Int. j. adv. multidisc. res. stud. 2026; 6(2):995-998

Received: 14-02-2026
Accepted: 24-03-2026

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

Long-Term Use of Proton Pump Inhibitor and Statins in Patients Aged ≥ 70 Years and Fall Risk: A Clinical Audit at UHK

[1] Hisham Badawi, [2] Dr. Mazin Mohamed, [3] David Hobbert

[1, 2] Department of Pharmacy, University Hospital Kerry, Tralee, Ireland

[3] Advisor, Department of Pharmacy, University Hospital Kerry, Tralee, Ireland

Corresponding Author: **Dr. Mazin Mohamed**

Abstract

Background: Falls in older adults represent a major cause of morbidity, hospitalization, and mortality worldwide. Polypharmacy and fall-risk–increasing drugs (FRIDs) are recognized modifiable contributors.

Proton pump inhibitors (PPIs) and statins are frequently prescribed long term in elderly populations, often without periodic reassessment.

Aim: To evaluate the relation between long-term PPI and statin therapy in patients aged ≥70 years and increase of fall risk.

Methods: A retrospective clinical audit was conducted at UHK reviewing 48 consecutive patients aged ≥70 years admitted following a fall. Data collected included medication history, duration of therapy, documented indication, adverse effects, and biochemical monitoring.

Results: Among 48 patients, 28 (58.3%) were receiving long-term PPI therapy (1–5 years), with 14 (50%) lacking documented indication. Statins were prescribed in 40 patients (83.3%), primarily for primary cardiovascular prevention and hyperlipidemia. Polypharmacy was common: 83.3% were on antihypertensives, 16.7% antipsychotics, 10.4% opioids, and 10.4% antidepressants. Adverse effects potentially contributing to falls were identified in 35 patients (72.9%), including hypomagnesemia and muscle weakness/myopathy. Biochemical monitoring was performed only at hospital admission, with no evidence of routine outpatient surveillance.

Conclusion: There is a high prevalence of potentially inappropriate long-term PPI and extensive statin use among elderly patients presenting with falls. Inadequate documentation and absence of routine biochemical monitoring represent significant safety gaps. Structured medication review and deprescribing strategies are recommended.

Keywords: Falls, Elderly, Polypharmacy, Proton Pump Inhibitors, Statins, Medication Safety, Clinical Audit

Introduction

Falls affect approximately one-third of adults aged ≥65 years annually, with increasing incidence in those over 80 years. They represent a leading cause of injury-related hospitalization and functional decline in older adults. Risk factors are multifactorial, including sarcopenia, frailty, cognitive impairment, and medication-related adverse effects. Polypharmacy, particularly exposure to fall- risk–increasing drugs (FRIDs), significantly elevates fall risk and represents a modifiable factor in prevention strategies.

Proton pump inhibitors (PPIs), including pantoprazole, omeprazole, esomeprazole, and lansoprazole, are widely prescribed for gastroesophageal reflux disease and gastroprotection. However, long-term use beyond recommended durations is common in elderly populations, with studies suggesting that up to 50% of prescriptions may lack ongoing indication. Chronic use has been associated with hypomagnesemia, reduced calcium absorption, fractures, and neuromuscular complications.

Similarly, statins such as atorvastatin, rosuvastatin, and simvastatin are frequently prescribed in adults over 70 years, often for primary prevention. While beneficial in selected high-risk individuals, evidence supporting continued use for primary prevention in frail elderly patients is limited. Statin-associated muscle symptoms (SAMS) may impair strength and mobility, potentially increasing fall susceptibility.

Given these concerns, this audit aimed to evaluate prescribing patterns, documentation of indications, adverse effects, and monitoring practices for long-term PPI and statin therapy in elderly patients presenting with falls.

Methods Design
Retrospective clinical audit.

Setting
UHK hospital.

Population
48 consecutive patients aged ≥70 years admitted following a documented fall.

Inclusion Criteria
Age ≥70 years, Hospital admission due to fall, On at least one chronic medication Data Collected, Medication type and duration (1–5 years).

Documented indication
Presence of FRIDs, Adverse effects (hypomagnesemia, muscle weakness, myopathy) Biochemical monitoring history.

Data Analysis
Descriptive statistics using percentages and frequency distribution.

