ORIGINAL ARTICLE

Prevalence and Factors of Fall-Risk Increasing Drug Prescribing for Older Patients in Medical Wards

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ABSTRACT

INTRODUCTION: Falls represent a major health concern among older adults, frequently compounded by the use of fall-risk-increasing drugs (FRIDs). This study aims to assess the prevalence of FRID prescribing among older patients admitted to medical wards and at discharge in a Malaysian hospital and investigates the associations between patient characteristics and the prescribing of FRIDs. **MATERIALS AND METHODS:** This is a retrospective cross-sectional study involving 455 older patients aged ≥60 years. FRIDs were identified using the Screening Tool of Older Persons' Prescriptions in older adults with high falls risk (STOPPFall) criteria. Sociodemographic and clinical data, including polypharmacy and comorbidities, were analyzed for associations with FRID prescribing during admission and discharge. **RESULTS**: FRIDs were prescribed to 60.7% of patients during admission and 48.4% at discharge. During admission, FRID prescribing demonstrated significant associations with polypharmacy, prolonged hospitalization, and the presence of multiple chronic conditions. At discharge, FRID prescribing was significantly associated with polypharmacy and multiple chronic conditions. The most prescribed FRIDs during admission included diuretics (28.4%), opioids (20.7%), and sedative antihistamines (8.1%), with these patterns persisting at discharge. **CONCLUSION**: FRID prescribing is prevalent during admission and at discharge, highlighting the need for targeted interventions. Pharmacists can play a critical role in mitigating fall risks through comprehensive medication reviews, deprescribing, and patient education.

Keywords
Aged, Drug Prescriptions, Accidental Falls, Polypharmacy, Pharmacists

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INTRODUCTION

The global population of older adults is projected to more than double by 2050, exceeding 1.5 billion, with one in six individuals worldwide aged 65 years or older. This demographic shift has heightened the public health burden of falls, a significant concern among older adults. According to the World Health Organization (WHO), 28–35% of individuals aged 65 and above experience at least one fall annually, and as life expectancy increases, the incidence of fall-related injuries continues to rise.[1]

In Malaysia, falls are prevalent among older adults, with rates varying across populations and settings. The National Health and Morbidity Survey 2018 reported that 14.1% of Malaysian older adults (aged ≥60 years) experienced at least one fall in the past year.[2] The Malaysian Elders Longitudinal Research (MELoR) study estimated a fall prevalence of 18.9% among urban older adults (aged ≥55 years).[3] These findings underscore the urgent need for targeted interventions that address modifiable fall risk factors.

One of the key modifiable risk factors for falls is the use of medication. Certain medications, commonly referred to as fall-risk-increasing drugs (FRIDs), including

antihypertensives, sedative-hypnotics, antipsychotics, antidepressants, antihistamines, and opioids, can significantly elevate the risk of falls. This risk is mainly due to central nervous system effects—sedation, dizziness, impaired balance, and orthostatic hypotension. Multiple studies have consistently demonstrated the association between FRIDs and an elevated risk of falls. For example, the adjusted relative risk (ARR) of falls among patients prescribed FRIDs was reported to be 1.35.[4] Additionally, another study found that the use of at least one FRID was associated with higher incidence rates of total, injurious, and recurrent falls.[5]

The prevalence of FRID prescribing during hospital admissions has been reported to be high in various studies. For instance, a retrospective study in Ireland involving 162 inpatients aged ≥65 years referred to a Falls and Syncope service reported that 74.1% were prescribed at least one FRID during admission.[6] A study in Spain found an even higher prevalence, with 91.3% of 252 older adults admitted for fall-related fractures prescribed at least one FRID.[7] Additionally, a multicentre study of 1,147 patients hospitalized for heart failure revealed that 94% were taking at least one FRID at admission.[8]

The World Guidelines for Fall Prevention emphasize the importance of structured screening and assessment tools to identify FRIDs.[9] Tools such as the Screening Tool of Older Persons' Prescriptions (STOPP)[10] and the Screening Tool of Older Persons' Prescriptions in older adults with high falls risk (STOPPFall)[11] have been specifically recommended for this purpose. STOPPFall, developed by Seppala et al. using the Delphi technique, provides a comprehensive and explicit list of drug classes associated with an increased risk of falls in older adults. This tool supports deprescribing by offering practical guidance and decision trees to assist healthcare professionals in discontinuing potentially inappropriate medications in patients with a history of falls.[11] Studies utilizing STOPPFall in both inpatient and outpatient settings have reported the prevalence of FRIDs identified by this tool to range from 33% to 74.1%.[4,6,12]

To date, the applicability of the STOPPFall criteria in Malaysian healthcare settings remains unknown, and there is a lack of studies examining FRIDs in both inpatient and outpatient contexts within Malaysia. This study primarily aims to determine the prevalence of FRID prescriptions among older adults admitted to the medical wards of a Malaysian tertiary teaching hospital, both during admission and at discharge and to explore the characteristics associated with FRID use during admission and at discharge.

