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Inappropriate prescribing in older fallers presenting to an Irish emergency department

C. Geraldine McMahon[1], Caitriona A. Cahir[2], Rose Anne Kenny[3], Kathleen Bennett[2]

[1]Emergency Medicine, St James's Hospital, Trinity College Dublin, Dublin 8, Ireland
[2]Department of Pharmacology and Therapeutics, Trinity Medical School, Trinity College Dublin, Dublin 8, Ireland
[3]Department of Medical Gerontology, Trinity College Dublin, Dublin 2, Ireland

Address correspondence to: C. G. McMahon. Tel: +353 14162745; Fax: +353 14103541. Email: geraldinemcmahon@upcmail.ie

Abstract

Background: certain medications increase falls risk in older people.
Objective: to assess if prescribing modification occurs in older falls presenting to an emergency department (ED).
Design: before-and-after design: presentation to ED with a fall as the index event.
Subjects: over 70's who presented to ED with a *fall* over a 4-year period.
Methods: dispensed medication in the 12 months pre- and post-fall was identified using a primary care reimbursement services pharmacy claims database. Screening Tool of Older Person's PIP (STOPP) and Beers prescribing criteria were applied to identify potentially inappropriate prescribing (PIP). Polypharmacy was defined as four or more regular medicines. Psychotropic medication was identified using the WHO Anatomical Therapeutic Chemical classification system. Changes in prescribing were compared using McNemar's test (significance $P < 0.05$).
Results: One thousand sixteen patients were eligible for analysis; 53.1% had at least one STOPP criteria pre-fall with no change post-fall (53.7%, $P = 0.64$). Beers criteria were identified in 44.0% pre-fall, with no change post-fall (41.5%, $P = 0.125$). The most significant individual indicators to change were neuroleptics, which decreased from 17.5 to 14.7% ($P = 0.02$) and long-acting benzodiazepines decreased from 10.7 to 8.6% ($P = 0.005$). Polypharmacy was observed in 63% and was strongly predictive of PIP, OR 4.0 (95% CI 3.0, 5.32). A high prevalence of psychotropic medication was identified pre-fall: anxiolytics (15.7%), antidepressants (26%), hypnosedatives (30%). New initiation of anxiolytics and hypnosedatives occurred in 9–15%, respectively, post-fall.
Conclusion: a significant prevalence of PIP was observed in older fallers presenting to the ED. No substantial improvements in PIP occurred in the 12 months post-fall, suggesting the need for focused intervention studies to be undertaken in this area.

Keywords: *potentially inappropriate prescribing, falls, older people*

Introduction

The older population is expanding and is predicted to represent 25% of the population in Westernised societies by 2030 [1]. This is reflected in an increased prevalence of older trauma patients presenting to emergency departments (ED) [2]. Falls are a serious problem for community-dwelling older people and the primary cause of injury-related death, accounting for >50% of all injuries in this age group [3]. Falls are also a leading cause of functional decline, hospitalisation and early entry into residential care, representing an important public health issue worldwide [4].

Up to 40% of falls are preventable and are multifactorial in aetiology, with factors such as cardiovascular causes, medication, impaired balance, frailty, environmental hazards requiring consideration. Initiatives that focus on risk factor prevention are important to prevent recurrent falls and functional decline in this group. A multifactorial approach targeting the various risk factors simultaneously is most effective prevention strategy [5, 6]. There is strong evidence of an association between potentially inappropriate prescribing (PIP) and falls in older populations. Psychotropic medications, including serotonin-reuptake inhibitors, tricyclic antidepressants, benzodiazepines and hypnosedatives, are particularly associated with increased falls risk [7, 8]. Polypharmacy defined as four or more regular medicines is also a risk factor [9]. Falls in older people presenting to the ED is a red flag event and should trigger a comprehensive

falls risk assessment in line with current practice guidelines [10, 11]. Medication is an independent modifiable risk factor for falls and should form an important part of the assessment and intervention to reduce further falls risk in this group [10–12].