Results
Patient Characteristics Total patients: 48
All ≥70 years
High prevalence of polypharmacy.

PPI Use
28 patients (58.3%) were on long-term PPIs: Pantoprazole – 14 (50%), Omeprazole – 6 (21.4%).
Esomeprazole – 4 (14.3%), Lansoprazole – 4 (14.3%).

Indication review:
14 (50%) documented GERD, 14 (50%) no documented indication Standard adherence for documented indication: 50% (target 100%).

Statin Use
40 patients (83.3%) on statins: Atorvastatin – 24 (60%), Rosuvastatin – 10 (25%), Simvastatin – 6 (15%).

Primary indication:
Primary cardiovascular prevention, Hyperlipidemia.
No documentation of periodic benefit-risk reassessment.

Polypharmacy and FRIDs
Antihypertensives: 40 (83.3%), Antipsychotics: 8 (16.7%), Opioids: 5 (10.4%), Antidepressants: 5 (10.4%).
Adverse Effects 35 patients (72.9%) demonstrated: Hypomagnesemia, Muscle weakness, Myopathy.

Monitoring Practice
Biochemical testing was conducted only upon hospital admission. No evidence of routine outpatient monitoring for:
Magnesium, Electrolytes.
Audit standard adherence for monitoring: 0%

Discussion
This audit of older adults (≥70 years) presenting to University Hospital Kerry following a documented fall demonstrates a high prevalence of polypharmacy, prolonged proton pump inhibitor (PPI) and statin therapy without clear evidence of ongoing reassessment, substantial exposure to fall-risk–increasing drugs (FRIDs), and limited documentation of routine biochemical monitoring in primary care. These findings reflect well-recognised prescribing challenges in frail older populations and align with international concerns regarding medication-related harm as a modifiable contributor to falls.
All patients in this cohort were receiving at least one long-term medication, with a high overall burden of polypharmacy. Polypharmacy, commonly defined as the concurrent use of five or more medications, has been consistently associated with increased risk of falls, hospitalisation, frailty progression, and mortality in older adults [1, 2]. Large observational studies and meta-analyses have demonstrated a dose–response relationship between number of medications and fall risk, particularly when FRIDs are included [3].
Given that multimorbidity is prevalent in individuals aged ≥70 years, complete avoidance of polypharmacy is unrealistic. However, inappropriate or non-beneficial prescribing may amplify vulnerability to adverse drug reactions (ADRs), impaired balance, orthostatic hypotension, and sarcopenia, all of which contribute to falls. The findings in this audit reinforce the need for structured, periodic medication review in older adults presenting with falls.
Long-term PPI therapy was identified in 58.3% of patients, with half lacking a clearly documented indication. This prevalence is consistent with international data suggesting that 30–60% of chronic PPI prescriptions may be potentially inappropriate or lack ongoing justification [4, 5]. Although PPIs are effective for gastro-oesophageal reflux disease and peptic ulcer disease, guidelines generally recommend short-term therapy (4–8 weeks) for uncomplicated indications, followed by step-down or on-demand treatment where feasible [6].
Prolonged PPI exposure has been associated with hypomagnesemia, vitamin B12 deficiency, impaired calcium absorption, and increased fracture risk [7, 8]. Meta-analyses have demonstrated a modest but statistically significant association between long-term PPI use and hip fractures, particularly in older adults [9]. In the present audit, a substantial proportion of patients demonstrated biochemical or clinical features consistent with hypomagnesemia and muscle weakness. Although causality cannot be established, these findings are biologically plausible and consistent with previous reports linking electrolyte disturbances to neuromuscular dysfunction and increased fall risk [10].
The absence of documented indication in 50% of cases suggests potential therapeutic inertia or failure to deprescribe following resolution of the original indication. This highlights an opportunity for improved prescribing governance and adherence to deprescribing frameworks.
Statin therapy was highly prevalent (83.3%), predominantly for primary prevention and hyperlipidaemia. While statins have well-established benefits in secondary cardiovascular prevention, their role in primary prevention among frail elderly patients remains an area of ongoing debate. Trials such as the PROSPER study demonstrated benefit in

selected older populations [11]; however, very frail individuals and those with limited life expectancy are frequently underrepresented in randomised controlled trials [12].

