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Methodology

Projections of hospitalised fall-related injury in NSW, Australia: Impacts on the hospital and aged care sectors

Wendy L. Watson [a,*], Yang Li [a,b], Rebecca J. Mitchell [a,c]

[a] NSW Injury Risk Management Research Centre, University of New South Wales, Sydney, Australia
[b] Current affiliation: Critical Care & Trauma Division, The George Institute for Global Health, Level 7, 341 George St, Sydney NSW 2000, Australia
[c] Department of Aviation, University of New South Wales, Sydney, Australia

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ABSTRACT

Projections of the number, rate and cost of fall-related hospitalised injuries for individuals aged 65 years and older in New South Wales (NSW), Australia were estimated to 2051 for two scenarios: (1) demographic change only using 2008 admission rates; and (2) modelled change using negative binominal regression taking into account current trends in admission rates. Based on demographic change alone, the number and cost of fall injury hospitalisations among older people is expected to increase almost three-fold by 2051. Transfers to permanent residential aged care will also increase 3.2 fold. However, if the fall-related hospitalisation rate sustains its current trend, these increases are projected to be more than ten-fold by 2051. Even with demographic change alone, there will be a significant impact on the resources required to care for older people suffering a fall injury hospitalisation over the next forty years in NSW. The impact on the hospital and aged care sectors will be considerable unless significant improvements occur in the prevention and treatment of fall-related injury in older people.

1. Introduction

Falls are a leading cause of injury-related morbidity and mortality. Globally, fall injuries are second only to road traffic injuries in terms of total injury-related disability adjusted life-years (DALYs) lost, but account for significantly more deaths in older people than road traffic injuries (Peden, McGee, & Sharma, 2002).

In Australia, falls are the single most common cause of injury-related hospitalizations and death among people aged 65 years and older. They account for an estimated 134,000 emergency department (ED) presentations, 67,000 hospital admissions (Bradley & Pointer, 2009), and 2,600 deaths annually (Henley & Harrison, 2009). A fall can have significant consequences for an older individual as it can result in an injury requiring hospitalization (Boufous, Finch, & Lord, 2004) and/or premature admission to residential aged care (Tinetti & Williams, 1997). The cost of these injuries to the Australian heath system is significant. For example, in New South Wales (NSW), fall-related injuries cost the health system more than those resulting from road trauma (NSW Department of Health, 2003). The annual lifetime treatment and care cost of fall-related injuries was recently estimated at $558.5 million, which was equivalent to 5% of the total NSW health budget (Watson, Clapperton, & Mitchell, 2011).

Population aging is having a significant effect on the number of falls-related injuries and deaths. Due to improvements in lifestyle and healthcare, the average lifespan continues to increase and the older population is growing more rapidly than other age groups. By 2050, the number of people globally aged 60 years and older is expected to triple to over 2 billion. The population of older persons is itself aging with the oldest-old (those aged 80 years or over) increasing at the fastest rate. Currently those aged 80 years or over account for about one in every seven older people (60 or over), but this is expected to increase to one out of every five by 2050 (United Nations Department of Economic and Social Affairs Population Division, 2010).

In Australia, the population aged 65 years and over is increasing substantially with the proportion of the total population in this age-group projected to double from 13% in 2005 to 27% by 2050 (Schofield & Earnest, 2006). As the population ages, the number of fall-related injuries is also expected to increase with public hospital bed-day utilization expected to increase significantly by 2051 due to demographic changes alone (Moller, 2003). Similar trends in population growth (Libreri & O'Reilly, 2008) and in future health service utilization associated with fall-related injuries are expected in NSW (Moller, 2002). However, data on which prior estimates of the projected fall injury hospital burden (Moller, 2002) are now dated and these estimates did not take into account the increasing long-term trend in fall-related hospital admissions.

* Corresponding author at: NSW Injury Risk Management Research Centre, L1 Old Main Building, University of New South Wales, SYDNEY NSW 2052, Australia. Tel.: +61 2 9385 4404; fax: +61 2 9385 6040.
E-mail address: w.watson@unsw.edu.au (W.L. Watson).

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The aim of this study was to estimate the projected number and cost of fall injury-related hospitalizations among individuals 65 years and older in NSW and the subsequent number of residential aged care beds required, to 2051, based on two scenarios:

(1) Population change only with current admission rates
(2) Population change with increasing trend in fall-related hospital admission rates

2. Method

2.1. Setting

NSW is the most populous state in Australia, accounting for one-third of the country's population, with an estimated resident population of 7.24 million at June 30, 2010 (Australian Bureau of Statistics, 2010). Almost 60% of the population live in the metropolitan area of the state capital, Sydney (NSW Department of Planning, 2010). In 2010, there were almost 1.02 million people aged 65 years and older in NSW, accounting for 14% of the total NSW population (Australian Bureau of Statistics, 2010).