PIP in older adults is defined as medication for which the potential harm outweighs the benefit and for which a good alternative is available [13]. Criteria for measuring PIP in older populations have been developed in the USA and Europe [14, 15]. Older people are vulnerable to PIP because of multiple drug regimens, co-morbid conditions and age-associated physiological changes that alter pharmacokinetics and enhance pharmacodynamic sensitivity [16]. Population studies in the UK and the Netherlands report PIP prevalence rates of 28 and 20%, respectively, with long-acting benzodiazepines and amitriptyline as the most frequently prescribed inappropriate drugs [15]. In a European study, when the Screening Tool of Older Person's PIP (STOPP criteria) [15] was applied in six acute geriatric units, PIP prevalence rates ranged from 35% in the Czech Republic to 77% in Switzerland. The most frequently encountered criteria were benzodiazepines and neuroleptics [17]. Studies evaluating PIP prevalence in older fallers presenting to EDs are limited [18].

The aim of this study was to examine the prevalence of PIP in older fallers presenting to the ED and whether the expected modification of prescribing occurred following this index event in line with current practice guidelines.

Methods

Study population and design

Our ED serves a catchment area of 265,205 with 14,617 (5.5%) aged ≥70 (4.9% males, 6.1% females >70). There were 42,760 new attendances to ED in 2010. About 12,779 (29.9%) were over 70.

This study is a before-and-after design, examining the prevalence of: (i) PIP, (ii) psychotropic medications and (iii) polypharmacy in patients aged 70 years or older presenting with a fall (index event) to the ED. The prevalence of PIP, psychotropic medications and polypharmacy were estimated and compared at 12 months prior (pre-fall) to the index fall event and 12 months after the fall (post-fall). Twelve-months dispensing data prior to and following the fall was required to evaluate regular medication trends. Any polypharmacy and number of comorbid conditions were examined as potential risk factors for PIP both pre- and post-fall. Institutional ethics committee permission was obtained.

Pharmacy claims data were obtained from the Irish Health Services Executive-Primary Care Reimbursement Services (HSE-PCRS) Payments Board database. This General Medical Services (GMS) scheme provides free healthcare including medicines to 30% of the Irish population. All over 70 s are eligible for the GMS scheme and registered patients possess a unique identifier and are issued a medical card. Over 97% of older patients nationally avail of the scheme. The database contains demographic details (age, gender), information on the medicines dispensed including the proprietary and non-proprietary drug name, strength and quantity of the drug dispensed together with the cost and dispensing fee. Diagnostic data are not recorded. All prescription items are coded using the WHO Anatomical Therapeutic Chemical (ATC) classification system.

Date of ED presentation with 'fall' and discharge code was captured using the Hospital Patient Administration System (PAS) system (iSOFT Plc) and the Hospital In-Patient Enquiry Scheme (HIPE) data. 'Fall' was captured in the presenting complaint data notes field in the PAS ED records. The pharmacy claims data were linked to the hospital PAS and HIPE data and records anonymised. Only the first episode of attendance was recorded for each patient, to avoid duplication and dependency among the observations. Dispensed medication for fallers was assessed for PIP, psychotropic medication and polypharmacy during the 12-month period before and 12 months after the index fall event for each patient.

PIP STOPP criteria

STOPP consists of 65 indicators of PIP associated with adverse drug events in older populations. STOPP is a validated physiological system based screening tool, which considers drug dose, duration and drug–drug and drug–disease interactions [15]. Thirty STOPP criteria ($STOPP_{30}$) were applied to the prescription data for the study cohort, these do not require diagnostic data [19]. In addition, three items in the STOPP criteria ($STOPP_{33}$) which refer specifically to fallers (any benzodiazepines, neuroleptics or antihistamines) were also assessed [9].

PIP Beers criteria

Beers criteria were initially developed to capture PIP for nursing home residents [13] and were revised to include all geriatric care settings [14]. The existing and revised Beers criteria were applied in this study. All of the STOPP and Beers criteria were included in individual composite binary indicators defined as whether or not a patient had received any PIP indicator (yes/no).

Psychotropic medications

Psychotropic medications included antipsychotics (ATC code N05A), anxiolytics (ATC N05B), hypnosedatives including benzodiazepines (ATC N05C), antidepressants (ATC N06A) and antidementia medication (ATC N06D).

Polypharmacy and comorbidity

Polypharmacy is defined as four or more individual prescription medications that are tablet or capsule form on any claim for three claims or more in the 12 months pre- or post-fall [9]. Individual prescription medications were at the ATC3 level. Medications intended for short-term use, such as antibiotics were removed.