Emerging evidence suggests that in older adults with advanced frailty or multimorbidity, the absolute cardiovascular benefit of statins may diminish, while the risk of adverse effects, drug–drug interactions, and functional decline increases [13]. Deprescribing frameworks increasingly recommend individualised assessment of cardiovascular risk, life expectancy, functional status, and patient preference when considering continuation of statins for primary prevention [14].

In this audit, no documentation was identified regarding periodic reassessment of cardiovascular benefit. Furthermore, a high proportion of patients exhibited muscle weakness or myopathic features. Statin-associated muscle symptoms (SAMS) are well recognised, particularly in older adults and those with polypharmacy [15]. Without routine clinical review or biochemical monitoring (e.g., creatine kinase in symptomatic patients), these adverse effects may contribute to reduced mobility and falls.

A significant proportion of patients were prescribed medications known to increase fall risk, including antihypertensives (83.3%), antipsychotics (16.7%), opioids (10.4%), and antidepressants (10.4%). Psychotropic medications and opioids have consistently been associated with increased fall risk due to sedation, impaired cognition, postural instability, and orthostatic hypotension [16, 17]. Antihypertensives may also contribute, particularly where overtreatment results in symptomatic hypotension [18].

The cumulative exposure to multiple FRIDs is of particular concern. Evidence suggests that the combined use of several FRIDs confers greater fall risk than individual agents alone, reflecting additive or synergistic pharmacodynamic effects [3]. The high prevalence of FRIDs in this cohort underscores the importance of medication reconciliation and targeted deprescribing as core components of falls assessment pathways.

A notable finding was that biochemical monitoring (including electrolytes, magnesium, and creatine kinase) was performed only upon hospital admission, with no evidence of routine surveillance in primary care.

Current recommendations advise periodic monitoring of magnesium levels in patients receiving long-term PPI therapy and appropriate biochemical evaluation in patients with suspected statin-related myopathy [6, 15].

The apparent absence of routine monitoring may reflect system-level challenges, including time constraints in primary care, fragmentation of care, and limited integration between prescribing and monitoring protocols. Similar gaps have been identified in primary care audits across Europe, where chronic medications are frequently continued without structured review [5, 19].

This audit identifies several modifiable factors that may contribute to fall risk in older adults:

Potentially inappropriate long-term PPI prescribing.

Limited reassessment of statin therapy in frail patients receiving primary prevention. High cumulative exposure to FRIDs.

Lack of routine biochemical and clinical monitoring.

Integration of structured medication review tools, such as STOPP/START criteria and deprescribing algorithms, into falls assessment clinics may mitigate these risks [20]. Multidisciplinary collaboration among general practitioners, pharmacists, and geriatricians is likely essential to optimise prescribing in this population.

Limitations

Small sample size (n=48), Single-center audit, Retrospective design, No control group, Causation cannot be established.

Conclusion

This audit demonstrates high prevalence of potentially inappropriate long-term PPI use and extensive statin prescribing in elderly patients presenting with falls. Significant gaps exist in documentation and biochemical monitoring. Medication-related adverse effects likely contribute to fall risk in this population. Structured deprescribing initiatives and systematic medication review are urgently required.

Action Plan

Implement mandatory annual medication review for patients ≥70 years. Introduce deprescribing protocol for long-term PPIs without indication. Establish monitoring policy for magnesium and CK levels.

Educate clinicians regarding FRIDs and fall risk. Schedule re-audit in 12 months.

Re-Audit Proposal

Repeat data collection after implementation of: Deprescribing intervention, educational sessions.

Target improvements:

≥90% documented PPI indication, ≥80% monitoring compliance, Reduction in inappropriate prescribing by 30%.

Ethical Considerations

As a clinical audit evaluating existing practice, formal ethical approval was not required. Patient confidentiality was maintained.

