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Declining age-adjusted incidence of fall-induced injuries among elderly Finns

NIINA KORHONEN1,2, SEppo NIemi1, MIKA PALVANEN1, JARI PARKKARI3, HARRI SIEVÄNEN1, PEKKA KANNUS1,4

1Injury and Osteoporosis Research Center, UKK Institute for Health Promotion Research, Tampere, Finland
2Bone and Cartilage Research Unit, University of Eastern Finland, Kuopio, Finland
3Tampere Research Center of Sports Medicine, UKK Institute for Health Promotion Research, Tampere, Finland
4Division of Orthopaedics and Traumatology, Department of Trauma, Musculoskeletal Surgery and Rehabilitation, Tampere University Hospital, Medical School, University of Tampere, Tampere, Finland

Address correspondence to: N. Korhonen. Tel: (+358) 3 282 9111; Fax: (+358) 3 282 9200. Email: njkorhon@student.uef.fi

Abstract

Background: elderly people’s fall-induced injuries are a major public health challenge.

Methods: we determined the current trends in the number and age-adjusted incidence (per 100,000 persons) of fall-induced injuries among older adults in Finland by taking into account all persons 80 years of age or older who were admitted to Finnish hospitals for primary treatment of a first fall injury over the period 1970–2009.

Results: the number of fall-induced injuries in elderly Finns increased considerably during the study period: for women and men separately, these numbers were from 927 to 10,333 (an 11-fold rise), and from 212 to 3,258 (a 15-fold rise), respectively. In both genders, the age-adjusted incidence (per 100,000 persons) of fall-induced injuries increased till the late 1990s but decreased thereafter, the incidence being 2,729 (women) and 1,455 (men) in 1970, and 5,930 (women) and 4,240 (men) in 2009. Even with the current injury incidence the number of these injuries is expected to more than double by the year 2030.

Conclusion: the rise in the age-adjusted incidence of hospital-treated fall injuries of 80 year old and older Finns from the 1970s to the late 1990s has been followed by declining injury rates. Despite this we have to effectively continue implementation of fall prevention actions.

Keywords: fall-induced injuries, older adults, time trends, hospitalisation, ageing
Introduction

Falls are a major cause of morbidity and mortality among the older population and thus a major public health concern in modern societies with ageing populations [1–3]. Fall-induced injuries may reduce the quality of life of the elderly people considerably because very easily they result in long-standing pain, functional impairment and disability [1, 2, 4, 5]. In addition they have a large impact on healthcare costs [6, 7].

Previously, we reported that the number and age-adjusted incidence of fall-induced injuries rose among Finns 80 years of age or older between 1970 and 2002 [8]. We have now followed the population another 7 years (to the end of 2009) and want to bring to immediate attention some interesting news: the rise in the incidence of fall-induced injury has levelled off and the incidence has even started to decline.

Materials and methods

Finland is an EU country with a well-defined Caucasian population of 5.3 million people. The data on the fall-induced injuries 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). The Register is continuously updated and monitored for quality by the Department of Registers and Statistics, National Institute for Health and Welfare, Helsinki, Finland and provides reportedly reliable data for hospital-treated injuries in Finland [1, 9–12]. The register has been shown to cover acute injuries in the population adequately (annual coverage of injuries is 90% or over) and record them accurately (annual accuracy of the NHDR injury diagnoses is also 90% or over) [1, 9–12].

To calculate the incidence rates of fall-induced injuries, annual mid-year populations were taken from the Official Statistics of Finland, the statutory computer-based population register of the country [13]. The data on fall-induced injuries were drawn from the entire 80 year old and older population of Finland, which was 50,943 in 1970 and 242,880 in 2009. Thus, the reported absolute numbers and incidence rates of injuries were not cohort-based estimates but complete population results.

Throughout the study years, a fall-induced injury was defined as an injury occurring in Finns aged 80 years and older as a consequence of a fall from a standing height of 1 m or less and resulting in hospital admission. Only the primary treatment of a first fall injury was taken into account each year over the period 1970–2009. Thus, one person was counted only once. Injuries caused by vehicular accidents and other types of high-energy trauma were excluded. Annually, approximately 70% of the recorded injuries were bone fractures, 12% were soft tissue bruises and contusions, 6% head injuries other than fractures, 5% wounds and lacerations, 3% joint distortions and dislocations and 4% other injuries.