The RxRisk-V co-morbidity score was examined as a measure of co-morbidity to provide further detail on the level of morbidity in the study population. This score was developed as an adaptation of the RxRisk index [20], which includes disease categories for assessing disease burden in older patients [21]. This comorbidity score is calculated from the sum of 45 potential disease groups derived from prescribing data using ATC classification codes modified to the Irish health care system, having been validated in similar populations [22]. Individuals are classified as having a condition included in the RxRisk-V index if dispensed at least one prescription during the study period.

Statistical analysis

Prevalence of PIP using the STOPP and updated Beers criteria were calculated both pre- and post-index fall for ED fallers aged 70 or older presenting between 2007 and 2010. Data are presented as percentages. Comparisons between percentages with any STOPP or Beers Criteria were made between admitted or not admitted to hospital using Chi-square statistics. Means (SDs) are presented for normally distributed continuous data and medians (IQRs) otherwise. *T*-tests were used to compare mean values between groups where appropriate and the Mann–Whitney *U* test for non-parametric data. To compare prescribing pre- and post-index fall, McNemar's test was used for paired data to examine any change in prescribing. Logistic regression was used to examine the association between overall PIP criteria pre- and post-fall, and any polypharmacy or number of comorbidities adjusting for age and gender. Analyses were performed using the SAS system for windows version 9.1 (SAS Institute, Inc., Cary, NC, USA). *P*-values < 0.05 were considered statistically significant.

Results

Study population

One thousand and sixteen patients were eligible for inclusion in the study (Figure 1). Falls presentations were more common in women, 69.7% were female. The mean age was 82.65 years (SD, 6.05), and median age was 82.67 years (IQR: 77.9, 86.83). Fifty-one percent of fallers required admission to hospital (517), representing >10% of all emergency admissions in patients >70 years at our institution. Seventeen percent sustained hip fractures. There was no gender difference in admissions ($P = 0.611$), but those admitted were older [mean age 83.6 (SD 5.85) versus 81.7 (SD 6.1), $P < 0.0001$]. Seventy-eight percent of the >70 year old fallers had valid medical cards.

PIP STOPP criteria

The prevalence of PIP, as defined by $STOPP_{30}$ criteria, at the time of the index fall was 42.2% pre- and 42.9% post-fall (McNemar's test, $P = 0.67$). The prevalence of PIP was 53.1% pre- and 53.7% post-fall (McNemar's test, $P = 0.64$) when three-additional items that refer to fallers were applied,

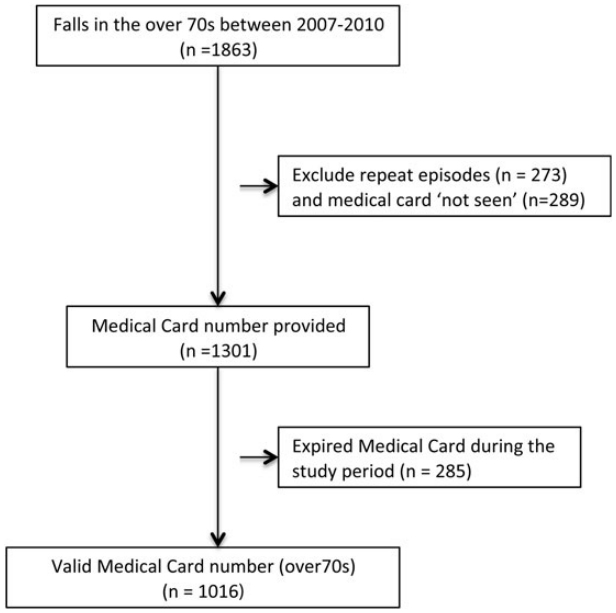

Figure 1. Flow chart of datasets used and included in the study.

($STOPP_{33}$ criteria, Table 1). Of those admitted 52.6% had $STOPP_{33}$ criteria pre-fall compared with 55.9% during the 12 months post-fall (McNemar's test, $P = 0.14$). PIP rates for non-admitted patients were similar, 53.5% pre-fall compared with 51.5% post-fall ($P = 0.30$). The significant individual $STOPP_{33}$ criteria which changed were long-term (>4 weeks) use of long-acting benzodiazepines decreasing from 10.7 to 8.6% ($P = 0.0045$), neuroleptics decreasing from 17.5 to 14.7% ($P = 0.022$), proton pump inhibitors >8 weeks duration increasing from 19.3 to 22.5% ($P = 0.012$) (Table 1). Other marginally significant increases were seen for the use of tricyclic antidepressants in dementia and theophylline in chronic obstructive pulmonary disease ($P < 0.05$, data not presented). When separately analysed by admission versus non-admission there were no overall significant differences identified except the long-term use of long-acting benzodiazepines which decreased from 11.4 to 7% ($P = 0.0001$) in those admitted compared with non-admitted where there was no change.

