JAMDA xxx (2018) 1–6

JAMDA

journal homepage: www.jamda.com

Original Study

Predictors of Falls and Fractures Leading to Hospitalization in People With Dementia: A Representative Cohort Study

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Keywords:
Falls
fractures
dementia
hospital admission
Alzheimer's disease
mortality

A B S T R A C T

Objectives: Investigate predictors of falls and fractures leading to hospitalization in a large cohort of people with dementia.
Design: A retrospective cohort study.
Setting and Participants: People with diagnosed dementia between January 2007 and March 2013, aged >65 years, were assembled using data from the Maudsley Biomedical Research Centre Case Register, from 4 boroughs in London serving a population of 1.3 million people.
Measures: Falls and/or fractures leading to hospitalization were ascertained from linked national records. Demographic data, cognitive test scores, medications, and symptom and functioning scores from Health of the Nation Outcome Scales (HoNOS65+) were modeled in multivariate survival analyses to identify predictors of falls and fractures.
Results: Of 8036 people with dementia (63.9% female), 2500 (31.1%, incidence rate 125.5 per 1000 person-years) had a fall during a mean follow-up of 2.5 years and 1437 (17.7%, incidence rate 65.5 per 1000 person-years) had a fracture. In multivariable models, significant predictors of falls were increased age, female gender, physical health problems, previous fall or fracture, vascular dementia vs Alzheimer's disease, higher neighborhood deprivation, noncohabiting status, and problems with living conditions. Ethnic minority status was protective of falls (eg, Caribbean/Asian ethnicity). Medications (including psychotropic and antipsychotics), neuropsychiatric symptoms, cognitive (Mini-Mental State Examination scores), or functional problems did not predict hospitalized falls. Predictors of fractures were similar to those predicting falls.
Implications: Over an average of 2.5 years, a third of people with dementia had a fall leading to hospitalization, necessitating action in clinical practice. Clinicians should consider that besides established demographic and physical health—related factors, the risk of hospitalization due to a fall or fractures in dementia is largely determined by environmental and socioeconomic factors. Interestingly, our data suggest that neuropsychiatric symptoms, cognitive status, functioning, or pharmacotherapy were not associated with falls/fractures.

S. Sharma and C. Mueller are co—first authors.
G. Perera and B. Stubbs are co—last authors.
R. Stewart has received research funding from Roche, Janssen, and GSK outside the submitted work. The rest of the authors declare no conflicts of interest.

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https://doi.org/10.1016/j.jamda.2018.03.009

Falls are common in older age and associated with morbidity, reduced quality of life, increased risk of admission to long-term care facilities, health care expenditure, and premature mortality.[1–3] Consequently, understanding the predictors of falls and fractures is a global health priority.[4] Although it is established that reduced global cognition, increasing cognitive impairment, and dementia are associated with an increased risk of falls,[5] less is known about the predictors of falls and fractures, specifically among people with confirmed dementia.

A systematic review[6] with a search date of more than 10 years ago identified across 6 studies that motor impairments, impaired vision, type and severity of dementia-related behavioral disturbances, functional impairments, fall history, neuroleptics, and low bone mineral density were key risk factors for falls. A more recent systematic review[7] confirmed the earlier risk factors and also found mixed results for sociodemographic risk factors, while noting that psychotropic medication (particularly benzodiazepines and antipsychotics) and orthostatic hypotension were associated with an increased risk of falls. Although these comprehensive systematic reviews have advanced the field, a number of limitations persist. First, no study has been conducted in a sample of more than 300 people with dementia, which raises questions about the generalizability of the earlier research on risk factors of falls. Second, very few studies with an adequate sample size have investigated how risk for falls varies by dementia subtype. Third, there is a lack of representative information on the respective risk for falls from commonly used medications in dementia such as benzodiazepines, anticholinergics, and cholinesterase inhibitors. Fourth, although fractures are known to be common in people with dementia[8,9] and associated with adverse outcomes[10] in this population, including premature mortality,[11] the predictors of fractures are unclear.