In calculating the age-adjusted incidence of fall-induced injury (per 100,000 women and men 80 years of age and older), the age adjustment was done by means of direct standardisation using the mean 80 year old or older female and male populations between 1970 and 2009 as the standard population. The age-specific incidence rates were calculated for the age groups of 80–84, 85–89 and 90 years and older. A linear regression model was used to predict these rates until the year 2030, and then, within each age and sex group, the predicted absolute number of injuries was obtained by multiplying the incidence by the estimated population, the latter being obtained from the Finnish Population Projects 2010–30 [14].

Results

The number of fall-induced injuries among Finns aged 80 years and older increased considerably during the study period, from 1,139 in 1970 to 13,591 in 2009 overall (a 12-fold rise). Among women, the number of fall-induced injuries rose from 927 in 1970 to 10,333 in 2009 (an 11-fold rise) and among men, from 212 in 1970 to 3,258 in 2009 (a 15-fold rise). However, the age-adjusted incidence (per 100,000 persons) of fall-induced injuries decreased in both genders since the late 1990s (Figure 1).

At the beginning of our study period in 1970 the age-adjusted incidence was 2,729 per 100,000 persons in women and 1,455 in men. Among women, the rise in age-adjusted incidence was clear till the year 1997 (rate 7,079), but then started to decline, the incidence being 5,930 in 2009. Among men, the age-adjusted incidence...
rose till year 1998 (rate 5,467), but also declined thereafter, the incidence being 4,240 in 2009.

Findings concerning the age-specific incidences were similar: since the late 1990s incidences of fall-induced injuries have levelled off and even started to decline among both genders and all age groups, except among the oldest old of men (Figure 2A and B). Of note, a fall-related injury is clearly a gender-related and age-related phenomenon since the injury incidences are higher in women than men and in both genders the incidence increases with age (Figure 2A and B).

If the age-specific incidence of fall-induced injuries continues to rise at the average rate observed between 1970 and 2009 and the size of the 80 year old or older population of Finland increases as predicted (from 242,880 in 2009 to 530,442 in 2030), the number of these injuries will be 3.5-fold higher in 2030 (47,302 injuries) than in 2009 (13,591 injuries) (Figure 3, curve A). However, should the incidence remain at the 2009 level, the number of fall-induced injuries would be 2.2-fold higher by the year 2030 (29,694 injuries) compared with the year 2009 (Figure 3, curve B). If we assume that the incidence continues to decline at the average rate observed since the late 1990s, the absolute number of these injuries would still increase during the coming decades (1.6-fold rise resulting in 21,478 injuries in the year 2030) (Figure 3, curve C).

### Discussion

The current epidemiologic study shows that the rise in the incidence of fall-induced injuries of 80 year old and older Finns from the 1970s to the late 1990s has been followed by declining injury rates. However, the absolute number of these injuries is not decreasing because the population at hand, persons aged 80 years or older, is constantly expanding and will do so more rapidly in the near future.

Our long-term statistics on the entire spectrum of fall-induced injuries are in line with recent reports on more specific types of fall injuries in Finland (such as hip, proximal humeral and knee fractures); the rates of these severe injuries have also stabilised or started to decline [15–17]. Many other countries have also reported declining rates of hip fractures [18, 19, 20, 21, 22, 23]. Additionally, Finnish
findings concerning fall-induced deaths have been similar: the age-adjusted incidence is declining, but falls are yet the number one cause in the injury-induced deaths of adults [24, 25].

To our knowledge, our current finding on declining rate of fall-induced injuries among elderly adults is unique: to date other countries have reported rising trend of these injuries [3, 26]. Hopefully other populations are able to follow the declining Finnish trend soon.