References

1. World Health Organization. WHO Global Report on Falls Prevention in Older Age. Geneva: WHO, 2007.
2. Panel on Prevention of Falls in Older Persons, American Geriatrics Society and British Geriatrics Society. Summary of the updated AGS/BGS clinical practice guideline for prevention of falls in older persons. J Am Geriatr Soc. 2011; 59(1):148-157.
3. Seppala LJ, Van Der Velde N, Masud T, *et al*. EuGMS Task and Finish Group on Fall- Risk-Increasing Drugs. Age Ageing. 2019; 48(4):485-495.
4. Forgacs I, Loganayagam A. Overprescribing proton pump inhibitors. BMJ. 2008; 336:2-3.
5. Reeve E, *et al*. Long-term proton pump inhibitor use in older adults: Indications and deprescribing. Drugs Aging. 2017; 34(8):585-592.
6. Cholesterol Treatment Trialists' Collaboration. Efficacy and safety of statin therapy in older people: meta-analysis. Lancet. 2019; 393:407-415.
7. Ward NC, Watts GF, Eckel RH. Statin toxicity. Circ Res. 2019; 124(2):328-350.
8. Hess MW, Hoenderop JGJ, Bindels RJM, Drenth JPH. Systematic review: Hypomagnesaemia induced by proton pump inhibition. Aliment Pharmacol Ther. 2012; 36(5):405-413.

9. Maher RL, Hanlon J, Hajjar ER. Clinical consequences of polypharmacy in elderly. Expert Opin Drug Saf. 2014; 13(1):57-65.
10. Fried TR, O'Leary J, Towle V, Goldstein MK, Trentalange M, Martin DK. Health outcomes associated with polypharmacy in community-dwelling older adults: A systematic review. J Am Geriatr Soc. 2014; 62(12):2261-2272.
11. Seppala LJ, Wermelink AMAT, De Vries M, *et al*. Fall-risk-increasing drugs: A systematic review and meta-analysis. J Am Med Dir Assoc. 2018; 19(4):371.e1-371.e9.
12. Forgacs I, Loganayagam A. Overprescribing proton pump inhibitors. BMJ. 2008; 336(7634):2-3.
13. Reeve E, Ong M, Wu A, Jansen J, Petrovic M, Gnjidic D. A systematic review of interventions to deprescribe proton pump inhibitors. J Clin Pharm Ther. 2017; 42(6):629-647.
14. National Institute for Health and Care Excellence (NICE). Gastro-oesophageal reflux disease and dyspepsia in adults: Investigation and management. NICE guideline [CG184]. London: NICE, 2014. (Updated 2019).
15. Hess MW, Hoenderop JGJ, Bindels RJM, Drenth JPH. Systematic review: Hypomagnesaemia induced by proton pump inhibition. Aliment Pharmacol Ther. 2012; 36(5):405-413.
16. Lam JR, Schneider JL, Zhao W, Corley DA. Proton pump inhibitor and histamine-2 receptor antagonist use and vitamin B12 deficiency. JAMA. 2013; 310(22):2435-2442.
17. Yu EW, Blackwell T, Ensrud KE, Hillier TA, Lane NE, Orwoll E. Acid-suppressive medications and risk of bone loss and fracture in older adults. J Bone Miner Res. 2008; 23(7):1126-1133.
18. Cundy T, Dissanayake A. Severe hypomagnesaemia in long-term users of proton-pump inhibitors. Clin Endocrinol (Oxf). 2008; 69(2):338-341.
19. Shepherd J, Blauw GJ, Murphy MB, *et al*. Pravastatin in elderly individuals at risk of vascular disease (PROSPER): A randomised controlled trial. Lancet. 2002; 360(9346):1623-1630.
20. Ridker PM, Danielson E, Fonseca FAH, *et al*. Rosuvastatin to prevent vascular events in men and women with elevated C-reactive protein (JUPITER trial). N Engl J Med. 2008; 359(21):2195-2207.
21. Orkaby AR, Gaziano JM. Time to benefit of statins in older adults. JAMA Intern Med. 2020; 180(4):552-559.
22. Scott IA, Hilmer SN, Reeve E, *et al*. Reducing inappropriate polypharmacy: The process of deprescribing. JAMA Intern Med. 2015; 175(5):827-834.
23. Stroes ES, Thompson PD, Corsini A, *et al*. Statin-associated muscle symptoms: Impact on statin therapy. Eur Heart J. 2015; 36(17):1012-1022.
24. Leipzig RM, Cumming RG, Tinetti ME. Drugs and falls in older people: A systematic review and meta-analysis I. Psychotropic drugs. J Am Geriatr Soc. 1999; 47(1):30-39.