Rapid increase in fall-induced cervical spine injuries among older Finnish adults between 1970 and 2011

NIINA KORHONEN1, PEKKA KANNUS1, SEppo NIEMI1, JARI PARKKARI2, HARRI SIEVÄNEN1

1Injury and Osteoporosis Research Center, UKK Institute for Health Promotion Research, Tampere, Finland
2Tampere Research Center of Sports Medicine, UKK Institute for Health Promotion Research, Tampere, Finland

Address correspondence to: Niina Korhonen. Tel: (+358) 3282911; Fax: (+358) 32829200. Email: njkorhon@student.uef.fi

Abstract

Background: Fall-related injuries in older adults are a major public health challenge.
Methods: We determined the current trends in the number and age-adjusted incidence of fall-induced severe cervical spine injuries among older adults in Finland by taking into account all persons in 50 years of age or older who were admitted to Finnish hospitals for primary treatment of these injuries between 1970 and 2011. Similar patients aged 20–49 years served as a reference group.
Results: The number of fall-induced cervical spine injuries among older Finns rose six-fold from 59 in 1970 to 372 in 2011. The age-adjusted incidence of injury (per 100,000 persons) was higher in men than in women throughout this period and showed a clear increase from 1970 to 2011: From 8.5 to 20.3 in men, and from 2.8 to 11.7 in women. In both sexes, the increase was most prominent in the oldest age group, persons aged 70 years or older. In the reference group, the injury incidence did not rise by time.
Conclusions: The number and incidence of fall-induced severe cervical spine injuries among older Finns increased considerably between 1970 and 2011. An increase in the average risk of serious falls may partly explain the phenomenon. Wide-scale fall and injury prevention measures are urgently needed, because further ageing of the population is likely to worsen the problem in the near future.

Keywords: cervical spine, fall-induced injury, epidemiology, older people

Introduction

Falls and fall-related injuries in older adults are a serious public health concern in contemporary societies with ageing populations [1, 2]. In older patients, cervical spine injury commonly occurs after a relatively minor trauma [3, 4] and majority of these injuries are caused by falls [5–7]. Of all fall-induced injuries, a spinal cord injury or fracture to the cervical spine (alone or in combination) is a relatively rare event [8] but one of the most severe and disabling condition for the victims with high mortality [6, 9].

Previously, we reported that the number and age-adjusted incidence of fall-induced severe cervical spine injuries showed an alarming rise among Finns 50 years or older between 1970
We have now followed the population another 7 years (to the end of 2011) to analyse most recent changes and to assess whether the increase in injury rates has continued.

Materials and methods

Finland is an EU-country with a well-defined Caucasian population of 5.4 million inhabitants in 2011 (4.6 million in 1970). The data of the fall-induced cervical spine injuries occurring in Finland from 1970 to 2011 originates from the Finnish Hospital Discharge Register (FHDR). This statutory, computer-based register is the oldest nationwide discharge register in the world, and provides reportedly reliable data for severe injuries and their causes among the Finnish population [1, 11]. In this epidemiological study, a fall-induced cervical spine injury was defined as an injury (fracture, cord injury or their combination) that occurred in a person aged 50 years or older as a consequence of a fall from standing height of 1 m or less and resulted in hospitalisation of the victim. Also a younger reference group, all patients aged between 20 and 49 years, who were admitted to hospitals in Finland for primary treatment of an acute cervical spine injury between 1970 and 2011, were selected from the FHDR.

In calculating the gender-specific age-adjusted injury incidence (per 100,000 persons), the age adjustment was done by direct standardisation using the mean population of persons aged 50 years or older between 1970 and 2011 as the standard population. The annual mid-year populations were taken from the Official Statistics of Finland, the statutory, computer-based population register of the country [12].

The age-specific incidences (per 100,000 persons) were calculated for three 10-year age groups (50–59, 60–69 and >70 years). For data validation and comparison, the incidence of injury was also studied in the younger reference group.

In each of the above noted study groups, the future incidence prediction was assessed using a linear regression model, and then, within each age and sex group, the predicted absolute number of injuries in 2030 was obtained by multiplying the incidence by the estimated number of inhabitants. This estimation was obtained from the Finnish Population Projections 2010–2030 [13].