The exact reasons for the recent decrease in age-adjusted incidence of older adults’ fall-induced injuries are unknown. One explanation could be that average functional ability of elderly people in Finland has improved [27, 28, 29]. Today elderly people’s lifestyle could be physically more active compared with their age-mates’ in earlier decades and thus improved muscle strength, balance and coordination could reduce the risk of falling [30, 31]. In addition, changes in the environment of the older adults, such as improvements in promoting safety at home and public surroundings, and more systematic use of walking aids, could have made ambulation and moving around safer and thus reduced the risk of falling.

Previously, we speculated that a cohort effect towards healthier older populations might explain the positive development that was seen in specific injury types and now in fall-induced injuries in general [15–17]. Concerning the most typical fall injury of older adults or fracture, early-life risk factors for fractures (such as perinatal nutrition) may have had stronger effect on the fracture risk in the earlier than later birth cohorts. The risen average body weight and body mass index (BMI) could also explain the declining fracture incidence: in all adult age groups of Finnish population, the prevalence of obesity (BMI 30 kg/m² or over) has increased since the 1980s [32] and, a low BMI is a strong risk factor for hip fracture and high BMI is related to decreased fracture incidence in the population [33, 34].

Considering reduction in bone fractures further, we may suspect that the average bone mass and strength have increased in 1990s due to specific measures to prevent and treat osteoporosis, such as increased exercise and increased use of vitamin D, calcium and bone-specific drugs. On the other hand, over 80% of low-trauma fractures occur in people who do not have osteoporosis [35], bone mass and strength seem not to have changed since 1970s [36] and the declining fracture trend started clearly before the above noted measures were implemented in a wider scale [15–17].

Last but not least, actions and interventions to prevent falls and their severity (such as strength and balance training, periodical medical and medication review, calcium and vitamin D supplementation, correction of visual impairments, wearing of hip protectors and gait-stabilising antislip devices and home modification with environmental safety measures) could have had a favourable effect to injury incidence [31, 37]. However, as in other explanations, direct causal evidence is lacking.

One might speculate that our current findings on declining incidence in fall-related injury hospitalisations of older adults could be due to changes in the Finnish hospitalisation policy only (i.e. stricter criteria for injury-based hospital admissions in the new millennium). We feel that this hardly can explain the phenomenon, because similarly decreasing injury incidences have been seen in many severe fracture types, such as hip and knee fractures, and they have always resulted in hospital admission [16, 17]. In some types of injury, such as distal radius fractures, improved surgical techniques have actually resulted in rise in the absolute and relative number of victims taken into a hospital [38].

Although our study shows positive development in the incidence of fall-related injuries of older Finns, the number of these injuries will grow (even when the incidence declines at the current rate) because the population at risk is constantly expanding. In fact, our epidemiologic study underestimates the burden these injuries will cause in the future, because we took into account only the primary treatment period of each fall injury patient to minimise the ‘readmission and between-hospitals transfer’ problems in the statistics. Therefore, this study identified only persons who were hospitalised due to a fall injury rather than revealed all hospitalisations and treatment periods contributing to our health care costs. Apparently, the entire burden of fall-induced injuries of older adults exceeds the numbers described in this study.

In conclusion, the present study shows a positive and most welcome trend change in the incidence of fall-induced injuries among elderly Finns. Nevertheless, there is a clear need for all feasible fall prevention actions to decline the injury incidence further, since the population at risk is growing very rapidly in the near future. Many recent studies have verified that elderly individuals’ falls prevention is effective and preventive measures can be organised cost-effectively [37, 39], but the existing programmes need larger implementation.

Key points

- Incidence of fall-induced injuries in 80 year old and older Finns has started to decline since the late 1990s.
- However, sharp focus on falls prevention is needed, because our elderly population will grow rapidly in the future.
- Continuous decline in the incidence of fall-induced injuries will be the only way to limit the absolute number of injuries.

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Supplementary data

Supplementary data mentioned in the text is available to subscribers in Age and Ageing online.

References

The long list of references supporting this article has meant that only the most important are listed here and are represented by bold type throughout the text. The full list of references is considered as Supplementary data are available in Age and Ageing online and is available on the journal website.


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