ORIGINAL ARTICLE

Falls in the elderly were predicted opportunistically using a decision tree and systematically using a database-driven screening tool

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Abstract

Objective: To identify risk factors for falls and generate two screening tools: an opportunistic tool for use in consultation to flag at risk patients and a systematic database screening tool for comprehensive falls assessment of the practice population.

Study Design and Setting: This multicenter cohort study was part of the quality improvement in chronic kidney disease trial. Routine data for participants aged 65 years and above were collected from 127 general practice (GP) databases across the UK, including sociodemographic, physical, diagnostic, pharmaceutical, lifestyle factors, and records of falls or fractures over 5 years. Multilevel logistic regression analyses were performed to identify predictors. The strongest predictors were used to generate a decision tree and risk score.

Results: Of the 135,433 individuals included, 10,766 (8%) experienced a fall or fracture during follow-up. Age, female sex, previous fall, nocturia, anti-depressant use, and urinary incontinence were the strongest predictors from our risk profile (area under the receiver operating characteristics curve = 0.72). Medication for hypertension did not increase the falls risk. Females aged over 75 years and subjects with a previous fall were the highest risk groups from the decision tree. The risk profile was converted into a risk score (range −7 to 56). Using a cut-off of ≥9, sensitivity was 68%, and specificity was 60%.

Conclusion: Our study developed opportunistic and systematic tools to predict falls without additional mobility assessments. © 2014 Elsevier Inc. All rights reserved.

Keywords: Falls risk; Fractures; Elderly; Screening tool; General practice; Medical records systems; Computerised

1. Introduction

Falls are the leading cause of injury in individuals aged over 65 years [1]. A total of 30% of this population will experience a fall each year [2–5], with the total number steadily increasing as the elderly population grows [6]. They are a cause of substantial physical and psychological morbidity, with 10% of falls resulting in a major injury [5,7], 5% resulting in a fracture [5,7,8], and many elderly individuals being left with a residual fear of falling leading to social isolation [9–11], increased dependence, and institutionalization [7,12,13]. Falls are a considerable public health burden with an estimated annual cost to the National Health Service (NHS) of £1.7 billion [14].

Falls prevention services have been shown to reduce the risk of falls by up to 55% [15], and reviews have shown that interventions to prevent falls can be cost saving [16]. Limitations on health-care resources mean that it is not possible to offer these services to all patients. There is therefore a need for an accurate risk assessment tool that can be easily implemented to identify which individuals are at highest risk of falling and would most benefit from referral to these services.

What is new?

Key finding

- This study adds evidence for nocturia and urinary incontinence to known predictors of falls: age, female sex, previous falls, and anti-depressants.

- Increased age, female sex, previous fall, nocturia, anti-depressant use, and urinary incontinence were the strongest predictors of falls from our risk profile.

What this study adds to what was known?

- Individuals at high risk of falls can be identified opportunistically from routinely collected GP data without requiring face-to-face functional mobility assessments.

- A systematic database-driven screening tool has been created, with the potential for incorporation into existing GP electronic systems, to allow automated screening of practice populations to flag-up high-risk individuals.

What is the implication and what should change now?

- Opportunistic and systematic assessment tools have been developed based on risk factors, and after validation in a large population, they could be readily implemented as screening tools in primary care.

- These tools can be used as part of routine fall assessments to guide referrals to fall prevention services.

There are a number of epidemiologic studies on risk factors for falls, with use of sedative medications, previous falls, dizziness, and poor performance on balance assessments being among the strongest predictors [4,14,17,18]. Based on these findings, a number of falls risk screening tools have been developed [4,7,12,18−22]. These are either purely functional mobility assessments (FMAs) of gait, strength, and balance or an FMA combined with other risk factors to generate a multi-factorial assessment (MFA) tool for falls. FMAs can provide important information on the physical attributes of individuals, which may predispose them to falls, but these measures are time consuming, subjective, and cannot be easily carried out across a population as part of a screening tool in the community-dwelling elderly. Additionally, the information is not readily available from routinely collected general practice (GP) data, and the predictors used to form the basis of the existing falls risk assessments have been identified from relatively

small populations with great variation in risk factors found to be significant contributors to falls between the studies described in the literature. There is no stand-alone MFA tool based on risk factors derived from a large population that can be easily implemented as a screening tool in primary care.

We carried out this large cohort study to identify significant risk factors for falls in the elderly, with specific attention to the impact of blood pressure and use of anti-hypertensive medication on occurrence of falls, as set out by the quality improvement in chronic kidney disease (QICKD) trial protocol [23]. From these findings, we aim to develop two screening tools based on routinely collected GP data. Screening in family practice can be either opportunistic, carried out when the patient presents; or systematic, involving methodical searching of practice data and recalling patients who meet the eligibility criteria for the given screening process. We, therefore, developed tools that might be used in either of these ways: a quick, simple visual aid for opportunistic case identification during GP consultations in all elderly patients, completed using information already available to the GP's from previous and current consultations, and a comprehensive GP database screening tool for integration into existing computerized medical record systems to systematically flag up individuals at high risk of falls who may benefit from falls prevention services. Use of computerized prompts has become a routine element of GP consultations [24]. Two distinct tools will be developed as it appears from studying other disease areas, such as atrial fibrillation [25], that both opportunistic and systematic approaches to case finding have a role in primary care.

2. Methods

2.1. Study population

Data for this study were collected as part of the QICKD randomized cluster trial using routinely collected information from 127 GP databases across the UK [23,26]. The initial trial data set comprised a comprehensive set of 11,541 variables relating to cardiovascular disease, risk and management. The sampling and data collection protocols for the QICKD trial have been previously described in detail [23]. As data were extracted for the whole practice population in the QICKD trial to identify people with chronic kidney disease (CKD), there were no exclusions that might have resulted in selection bias being applied. A sub-sample of the QICKD population was selected for use in this study based on the eligibility criteria of participants being aged 65 years or above as of June 1, 2008, the end point of the initial data collection period. A total of 135,433 individuals were identified from the parent population of 965,782 patients and were subsequently included in this study. Data collection was performed over a 5-year period between January 2006 and December 2010; data collected during the first 30 months were used to determine