The absolute numbers and incidences of fall-induced cervical spine injuries were not cohort-based estimates, but actual population-based results drawn from the entire population of Finland. Therefore, the study, in full agreement with previous investigations [1, 8, 10, 14], did not use statistical analyses with confidence intervals.

Results

The number of a fall-induced cervical spine injury among 50-year-old or older Finns rose considerably between the years 1970 and 2011, from 59 in 1970 to 372 in 2011 (Figure 1A). The relative increase was 531%. The crude
incidences per 100,000 persons were 5.2 and 17.6 (238% increase), respectively.

Throughout the study period, the age-adjusted incidence of injury (per 100,000 persons) was higher in men than women and showed a clear increase from 1970 to 2011: from 8.5 to 20.3 in men, and from 2.8 to 11.7 in women (Figure 1B).

The increase was most prominent in the oldest age group. In men, the age-specific incidence rates (per 100,000 persons) in 1970 versus 2011 were 6.9 versus 9.3 (among men aged 50–59 years), 10.0 versus 20.4 (60–69 years) and 10.5 versus 43.3 (70 years or older). In women, the respective incidence rates were 2.6 versus 3.4 (women aged 50–59 years), 2.1 versus 4.5 (60–69 years) and 3.7 versus 30.9 (70 years or older).

The average age of a patient having a fall-induced cervical spine injury in the 50-year-old or older population increased from 1970 to 2011: from 62 years to 71 in men and from 65 to 79 in women.

In the younger reference group aged 20–49 years, the annual number and age-adjusted incidence of injury decreased somewhat over time: in 1970, the number and incidence were 85 and 4.5, respectively, and 65 and 3.2 in 2011 (Figure 1A and B). Across the study period, male predominance was also clear in this younger age group: 79% and 77% of the patients were men in 1970 and 2011, respectively.

If the aforementioned increase in 50-year-old or older people’s age-adjusted and age-specific injury incidence continues at the same rate as in 1970–2011 and the size of this population in Finland increases ~18% (as predicted for the next 20 years) [13], the number of fall-induced cervical spine injuries in this population will be over 50% higher in the year 2030 (~580 injuries) compared with 372 injuries in 2011 (Figure 1C).

**Discussion**

In this nationwide study, we described the trends of fall-induced severe cervical spine injuries in the entire Finnish adult population between 1970 and 2011. We found that the injury incidence increases with age, is higher in men than in women, and that the overall number as well as the age-adjusted and age-specific incidence of these injuries clearly rose from 1970 to 2011. In the younger adults aged 20–49 years, such an increase was not seen.

Previous studies have also reported increasing numbers of fall-induced cervical spine injuries among older adults, including Sweden [15], USA [16] and Iceland [17]. Further ageing of the populations is likely to increase the problem so that by the year 2030 Finland, for example, is likely to face 50% rise in fall-induced injuries of the cervical spine among persons 50 years of age or older (up to 580 victims per year).

The majority of cervical spine injuries seem to occur at the upper cervical spine (C1–C2 level) [4, 15, 18] making the treatment (stabilisation and immobilisation with halo brace, rigid collars or surgery) [19] very hard for the patient [20] and prone to complications [6, 21]. Furthermore, elderly people’s cervical spine injury has been associated with high mortality [6, 9]. In cervical spine fractures, the risk of death has been reported to be as high as 28% at 1 year [9]. High mortality, in turn, has been associated with neurological involvement [21], increased age and comorbid conditions [9], but even an isolated cervical spine injury can result in death or discharge to a long-term care facility [6]. At the other end of the outcome spectrum, there have been reports about patients regaining good function and returning home after discharge from hospital [21, 22]. Concerning injury costs, literature does not provide cost analyses for fall-induced cervical spine injuries of older adults, but in general it is well known that injuries of the head region are one of the most costly fall-induced injuries in the ageing population [23].