Beers criteria

When Beers criteria were applied, PIP was present in 44.0% pre-fall with no significant reduction post-fall (41.5%, $P = 0.125$; Table 1). The prevalence of PIP in those admitted compared with those discharged from ED, revealed no overall sustained improvement in PIP 12 months post-fall in either group. The significant individual Beers criteria to change were a slight reduction in the use of alpha-blockers, doxazosin ($P = 0.04$) and an increase in the use of short- and intermediate-acting benzodiazepines ($P = 0.0002$) (Table 1).

Psychotropic medications

Of the total study population, 29.5% received hypnosedatives during the 12 months pre-fall, rising to 32.1% post-fall

Table 1. Individual STOPP and beers criteria applied to fallers ($n = 1016$)

Criteria	Prescribing pre-fall (%)	Post-fall (%)	Significance (McNemar's test), *P*-value
Any $STOPP_{30}$ criteria (prescribing only)	42.2	42.9	0.7
Any $STOPP_{33}$ criteria (prescribing and falls criteria)	53.1	53.7	0.6
Long-acting benzodiazepines >4 weeks duration	10.7	8.6	0.005
Neuroleptics >4 weeks duration	4.3	4.1	0.8
Proton pump inhibitor full dose >8 weeks duration	19.3	22.5	0.01
NSAIDS for >3 consecutive months	8.5	7.3	0.20
Any duplication of drugs on same claim, e.g. two or more antidepressants, opiates etc.	3.7	4.9	0.1
STOPP criteria assoc. with falls			
Benzodiazepines	15.3	13.6	0.1
Neuroleptic drugs	17.5	14.7	0.0
First generation antihistamines	1.9	1.7	0.7
Any Beers criteria (2012)	44.0	41.5	0.1
Alpha-blockers, Doxazosin	4.8	3.7	0.04
Tertiary TCAs alone or in combination	5.3	4.3	0.1
First and second generation antipsychotics—in dementia	3.0	3.4	0.42
Benzodiazepines—short and intermediate acting	10.5	14.4	0.0002
Benzodiazepines – long acting	15.3	13.6	0.1
Non-benzodiazepine hypnotics >90 days	4.8	4.4	0.6
Non-cox selective nsaid chronic use>3 months	8.5	7.3	0.2

Table 2. Prevalence of psychotropic medications associated with falls

Drug class	Pre-fall % (*n*)	Post-fall % (*n*)	(%) New initiation[a]	Significance (McNemar's test), *P*-value
Antipsychotics	15.0 (152)	17.5 (178)	11.0	0.04
Anxiolytics	17.5 (178)	19.0 (193)	9.1	0.20
Hypnosedatives Incl. Benzodiazepines	29.5 (300)	32.1 (326)	15.4	0.06
Antidepressants	25.6 (260)	28.4 (289)	12.7	0.02
Antidementia	9.8 (100)	11.6 (118)	4.9	0.03

[a]As a proportion of those not on drug pre-fall.

(Table 2). Anxiolytics were dispensed for 17.5% before the fall, rising to 19% post-fall. Antipsychotics were dispensed in 15.0% rising to 17.5% post-fall event and the prescription of antidepressant medication rose from 25.5 to 28.4% post-fall (Table 2). Table 2 shows the percentage of new initiation of psychotropic medication post-fall. The increase in psychotropic prescribing was greatest for hypnosedatives.

Polypharmacy

The polypharmacy pre-fall rate was 63.1%. There was no significant difference post-fall (64% McNemar's test, $P = 0.565$).

Polypharmacy and comorbidity as potential risk factors for PIP in fallers

The risk of PIP was strongly associated with polypharmacy, with an adjusted OR = 3.32 (95% CI: 2.84–4.44) for the association between PIP and polypharmacy pre- and an adjusted OR = 3.98 (95% CI: 3.0–5.32) post-fall using $STOPP_{33}$. Similar results were found when using the Beers criteria with adjusted OR = 3.86 (95% CI: 2.84–5.26) pre and adjusted OR = 3.82(95% CI: 2.80–5.21) post-fall.