MATERIAL AND METHODS

Study design and setting

This retrospective cross-sectional study was conducted among older patients admitted to the four medical wards of Hospital Al-Sultan Abdullah (HASA) in Puncak Alam, Malaysia. HASA is a 400-bed public teaching hospital that provides comprehensive multidisciplinary healthcare services, including specialist outpatient clinics, diagnostic centres, an emergency department, and pharmacy services. The study procedures and findings were documented in accordance with the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) Checklist.[13]

Study population

This study analyzed data from eligible older individuals aged ≥60 years who were admitted to the general medical wards between January 2022 and December 2023. The inclusion criteria were patients admitted during the specified period, prescribed at least one medication during their hospital stay, and discharged with at least one medication. Individuals with incomplete or missing data were excluded from the analysis.

The sample size was determined using the formula: $n = [Z^2P(1 - P)]/d^2$, where n represents the sample size, Z is the Z statistic corresponding to a 95% confidence level (1.96), P is the expected prevalence of FRID use (60%, or 0.6)[12], and d is the margin of error (0.05).[14] Based on this formula, the minimum required sample size was determined to be approximately 369 participants. To account for the potential issue of incomplete medical records, a 25% adjustment was applied, resulting in a final target sample size of 460 participants for recruitment.

Sampling

A list of patients aged 60 years and older admitted to all medical wards between the study period was retrieved using the electronic hospital healthcare information system, UniMEDS. A total of 1035 older patients were identified, and each was assigned a unique identification number to ensure anonymity and facilitate data management. From this cohort, 460 patients were randomly selected for inclusion in the study using a random selection software tool. Following further evaluation, 455 patients were confirmed to meet the inclusion criteria.

Study tool

A self-designed standardized data collection form was developed to systematically gather relevant information. It comprised two sections: Section 1 included sociodemographic details and clinical information (e.g., number of chronic medical conditions, number of prescriptions, Morse Fall Scale [MFS] score at admission and fall history). Section 2 documented medications classified as FRIDs based on the STOPPFall criteria.[11]

MFS scores were extracted from medical records, as it is routinely assessed for all admitted patients at HASA. The MFS is a validated tool that evaluates fall risk on a numeric scale, incorporating factors such as fall history, medical conditions, use of ambulatory aids, intravenous therapy, gait patterns, and mental status. Scores range from 0 to 125, with standardized categories indicating low risk (0–24), medium risk (25–44), and high risk (≥45). Higher scores reflect a greater risk of falling.[15]

The STOPPFall is a structured tool designed to identify FRIDs. Developed via a Delphi consensus by European experts, it integrates evidence from meta-analyses and national fall prevention guidelines. The tool covers medication classes such as diuretics, alpha-blockers for hypertension, opioids, antidepressants, antipsychotics, antiepileptics, benzodiazepines, centrally acting antihypertensives, alpha-blockers for prostate hyperplasia, sedative antihistamines, vasodilators for cardiac conditions, and drugs for overactive bladder and urge incontinence.[11]

Study procedure

Upon identifying eligible patients, their sociodemographic information, clinical details, and medication usage were retrieved from the UniMEDS. The MFS scores were extracted from physical medical record files. Additionally, physical nursing charts and medication administration records were referred when necessary to supplement the electronic data. From each patient's medication list, FRIDs were identified and recorded based on the medication classes outlined in the STOPPFall tool. Data was extracted by the primary researcher (FMR), and where there was doubt, the cases were discussed with the co-researchers, and consensus was reached.

Data analysis

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS, Version 29, IBM Corp). Descriptive analysis was conducted, with categorical variables presented as frequencies and percentages, and continuous variables expressed as mean ± standard deviation (SD). Patients were categorized into two groups: those prescribed no FRIDs and those prescribed one or more FRIDs. Inferential statistical analysis was conducted to examine the associations between FRID prescribing and patient characteristics, including sociodemographic and clinical factors, using the chi-square test (χ^2). A p-value <0.05 was considered statistically significant.

RESULTS

Sociodemographic and clinical characteristics of patients

Table 1 provides an overview of the demographic and clinical characteristics of the 455 patients included in this study. Most patients were females (53.4%), with a mean ± SD age of 70.91 ± 7.65 years (range: 60–97 years). The largest age subgroup comprised individuals aged 60–69 years (49.2%), followed by those aged 70–79 years (37.6%) and those aged 80 years or older (13.2%). Additionally, majority of the patients (86.6%) had two or more chronic medical conditions.