The exact reasons for the rise in the elderly people’s age-adjusted and age-specific incidence of fall-induced cervical spine injuries are uncertain [1, 2, 10]. An increase in the average risk of falling—caused by impaired muscle strength, balance and reaction time—may partly explain the phenomenon. On the other hand, today’s older people may have more serious consequences of falling than their predecessors; that is, an increasing number of less-healthy and functionally less-capable elderly people are, among others, now surviving to older ages (e.g. because of more effective healthcare and life-extending treatments and medication) and this may underlie increased incidence in severe falls [2, 14]. In addition, degenerative changes (with diminished flexion–extension mobility and spinal stenosis) and osteoporosis in the cervical spine of older adults increase the risk for spinal injury after a relatively minor trauma [22].

It is of interest that while the overall incidence of elderly people’s fall-induced injuries has declined during the new millennium in Finland [8], the steep rise in the incidence of severe injuries to the head [14] and cervical spine has continued. The reasons behind these differences are speculative but, as noted above, secular changes in the severity and mechanisms of falling could partly explain the phenomenon. A recent video study on authentic falls of older adults in long-term care facilities showed that head impact occurred in surprisingly many cases (37%) and that head impact was particularly common in forward falls [24].

In this study of fall-induced severe cervical spine injuries, the age-adjusted injury incidence was higher in men than in women. Previously, we have made a similar observation in older adults’ fall-induced traumatic brain injuries [14] and fall deaths [25]. Since the general incidence of falling is higher in elderly women than elderly men [1, 2, 26], it can be hypothesised that elderly men have a greater risk for severe outcomes of falls than their female counterparts. Taller and heavier body (i.e. higher impact energy while falling), higher consumption of alcohol, poorer nutritional status, greater occurrence of comorbidities and greater risk-taking behaviour among older men compared with older women may explain this gender disparity [25]. Further studies are, however, needed to confirm our observations and elaborate the reasons for the difference between genders.

Our study confirms the previous findings that the average age of the patients with an acute traumatic spinal cord injury
is increasing [16, 27]. Nevertheless, effective falls prevention programmes among older adults have potential to reduce serious fall-related injuries and subsequent emergency department visits, hospitalisations, nursing home placements, functional decline and mortality [2, 28–30]. Also, single interventions, such as strength and balance training, withdrawal of psychotropic medication, calcium and vitamin D supplementation, correction of visual impairment, a multifaceted podiatry care, gait-stabilising shoe devises, and home-hazard assessment and modification, can be effective [2, 28, 29]. Moreover, recent analysis of head impacts during falls suggested that backward rotation during decent could protect the head, but hand impact as protective response appeared ineffective [24]. Thus, improving upper-limb strength and teaching falling techniques were suggested to reduce fall-related head impacts in older adults [24].

Taken together, the number of fall-induced severe cervical spine injuries among Finnish adults 50 years of age or older has increased between 1970 and 2011 with a rate that cannot be explained merely by demographic changes. Therefore, wide-scale falls and injury prevention actions should be urgently adopted to control the development.

Key points

• The incidence of fall-induced severe cervical spine injuries among older Finns increased sharply from 1970 to 2011.
• The injury incidence increased with age and was clearly higher in men than in women.
• Effective fall and injury prevention is needed, because the elderly population will grow rapidly in the near future.

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Conflicts of interest

None declared.

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Effect of cold indoor environment on physical performance of older women living in the community

ULRICH LINDEMANN1, JUHA OKSA2, DAWN A. SKELTON3, NINA BEYER4, JOCHEN KLENK1,5, JULIA ZSCHEILE1, CLEMENS BECKER1

1Department of Clinical Gerontology and Rehabilitation, Robert-Bosch-Hospital, Auerbachstr. 110, Stuttgart 70376, Germany
2Physical Work Capacity Team, Finnish Institute of Occupational Health, Oulu, Finland
3Institute of Applied Health Research, Glasgow Caledonian University, Glasgow, UK
4Musculoskeletal Rehabilitation Research Unit, Bispebjerg and Frederiksberg Hospitals, University of Copenhagen, Copenhagen, Denmark
5Institute of Epidemiology, Ulm University, Ulm, Germany

Address correspondence to: Ulrich Lindemann. Tel: (49) 711 81012231; Fax: (49) 711 81016116. Email: ulrich.lindemann@rbk.de

Abstract

Background: The effects of cold on older persons' body and mind are not well documented, but with an increased number of older people with decreasing physical performance, these possible effects need to be understood.

Effect of cold indoor environment on physical performance

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