1970 to 2007 for primary treatment of such fracture. Traffic accidents and other high energy trauma were excluded. During the entire study period of 38 years, all Finnish hospitals treating fracture patients were included in the NHDR system, the annual number of hospitals ranging from 246 to 378.

The Finnish NHDR (established in 1967) is the oldest nationwide discharge register in the world, and the data provided are well suited for epidemiologic analyses. This register is well validated covering the acute injuries in the population adequately (annual coverage of injuries are ≥90%) and recording them accurately (annual accuracy of injury diagnoses are also ≥90%). This concerns

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especially severe injuries with clear-cut diagnoses, such as bone fractures [17–21].

Fractures were recorded by evaluating primary and secondary diagnoses. According to the directives from the Finnish National Board of Health, the first diagnosis describes the main reason for the hospital stay. The second, third, and fourth diagnoses indicate other possible diseases or injuries.

The diagnoses were labeled with a 5-digit code according to the eighth, ninth, and tenth revisions of the International Classification of Diseases (ICD) that indicated the type of fracture. From 1970 to 1986, we used the eighth revision of ICD and its two code classes for fractures of the proximal humerus (81200 and 81210). From 1987 to 1995, the ICD-9 code classes were 8120A and 8121A, and from 1996 to 2007, the ICD-10 code class was S42.2.

In each study year, the study consisted of the entire Finnish population (5.3 million people in 2007). Thus, the given absolute numbers and incidence rates of proximal humeral fractures among 80-year-old or older women were not cohort-based estimates but final results in the respective total population. Therefore, this study, similar to our previous epidemiologic investigations [13,14,22], did not use statistical analyses with probability values and confidence intervals characteristically needed in cohort or sample-based estimations.

The annual midyear population figures for each 5-year age group in 1970–2007 were taken from the Official Statistics of Finland [23]. In this statutory, computer-based register, every Finn is registered by his or her personal identification number. The register is quality controlled continuously and updated by Statistics Finland, the Central Statistical Office of Finland.

Fracture incidence rates were expressed as the number of cases per 100,000 80-year-old or older women per year. In calculating the age-adjusted fracture incidence, age adjustment was done by direct standardization using the mean population from 1970 to 2007 as the standard population.

The age-specific fracture incidence rates observed in 3 different age groups over the study period (80–84, 85–89, and 90–) were used to predict the age-specific incidence rates and absolute number of proximal humeral fractures in this elderly female population in the years 2010, 2020, and 2030. The prediction was based on a linear trend continuation method using ordinary least squares regression and $r^2$ and standard error of estimate (SEE) as descriptors of the fit of the regression line to the data. The regression lines were first calculated for each age group and were then used to determine the predicted age-specific fracture incidence rates until the year 2030. Within each age group, the predicted absolute number of fractures was then obtained by multiplying the incidence by the estimate of the number of inhabitants [24].

## Results

The annual total number of Finnish 80-year-old or older women with a low-trauma proximal humeral fracture rose sharply and steadily during the study period, from 32 in 1970 to 478 in 2007 (Fig. 1A). During 1970-1995, the age-adjusted incidence of these fractures also rose (from 88 fractures per 100,000 women in 1970 to 304 fractures per 100,000 women in 1995), but thereafter, the fracture incidence remained rather stable (298 fractures per 100,000 women in 2007) (Fig. 1B).

If the age-adjusted or age-specific incidence of low-trauma fractures of the proximal humerus continues to rise at the average rate observed in 1970–2007 and the size of the 80-year-old or older female population of Finland increases as predicted (from 0.16 million in 2007 to 0.30 million in 2030) [24], the number of fractures in this population will be over three-fold higher in 2030 (1540 fractures) than in 2007 (478 fractures) (Fig. 2, curve A). If, however, the incidence rates of fractures were to become stabilized to the 2007 level, the

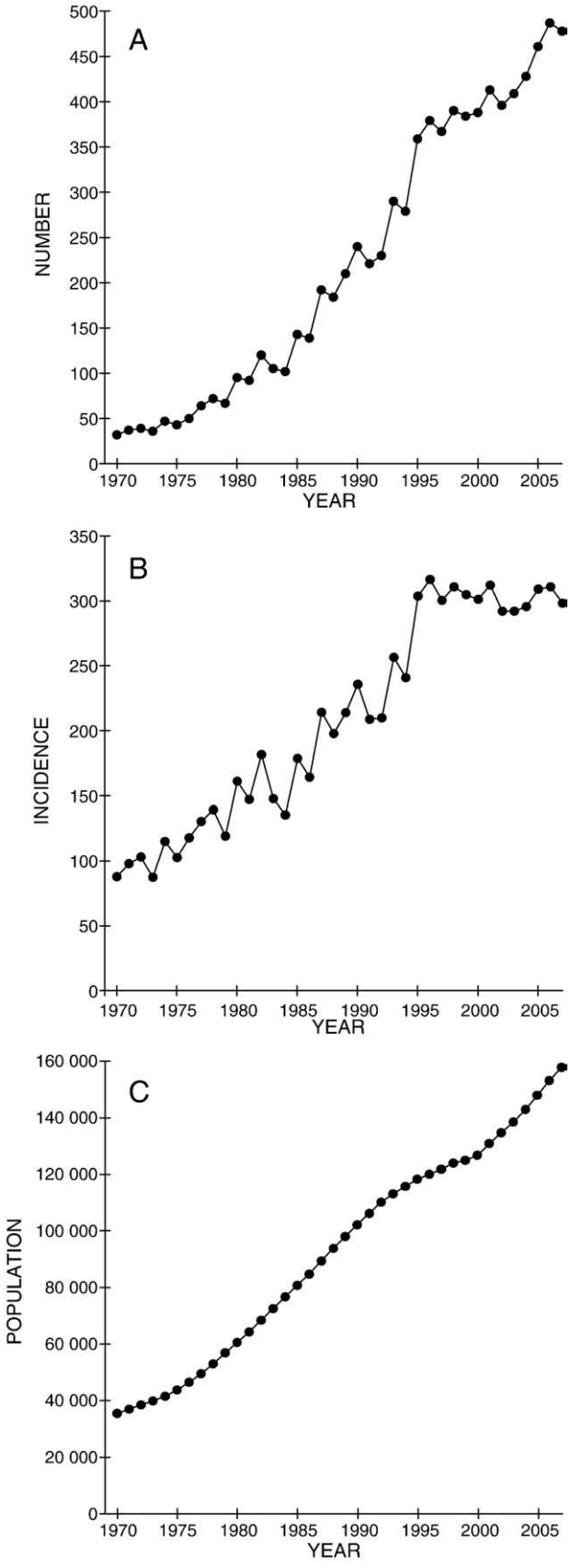


**Fig. 1.** The number (A) and age-adjusted incidence (per 100,000 individuals) (B) of proximal humeral fractures in women 80 years of age or older in Finland from 1970 to 2007. For comparison, the growth of this population is also demonstrated (C).