During hospitalization, a total of 4,897 medications were prescribed, with a mean ± SD of 10.76±5.09 medications per patient (range: 1–29). Polypharmacy was highly prevalent, as 90.3% of patients were prescribed five or more medications. At discharge, 3,229 medications were documented, with a mean ± SD of 7.10±3.79 medications per patient (range: 1–19), and 71.6% of patients continued to receive five or more medications.

The mean ± SD MFS score was 41.90±18.4, with patients categorized as low risk (14.1%), moderate risk (54.7%), and high risk (31.2%). A history of falls within the preceding three months was reported by 10.1% of patients, while 19.6% required the use of ambulatory aids. The mean ± SD length of hospital stay was 7.2±6.49 days.

Prevalence of FRID prescribing to study participants and its association with sociodemographic and clinical characteristics of study participants

Among patients admitted to the medical wards, 60.7% were prescribed FRIDs during their hospital stay, accounting for a total of 381 prescriptions. FRID prescribing during admission was significantly associated with the number of prescriptions (p<0.001), length of hospitalization (p=0.029), and the number of chronic medical conditions (p=0.007). At discharge, 48.4% of patients were prescribed FRIDs, amounting to 275 prescriptions. Significant associations were observed between FRID prescribing at discharge and both the number of prescriptions (p<0.001) and the number of chronic medical conditions (p=0.014).

Table 1. Sociodemographic and clinical characteristics of patients and their association with the prescribing of FRIDs

Characteristics	Total (n = 455)	During admission		p[a]	At discharge		p[a]
		No FRID (n = 179)	≥ 1 FRID(s) (n = 276)		No FRID (n = 235)	≥ 1 FRID(s) (n = 220)	
Gender							
Male	212 (46.6)	84 (46.9)	128 (46.4)	0.908	108 (46)	104 (47.3)	0.779
Female	243 (53.4)	95 (53.1)	148 (53.6)		127 (54)	116 (52.7)	
Age group (years)							
60 – 69	224 (49.2)	83 (46.4)	141 (51)	0.504	112 (47.7)	112 (50.9)	0.532
70 – 79	171 (37.6)	69 (38.5)	102 (37)		94 (40)	77 (35)	
≥ 80	60 (13.2)	27 (15.1)	33 (12)		29 (12.3)	31 (14.1)	
Ethnicity							
Malays	400 (87.9)	159 (88.8)	241 (87.3)	0.630	208 (88.5)	192 (87.3)	0.686
Non-Malays	55 (12.1)	20 (11.2)	35 (12.7)		27 (11.5)	28 (12.7)	
Number of chronic medical condition							
None	21 (4.6)	15 (8.4)	6 (2.2)	***0.007***	17 (7.2)	4 (1.8)	***0.014***
1	40 (8.8)	17 (9.5)	23 (8.3)		23 (9.8)	17 (7.7)	
≥ 2	394 (86.6)	147 (82.1)	247 (89.5)		195 (83)	199 (90.5)	
Number of prescriptions (during admission)[b]							
< 5	-	37 (20.7)	7 (2.5)	***<0.001***	-	-	-
≥ 5	-	142 (79.3)	269 (97.5)		-	-	
Number of prescriptions (at discharge)[b]							
< 5	-	-	-	-	87 (37)	42 (19.1)	***<0.001***
≥ 5	-	-	-		148 (63)	178 (80.9)	
Morse Fall Scale Score during admission							
Low risk (≤ 24)	64 (14.1)	28 (15.6)	36 (13)	0.613	40 (17)	24 (10.9)	0.161
Medium risk (25 – 44)	249 (54.7)	99 (55.3)	150 (54.3)		126 (53.6)	123 (55.9)	
High risk (≥ 45)	142 (31.2)	52 (29.1)	90 (32.6)		69 (29.4)	73 (33.2)	
History of a fall within the last 3 months							
No	409 (89.9)	158 (88.3)	251(90.9)	0.355	208 (88.5)	201 (91.4)	0.313
Yes	46 (10.1)	21 (11.7)	25 (9.1)		27 (11.5)	19 (8.6)	
Use of ambulatory aid(s)							
No	366 (80.4)	150 (83.8)	216 (78.3)	0.146	195 (83)	171 (77.7)	0.158
Yes	89 (19.6)	29 (16.2)	60 (21.7)		40 (17)	49 (22.3)	
Duration of hospitalization (days)							
≤ 7	318 (69.9)	136 (76)	182 (65.9)	***0.029***	169 (71.9)	149 (67.7)	0.318
8 - 14	104 (22.9)	36 (20.1)	68 (24.6)		53 (22.6)	51 (23.2)	
≥ 15	33 (7.3)	7 (3.9)	26 (9.4)		13 (5.5)	20 (9.1)	