The median comorbidity score differed significantly between those with $STOPP_{33}$ criteria [median 6 (IQR: 4–9)] and those without $STOPP_{33}$ criteria [median 3 (IQR: 0–6), $P < 0.0001$]. In those with Beers criteria, the median co-morbidity score was 7 (IQR: 5–9), and with no Beers criteria the median was 3 (IQR 0–6, $P < 0.0001$). There was a significant linear association between the number of comorbidities and PIP by $STOPP_{33}$ and Beers criteria ($P < 0.001$) pre- and post-fall.

Discussion

PIP was observed in between 44 and 53% of fallers over the age of 70 years presenting to our ED using Beers and $STOPP_{33}$ criteria, respectively. The significant prevalence of PIP in this group has not previously been reported. Falls in an older patients presenting to ED should trigger a medication review as part of a comprehensive assessment [10, 11]. Our study revealed a high prevalence of PIP in this cohort with no substantial improvements in prescribing following the event. A mixed picture was seen in admitted patients, with some reduction in benzodiazepine prescribing, but other improvements were not evident. Polypharmacy was identified in 63% of fallers and was strongly predictive of

PIP, where the odds of PIP increased nearly 4-fold. A higher co-morbidity score significantly increased the likelihood of PIP with a linear association of comorbidity and PIP, reflecting a higher prevalence of PIP in patients with multiple co-morbid conditions; thus compounding the falls risk associated with multiple comorbidities [23].

A high prevalence of psychotropic prescribing was also observed in our group despite a median age of 82 years: 17.5% anxiolytics, 15% antipsychotic medication, 30% hypnosedatives and 26% antidepressants. Furthermore, the incidence of new initiation of psychotropic medications increased in the 12 months post-fall. With new initiation of 15% of hypnosedatives and 9.1% of anxiolytics observed during the 12 months post-fall. Exploring the cause of this increased psychotropic prescribing post-fall was outside the scope of this study and requires further research. As falls are associated with the development of fear of falling, leading to isolation and depression this may account for this observation. Benzodiazepines are a particular issue as one of the main medication risk factors for falls and fractures in older people as a result of their negative impact on cognition, gait and balance [24]. The pharmacodynamics of benzodiazepines alters with advancing age, as the concentration producing half of a full response (EC_{50}) for sedation reduces by 50% with advancing age. Newer hypnosedatives such as Zolpidem, a non-benzodiazepine sedative-hypnotic also produces clinically significant balance and cognitive impairment upon awakening from sleep [25]. The use of these newer drugs is associated with higher risks than was previously recognised [25]. Psychotropic medication should be avoided in older patients due to the substantial increased risk of falls [26].

Our results compare with 36% PIP using $STOPP_{30}$ criteria in the national HSE-PCRS population [19] and 41% for the local population. Long-acting benzodiazepine prevalence rates in the over 70 s were higher in our catchment area (9%) and our study cohort (10.7%) than in population studies from Ireland (5.2%), the UK (4%) and the Netherlands (5%) [27].

Reducing PIP in older populations will require implementation of enhanced methods to regularly assess drug effectiveness, dosage, duration, interactions and adverse symptoms [28]. Although withdrawal of long-term benzodiazepines is challenging, due to dependency, phased discontinuation programmes and intervention strategies can be successful [12]. Indicators for appropriate initiation of benzodiazepines prescribing may prove a more realistic method to reduce prescribing in this area [29]. Reduction of polypharmacy is associated with a 31% reduction of falls risk [6]. In the UK, the National Service Framework for older people recommends regular medication reviews [30]. Patients taking four or more drugs should be reviewed every 6 months and those taking fewer medications should be reviewed annually. These standards were incorporated into the National Institute for Clinical Excellence (NICE) standards of the assessment and prevention of falls in 2004 [10]. Polypharmacy does not imply inappropriate prescribing but it is consistently associated with the risk of PIP [31]. Reducing the number of drugs used by older people would be expected to reduce the risk of PIP and reduce direct and indirect associated costs. Information technology systems and computerised decision supports may provide the infrastructure to monitor prescribing in older patients more effectively in the future. Interventions to reduce PIP and associated falls in older populations also require closer integration between hospital, primary care and pharmacy.