Therefore, we conducted a representative cohort study investigating predictors of falls and fractures leading to hospitalization among people with clinically diagnosed dementia.[12]

Methods

Study Setting and Data Source

A retrospective observational study was conducted using data from the South London and Maudsley NHS Foundation Trust (SLaM) Biomedical Research Centre (BRC) Case Register. SLaM is one of Europe's largest mental health and dementia care providers, serving a geographic catchment of 4 South London boroughs (Lambeth, Lewisham, Southwark, and Croydon) with a population in excess of 1.3 million. The data for the current study were captured from the Clinical Record Interactive Search (CRIS) application, which enables an anonymized version of SLaM's electronic health record to be accessible for research projects within a robust and patient-led governance framework.[13] The SLaM BRC Case Register has been described in detail[14,15] and has supported a range of studies, including several longitudinal cohort studies of dementia and related mental disorders of later life.[16–19] SLaM caters for most mental health and dementia care provided in this catchment area covering 1.3 million people, specifically the case register; includes representative data on people with mental health diagnoses from 4 London Boroughs; and is the largest electronic health record of mental health services in Europe.[14,15] Data are currently archived in CRIS on more than 300,000 cases with a range of mental disorders, and the database has full approval for secondary analysis (Oxford Research Ethics Committee C, reference 08/H0606/71+5). Data from CRIS have been extensively supplemented through natural language processing applications using Generalised Architecture for Text Engineering (GATE) software, applying information extraction techniques to derive structured information from the extensive text fields held in the mental health record.[13]

Participants

All SLaM patients receiving an outpatient diagnosis of dementia, coded according to ICD-10 criteria,[12] between January 1, 2007, and March 31, 2013, were included in the current analysis. The first recorded dementia diagnosis was grouped by recorded ICD-10 code as follows: Alzheimer's disease (F00), vascular dementia (F01), and dementia in other diseases (F02; which includes Lewy body dementias). If both Alzheimer's disease and vascular dementia were recorded at the time of the first dementia diagnosis, they were recorded as mixed dementia. To avoid bias arising from dementia diagnoses made during general hospital inpatient stays when physical illness impedes the cognitive assessment, patients receiving care from SLaM General Hospital Liaison services within a 6-month period before and after dementia diagnosis date were not included in the analysis. SLaM patient records have been linked with Hospital Episode Statistics, which were available until March 2013.[20] Information governance and data linkages are described in detail elsewhere.[13]

Falls and Fractures Data (Outcome)

The primary outcome was a hospitalized fall and/or fracture from general hospital records. An admission was considered due to a fall and/or fracture if the relevant ICD-10 code was recorded as any discharge diagnosis. ICD-10 codes applied to ascertain falls were W00-W19 and fractures M80-M84, M907, S02, S12, S32, S42, S52, S62, S72, S82, S92, S22, T02, T08, T10, T12X, T902, T911, T912, and T921. The censoring point for follow-up was either the first fall or fracture, death, or March 31, 2013 (end of time period for data collection).

Predictors

A range of measurements were extracted from CRIS and all independent variables (covariates) were derived from information recorded closest to the date of the first recorded dementia diagnosis in the records, and this first dementia diagnosis date was applied as the "index date" for all analyses. Demographic information extracted included age, gender, and index of multiple deprivation (IMD)[21] for the neighborhood of residence (Lower Super Output Area) at the time of diagnosis. The IMD has previously been used in CRIS[22] and takes into account area-level deprivation from Census data across several domains including income, employment, health, education, barriers to housing and services, living environment, and crime.[23] We also used information from the Mini-Mental State Examination (MMSE) score[24] at the time of diagnosis. Marital/cohabiting status was classified into cohabiting (civil partnership, married, cohabiting) and noncohabiting (single, divorced, civil partnership dissolved, widowed, separated) groups. Recorded ethnicity was extracted from structured fields and grouped into the following categories: white British, Irish, other white background, African, Caribbean, South Asian, and other.

Mental and physical well-being, as well as functional status, were determined from the Health of the Nation Outcome Scales (HoNOS 65+), which are routinely administered in UK mental health services and recorded as structured data on the electronic health record.[25] Scores for each item range from 0 (no problem) to 4 (severe problem), and we extracted scores relating to overactive or aggressive behavior, nonaccidental self-injury, problem-drinking or drug taking, hallucinations or delusions, depressed mood, physical illness or disability, relationship problems, activities of daily living (ADL) problems, living conditions, and occupational and recreational activities, where these scales were completed within 6 months before or after the index date. To ease analysis and interpretation, we dichotomized the scores into "no or mild problem" (score 0-1) and "problem present" (score 2-4). We further used hospitalization records to