[a] Chi-square test used.
b Total number was not reported since frequency during admission and discharge are different

Type of FRIDs prescribed during admission and at discharge

Table 2 presents the types of FRIDs prescribed during admission and at discharge, categorized based on the STOPPFall criteria. During admission, the most frequently prescribed FRID classes were diuretics (28.4%), opioids (20.7%), and sedative antihistamines (8.1%). At discharge, diuretics remained the most commonly prescribed class (24.6%), followed by opioids (11.2%) and sedative antihistamines (4.6%).

Table 2. Type of FRIDs prescribed during admission and at discharge (n=455)

FRID classes	n (%)	
	During admission	At discharge
Diuretics	129 (28.4)	112 (24.6)
Opioids	94 (20.7)	51 (11.2)
Sedative antihistamines	37 (8.1)	21 (4.6)
Alpha-blockers as antihypertensive	29 (6.4)	20 (4.4)
Antiepileptics	18 (4)	18 (4)
Vasodilators used in cardiac diseases	18 (4)	16 (3.5)
Antipsychotics	19 (4.2)	10 (2.2)
Alpha-blockers for benign prostate hyperplasia	14 (3.1)	15 (3.3)
Benzodiazepines and related drugs	18 (4)	9 (2)
Antidepressants	3 (0.7)	2 (0.4)
Centrally acting antihypertensive	1 (0.2)	1 (0.2)
Medication for overactive bladder	1 (0.2)	0 (0)

DISCUSSION

This study is the first in Malaysia to utilize the STOPPFall criteria to identify FRIDs prescribed during admission and discharge among older adults in medical wards of a tertiary teaching hospital. At admission, 60.7% of older patients received FRIDs, which were significantly associated with polypharmacy, hospitalization duration, and the number of chronic medical conditions. At discharge, 48.4% of patients were prescribed FRIDs, which were significantly associated with polypharmacy and the number of chronic medical conditions. Diuretics, opioids, and sedative antihistamines were the most prescribed FRIDs at admission and discharge.

In this study, the prevalence of patients with a history of falls within the previous three months was 10.1%, which is considerably lower than the prevalence reported in previous Malaysian studies involving larger samples of older people (14.1%–18.9%).[2,3] This disparity could be attributed to differences in the study periods: while the previous studies examined fall prevalence over the past 12 months, the current study focused on a shorter timeframe of three months. Notably, the use of FRIDs was not associated with a history of falls in this study, contrary to findings from earlier studies,[5,16] likely due to the limited sample size of patients with a history of falls in the present study.

The high prevalence of polypharmacy observed is noteworthy, with 90.3% of patients experiencing polypharmacy during admission and 71.6% at discharge. The average number of medications was 10.76 ± 5.09 during admission and 7.10 ± 3.79 at discharge. Freeland et al. reported that in patients aged ≥65 years with a history of falls, the risk of falls increases by 14% with each additional medication beyond four.[17] In this study, the prescribing of FRIDs was significantly associated with polypharmacy, consistent with prior findings.[8,18] This association is particularly concerning, as previous research has consistently demonstrated that the risk of falls escalates with the total number of medications, especially when FRIDs are included in the regimen.[19,20]

The high prevalence of FRID prescribing observed in this study aligns with previous reports, which range from 74.1% to 94% during admission [6-8] and 33% to 95.2% in outpatient settings.[4,12,18,21,22] Variations are influenced by care settings, patient characteristics, and criteria used to identify FRIDs. For instance, higher prescribing rates are frequently reported in orthopaedic and psychiatric settings due to the prevalent use of opioids and psychotropics.[23] Similarly, studies focusing on specific populations, such as patients with cardiovascular diseases or cancer, often report elevated use of cardiovascular-related FRIDs or opioids and antidepressants for symptom management.[8,22] Differences in the tools used to identify FRIDs further contribute to variability across studies.

A notable finding of this study is the concerning prevalence of FRIDs prescribed to high fall-risk patients and those with a history of falls, despite the absence of a significant association between FRID prescriptions and

these patient groups. Specifically, a substantial proportion of high fall-risk patients (63.4%, 90/142 during admission; 51.4%, 73/142 at discharge) and those with a history of falls (54.3%, 25/46 during admission; 41.3%, 19/46 at discharge) were prescribed FRIDs.