Limitations

The limitations of this study include the lack of detailed diagnostic information, precluding the application of all Beers and STOPP criteria. The STOPP/Beers criteria are based exclusively on all dispensed medications; however, there may be some differences in prescribing versus dispensing, which were not captured. The database does not include over-the-counter (OTC) medications; however, it is important not to underestimate the importance of OTC medications, such as antihistamines and other sedating OTC medications, an important consideration in falls risk assessment. OTC medications can also lead to significant drug–drug interactions (e.g. ginkgo biloba and St Johns Wort with warfarin resulting in increased bleeding risks). This study is limited geographically to one large centre and to medical cardholders. Replication in other geographical sites would be important for generalisability. Data capture was dependent on the registration of a fall at the time of triage. It is possible that some cases of falls were missed. Patients with syncope and transient loss of consciousness were not specifically captured. Correlation with other risk factors for falls such as frailty, cognitive impairment, history of previous falls, cardiac arrhythmia, poor eyesight and the use of walking aids were outside the scope of this study and warrant further evaluation by prospective study.

Conclusions

There was a significant prevalence of PIP in older fallers presenting to our ED, with no substantial improvements in the 12 months post-fall event. Furthermore, there was a high prevalence of new initiation of psychotropic medication in this group during the 12 months post-fall. Despite developed guidelines for optimal practice in this area, our study suggests the need for focused intervention studies to be undertaken in this area, as screening and detection does not always result in effective intervention.

Key points

- A high prevalence of PIP in older fallers presenting to the emergency services was observed.
- Attendance of older persons to ED offers a unique opportunity to review and modify medications.
- Integration between pharmacy, primary care and hospitals would be important to develop comprehensive risk reduction strategies.

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Conflicts of interest

All authors declare that the answer to the questions on your competing interest form are all No and therefore have nothing to declare.

Ethical approval

Ethical approval was obtained for this study.

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The predictive value of self-rated health in the presence of subjective memory complaints on permanent nursing home placement in elderly primary care patients over 4-year follow-up

Anni B. S. Nielsen[1], Volkert Siersma[1], Gunhild Waldemar[2], Frans B. Waldorff[1,2]

[1]The Research Unit and Section of General Practice, Institute of Public Health, University of Copenhagen, Copenhagen, Denmark
[2]Memory Disorders Research Group, Department of Neurology, Rigshospitalet, Copenhagen University Hospital, Copenhagen, Denmark

Address correspondence to: A. B. S. Nielsen. Tel: (+45) 35327960; Fax: (+45) 35327946. Email: annibrit@sund.ku.dk

Abstract

Background: self-rated health (SRH) predicts nursing home (NH) placement; subjective memory complaints (SMC) too. However, the predictive value of SRH in the presence of SMC is unclear.
Methods: seven-hundred fifty-seven non-nursing home residents ≥65 years from general practices in Central Copenhagen were followed for 4 years (2002–2006). Patients gave information on SRH, cognition (SMC and MMSE), quality of life (EQ-5D) and socio-demographics. Information on comorbidities and permanent NH placement came from registries. The association between SRH (dichotomised into good versus poor) and SMC, and permanent NH placement was assessed using Cox proportional hazard regression adjusted for potential confounders.
Results: NH placement totaled 6.5% at 4-year follow-up. Poor SRH increased NH placement [hazard ratio (HR) = 2.07, 95% CI: 1.11–3.87] adjusted for age, SMC, MMSE, sex and comorbidities. SRH was not associated with NH placement if accounting for additional health information; however, SMC was (HR = 2.47, 95% CI: 1.26–4.86). Increased placement was seen for patients with good SRH and SMC (HR = 6.64, 95% CI: 2.31–19.12), but not among patients with poor SRH and SMC (HR = 1.37, 95% CI: 0.59–3.20) when compared with the reference group (good SRH and without SMC).
Conclusions: both poor SRH and SMC were associated with permanent NH placement risk among elderly primary care patients. However, when SMC was present a reverse association was found for SRH: good SRH increased NH placement. Since SRH is integrated in widely used psychometric instruments, further research is needed to establish the mechanism and implications of this finding.

Keywords: *self-rated health, subjective memory complaints, nursing homes, cohort studies, family practice, older people*

Introduction

Several studies have identified risk factors for nursing home (NH) placement among older adults and addressed these either as predisposing factors, e.g. increasing age, lower education, female gender and white ethnicity, or need factors, e.g. diabetes, worse performance on physical function and cognitive impairment, lack of social/caregiver support and