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Continuously declining incidence of hip fracture in Finland Analysis of nationwide database in 1970–2016

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ABSTRACT

Background: Hip fractures of older adults are a major public health issue.
Methods: We determined the current trend in the number and incidence (per 100,000 persons) of hip fracture among older adults in Finland by taking into account all persons 50 years of age or older who were admitted to hospitals for primary treatment of such fracture between 1970 and 2016.
Results: The number of hip fractures rose sharply till the end of 1990s (from 1857 in 1970 to 7122 in 1997), but since then, the rise has slowed down (7716 fractures in 2016). Similarly, the age-adjusted incidence of hip fracture increased until 1997 but declined thereafter. The decline was especially clear in women whose age-adjusted incidence was 537.9 (per 100,000 persons) in 1997 but only 344.1 in 2016. In men, the corresponding incidence was 256.5 in 1997 and 194.7 in 2016. With the current 2016 incidence rates, the number of hip fractures in Finland will increase by 44% by the year 2030 due to the sharp growth of the population at risk. The only way to limit the rise is to have a further decline in fracture incidence in 2016–2030.
Conclusions: The decline in the incidence of hip fracture in Finland has continued through the entire new millennium. Despite this we have to effectively continue implementation of the fracture prevention efforts, because our elderly population will grow rapidly in the near future.

1. Introduction

Hip fractures in elderly people are a worldwide concern representing one of the most important causes of long-standing pain, functional impairment, disability, and death in this population (Kannus et al., 1999; Orimo et al., 2016; Papaioannou et al., 2016; Pueyo-Sánchez et al., 2017; Rosengren, Björk, Cooper, & Abrahamsen, 2017; Uusi-Rasi et al., 2017). They are also a major problem on our health care systems and their finances.

About half of previously independent elderly victims of hip fracture become partly dependent, and ultimately a third totally dependent, of external help (Kannus et al., 1999; Uusi-Rasi et al., 2017). Hip fractures also lead to an overall 10–20% reduction in expected survival with 5–20% excess mortality within the first year after the fracture (Kannus et al., 1999).

Previously we reported that the rise in the incidence of hip fracture in Finland until 1997 (Kannus et al., 1999) was followed by declining fracture rates (Korhonen et al., 2013). We have now followed the population to the end of 2016 to analyze the most recent data on the incidence of hip fracture and to assess whether the decline in the fracture rates has continued.

2. Materials and methods

As previously (Kannus et al., 1999; Korhonen et al., 2013), the data of the hip fractures were obtained from the Finnish National Hospital Discharge Register (NHDR). This statutory, computer-based register is the oldest nationwide discharge register in the world (in operation since 1967) and provides reportedly reliable data for severe injuries in Finland, a country with a well-defined Caucasian population of 5.5 million people (Huttunen, Kannus, Pihlajamäki, & Mattila, 2014; Keskimäki & Aro, 1991; Mattila et al., 2008; Sund, 2012). To calculate the incidence rates of fracture, annual midyear populations were taken from The Official Statistics of Finland, the statutory computer-based population register of the country (Official Statistics of Finland, 2017a).

Hip fractures were identified by assessing primary and secondary diagnoses with the code-class 820 of the International Classification of Diseases versions eight (ICD-8) (1970–1986) and nine (ICD-9) (1987–1995), and, the code-class S72 of the ICD-10 (1996–2016) (Korhonen et al., 2013). For each observation year, one person was

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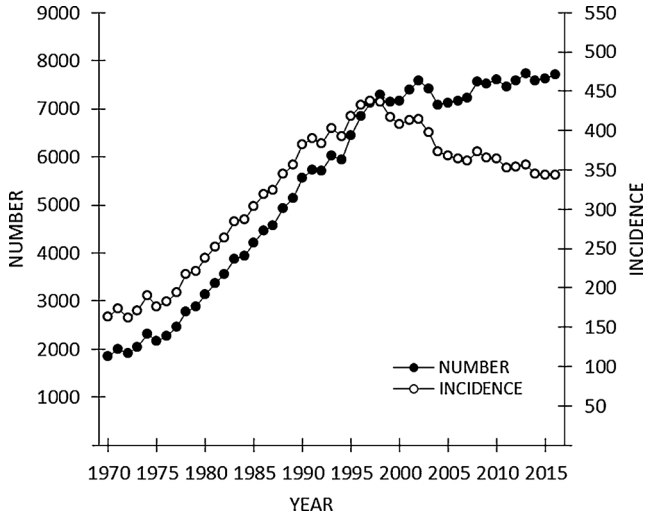

Fig. 1. Number and crude incidence (per 100,000 persons) of hip fracture in Finland in people 50 years of age or older between 1970 and 2016.