The widespread use of diuretics, opioids, and sedative antihistamines among our patients is consistent with findings from previous studies.[7,8,23,24] Diuretics, in particular, have been strongly associated with an increased risk of falls.[25,26] In our cohort, diuretic use showed a modest reduction from 28.4% during admission to 24.6% at discharge. A similar trend of slight reductions in prescribing rates was observed for other cardiovascular medications, such as alpha-blockers and vasodilators used for cardiac diseases. The limited decline may reflect deprescribing barriers, including concerns about symptom recurrence and lack of clear guidelines for managing cardiovascular disease in older populations.[27,28]

Opioids, the second most frequently prescribed FRIDs during admission and discharge, have been strongly associated with an increased risk of falls, particularly within the early days of initiation.[29] In this study, opioid prescribing decreased by approximately 45% from admission to discharge—a reassuring finding considering the well-documented challenges of deprescribing opioids, such as clinicians' time constraints and patients' concerns about pain recurrence.[30,31] This reduction may reflect the short-term use of opioids for managing acute pain and could also indicate an increasing awareness among clinicians of the risks associated with opioid use in older adults. Sedative antihistamines, though prescribed to only approximately 8% of patients at admission and 5% at discharge, should be used with caution due to their contribution to fall risk through adverse drug events (ADEs) such as light-headedness and somnolence.[32]

Our findings underscore the critical role of pharmacists in managing FRIDs. Pharmacists are well-equipped to conduct comprehensive medication reviews to identify and address FRIDs.[33] Significant associations between FRID prescribing at admission and patient characteristics such as polypharmacy, prolonged hospitalization, and multiple comorbidities highlight the importance of prioritizing these groups for medication reviews. Similarly, patients with a history of falls or identified as having a high fall risk should also be prioritized for such evaluations.

Pharmacists should minimize medications, ensuring that only essential ones are included, while reducing FRIDs to prevent falls in older patients.[20] The STOPPFall tool offers a systematic approach to identifying FRIDs and guiding deprescribing efforts.[11] In a study involving inpatients referred to a Falls and Syncope service where STOPPFall was utilized, nearly half of the patients prescribed a FRID had at least one FRID discontinued, and over a quarter of all FRIDs were deprescribed following review.[6] Furthermore, it is essential for pharmacists to adopt a more proactive role in patient education. Educating patients and caregivers about the potential risks associated with FRIDs and providing practical strategies to mitigate these risks remains a critical component of care.[34,35]

To improve clinical integration, the implementation of STOPPFall can be embedded into hospital workflows through pharmacist-led ward rounds and digital clinical decision support systems integrated within electronic health records. Furthermore, hospitals should consider incorporating STOPPFall assessments into discharge planning protocols to ensure safer medication regimens upon transition to home or community care settings.

The study has several limitations. Its generalizability is constrained by the small sample size and single-centre design. The focus on medical ward patients may underestimate FRID use in higher-risk populations, such as those with dementia or hip fractures. Moreover, the study primarily involved patients with low to moderate fall risk, with only 10% reporting a history of falls. Importantly, the data did not capture FRID dosages during admission, limiting the understanding of prescribing patterns. While a slight to moderate decline in FRID prescribing across most drug classes was observed, key details, such as dosage adjustments and treatment durations, were not documented. Future studies should address these limitations by including larger, more diverse

cohorts and accounting for dosage and treatment duration to provide a more comprehensive understanding of FRID prescribing practices.

CONCLUSION

The prevalence of FRID prescribing among older patients admitted to medical wards and upon discharge from a Malaysian tertiary teaching hospital is high. FRID prescribing during admission was significantly associated with polypharmacy, prolonged hospitalization, and the presence of multiple chronic conditions, while FRID prescribing at discharge was associated with polypharmacy and multiple chronic conditions. Diuretics, opioids, and sedative antihistamines were frequently prescribed during both admission and discharge. Prescribing rates showed a modest reduction at discharge for most drug classes. STOPPFall criteria application provides insights into FRID prescribing patterns. However, the single-center design limits the generalizability of the findings. Nevertheless, the findings of this study emphasizes the critical role of pharmacists in mitigating medication-related fall risks through comprehensive medication reviews and targeted patient education.

INSTITUTIONAL REVIEW BOARD (ETHICS COMMITTEE)

Ethical approval for the study was obtained from the Research Ethics Committee (REC) of Universiti Teknologi MARA (UiTM) ([PH]/PG/135/2024 [MR]), and authorization to conduct the research at HASA was granted (500-HUiTM [PJI.18/4/45]).

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