2.2. Data sources

A retrospective review of fall injury hospital admissions of individuals 65 years and older from the NSW Admitted Patients Data Collection (APDC) from 1 January 1999 to 31 December 2008 was conducted. Data from the NSW APDC include information on inpatient separations for individuals from public and private hospitals, private day procedures, and public psychiatric hospitals. It includes data on episodes of care in hospital, which end with the discharge, transfer, or death of the patient, or when the service category for the admitted patient changes. The hospitalization data were coded using the International Statistical Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (ICD-10-AM; National Centre for Classification in Health, 2006).

Age- and sex-specific population projections for NSW were obtained from the Australian Bureau of Statistics, Series B (Australian Bureau of Statistics, 2008). Hospital cost data and estimates of transfers of hospitalized fallers to residential aged care were derived from Watson, Clapperton, and Mitchell (2010, 2011).

2.3. Case selection criteria

Fall injury-related episodes of care (EOC) in the APDC were classified into three groups:

- **Fall-related cases (group 1):** An incident case was defined if the first external cause recorded was a fall (ICD-10-AM: W00-W19) and the principal diagnosis was an injury (i.e., ICD-10-AM range S00-T75 or T79). Transfers from other hospitals and changes in care-type within the same hospital were excluded so as to minimize the double-counting. Re-admissions within 28 days were included in the enumeration of incident cases.
- **Fall-related transfer episodes (group 2):** These were identified using the same criteria as above, except that the mode of admission was a transfer from another hospital or change in care type within the same hospital.
- **Fall-related follow-up care episodes (group 3):** These episodes were identified by a principal external cause code indicating a fall and a principal diagnosis code indicating other orthopaedic or other surgical follow-up care, care involving rehabilitation procedures, and persons awaiting admission to adequate facilities elsewhere (i.e., ICD-10-AM range Z47, Z48, Z50 or Z75.1).

Group 1 was used to estimate the rate of fall injury-related hospital admissions and all three groups were used in the calculation of associated hospital bed-days.

2.4. Data management and analyses

Analyses were performed using SPSS Version 18 (SPSS, 2009).

3. Historical data

The number of fall-related episodes of care in each of the three groups was calculated by gender and 10-year age group (i.e., 65–74 yrs, 75–84 yrs, and ≥85 yrs) for each calendar year between 1999 and 2008. Rates per 100,000 population were calculated separately for the estimated number of incident longer stay and same-day only admissions (group 1), and annualized rates of changes for each were derived from negative binomial regression analyses as described in the following section.

3.1. Projected incident hospital admissions

Two scenarios were used to estimate the projected number of incident cases (group 1) over time. In both, projections were calculated separately for same-day and longer stay cases, to account for any differences in historical trends between these two groups. The estimates were then summed to provide the total estimated incident number of falls hospital admissions (group 1) for each year. The two scenarios were:

1. *Demographic change only*
   Projections based on demographic change only, show what can be expected over time, if the falls admission rates are held constant at 2008 levels. Projections for each future year were estimated by multiplying the projected population for that year by the 2008 falls admission rates.
2. *Modeled change*
   The modeled change condition takes into account current trends in fall-related hospital admission rates as well as the demographic change over time.

Initially, Poisson regression was used to examine the statistical significance of changes in the trend over time using three main effects variables (i.e., gender, age group, and calendar year). Interaction effects of the three main effect variables, including two-way and three-way interaction, were all tested. Because of over-dispersion in the models, negative binomial regression was used to examine the trend using the three main effects and all three two-way interactions.

In the negative binomial model, testing the logarithm of the NSW population by gender, 10-year age groups, and calendar year from 1999 to 2008 was included as an offset variable in order to achieve best model fit. Estimates of predictors (i.e., main effect variables and interaction variables) were then applied to each gender, 10-year age, and calendar year group separately to generate corresponding logarithmic rates of admissions associated with falls in NSW for the period 2009–2051. The logarithmic rates were further exponentialized and calculated as rates per 100,000 population for each gender and age group for each calendar year and these were applied to the projected population estimates to derive the expected number of incident falls-related hospital admissions for each future year.

3.2. Projected bed-days

The total number of bed-days, occupied by persons with fall-related injuries, was calculated separately for each EOC group (groups 1–3) for each calendar year of data from 1999 to 2008 and for each gender and 10-year age-group. Bed-day projections were developed using the average 2008 length of stay and varying the number of incident cases projected (demographic only vs. modeled).