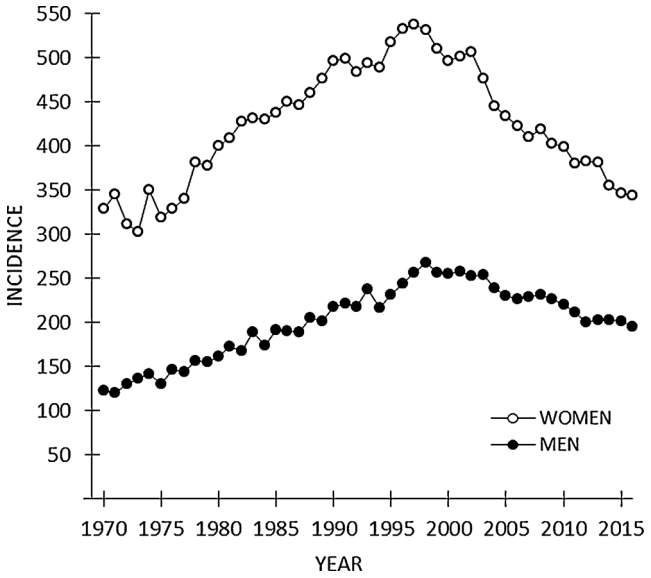

Fig. 2. Age-adjusted incidence (per 100,000 persons) of hip fracture in Finland in people 50 years of age or older between 1970 and 2016.

counted only once. Incidence rates of hip fracture were calculated for both sexes and were expressed as the number of cases per 100,000 50-year-old or older persons per year. For calculation of the age-adjusted fracture rates, age adjustment was done by direct standardization using the mean population between 1970 and 2016 as the standard population (Kannus et al., 1999; Korhonen et al., 2013).

The hip fracture data were drawn from the entire 50-year-old or older population of Finland, which was 1 137 945 in 1970, and 2 248 610 in 2016 (Official Statistics of Finland, 2017a). Thus the given absolute numbers and incidence rates of hip fractures were not cohort-based estimates but actual complete population results, and therefore, the study, in full agreement with our previous studies (Kannus et al., 1999; Kannus, Niemi, Sievänen, & Parkkari, 2017; Korhonen et al., 2013), did not use statistical analyses with confidence intervals intrinsically needed for cohort or sample-based estimations with sampling variability.

3. Results

The number of hip fractures among Finns 50 years or older rose considerably between 1970 and 1997, from 1857 to 7122 (Fig. 1). Since then, the rise has slowed down, the number of hip fractures being 7716 in 2016. Due to this development and the continuous increase in the population at risk, the crude incidence of hip fracture have decreased in Finland since 1997 (Fig. 1). Similarly, in both genders, the age-adjusted incidence of hip fracture rose until 1997 but has continuously declined thereafter (Fig. 2). The decline has been especially clear in women among whom the age-adjusted incidence was 537.9 (per 100,000 persons) in 1997 while only 344.1 in 2016. In Finnish men, the corresponding incidence was 256.5 in 1997 and 194.7 in 2016.

In both women and men, the age-specific incidence of hip fracture has declined in the three oldest age groups since 1997 (age groups 65–74, 75–84, and 85-), while in the youngest age group (50–64 years), the incidence has remained rather stable during 1997–2016 (Fig. 3). In contrast with the declined fracture incidence, the mean age of the Finnish hip fracture patients has risen steadily between 1970 and 2016: from 74.7 to 82.2 among women and from 70.2 to 77.3 among men.

Despite the declined hip fracture incidence since 1997, it is of interest that if the size of the 50-year-old or older Finnish population increases as predicted (from 2.25 million in 2016 to 2.48 million in 2030) (Official Statistics of Finland, 2017b) and the incidence of fracture remains at the current 2016 level, the number of hip fractures will increase in Finland between 2016 and 2030, up to about 11 000 annual fractures by the year 2030 (44% increase compared to the number in 2016) (Fig. 4). If, however, the incidence shows continuous decline from the year 1997 (as shown in Fig. 2), the annual number of hip fractures will slightly decline down to about 7 000 annual cases in 2030 (Fig. 4).

4. Discussion

This fresh epidemiologic study with an exceptionally long follow-up of 46 years indicates that after a sharp rise from the early 1970s to the late 1990s, the incidence of hip fracture has decreased in Finland during the entire new millennium. Although the age-adjusted incidence; that is, the average individual risk, of fracture has declined in both genders, the decline has been especially quick in elderly women.

Our data on the incidence of hip fracture are in line with recent findings from many other countries (Lucas et al., 2017), including Scandinavia (Abrahamsen and Vestergaard, 2010; Rosengren et al., 2017; Støen et al., 2012), Netherlands (Hartholt et al., 2011), Spain (Pueyo-Sánchez et al., 2017), Australia (Cassell & Clapperton, 2013), Japan (Orimo et al., 2016), Canada (Leslie et al., 2009; Papaioannou et al., 2016), and United States (Adams et al., 2013; Brauer, Coca-Perraillon, Cutler, & Rosen, 2009; Brown, Starr, & Nunley, 2012; Stevens & Rudd, 2010). They all report declining rates of hip fracture.

A major strength of the study is its nationwide database with excellent coverage and accuracy: the NHDR provides reportedly reliable data for severe injuries in Finland (Huttunen et al., 2014; Keskimäki & Aro, 1991; Mattila et al., 2008; Sund, 2012). A strength is also that annual midyear populations were not taken from census-based estimates but from the statutory computer-based population register of the country (Official Statistics of Finland, 2017a). In addition, since hip fracture is a serious injury and these patients have always been taken into a hospital in Finland, there is very little room for a suspicion that changes in the study methodology (e.g. ICD-coding) or reporting of hip fractures to the NHDR could explain the observed decline in fracture incidence.

A major limitation in the study is that the exact reasons behind the continuous decline in hip fracture incidence remained uncertain. As we previously speculated, a cohort effect toward healthier elderly populations could partly explain the development (Korhonen et al., 2013). Early-life risk factors including perinatal nutrition may have had stronger effect on the fracture risk in the earlier than later birth cohorts (Korhonen et al., 2013; Lucas et al., 2017). Also, changes in the socioeconomic factors by time, such as education, income and marital