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Management of fall-risk-increasing drugs in Australian aged care residents: a retrospective cross-sectional study

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Abstract

Background Globally, falls are considered a serious healthcare problem for aged care residents. Fall-risk-increasing drugs (FRIDs) are medications that can increase the risk of falling, given their adverse effects. Medication reviews are advocated to identify potentially inappropriate use of FRIDs. However, their impact on clinical and resident-centered outcomes is unclear. This study explored aged care residents' use of FRIDs and the content of medication review reports concerning these.

Methods A retrospective cross-sectional study of medication review reports completed between 1st July 2021 and 30th June 2022 was conducted. Statistical descriptive analysis was used to examine the use of FRIDs (defined as medications listed in the Screening Tool of Older Persons Prescriptions in older adults with high fall risk (STOPPFall)). The resident's medicine experience, identified drug-related problems (DRPs), and related recommendations concerning FRIDs were explored via content analysis. For recommendations to deprescribe FRIDs, clinical situations detailed in the reports were compared to those presented in STOPPFall.

Results Medication review reports relating to 966 residents were analysed. Of these residents, 83.2% ($n=804$) used FRIDs, with 31.2% ($n=301$) taking three or more FRIDs. In total, pharmacists made recommendations concerning 2635 identified DRPs, of which 19.7% ($n=520$) were the potentially inappropriate use of FRIDs and deprescribing was recommended. The clinical situation for which deprescribing was most frequently recommended was the use of a FRID for an indication of limited clinical benefit 37.9% ($n=197$). The clinical situation was not detailed for 130 (25.0%) recommendations to deprescribe FRIDs, and only three reports included the resident's viewpoint on deprescribing.

Conclusions FRID use was found to be highly prevalent among aged care residents. Pharmacists frequently identified opportunities to deprescribe FRIDs. However, reports often omitted resident viewpoints and the clinical grounds for deprescribing. Using resident-centered communication in medication review reports could improve their impact on FRID use and resident outcomes.

Keywords Aged care, Medication review, Fall-risk-increasing drugs, Deprescribing

Background

Falls are events in which a person comes to rest inadvertently on the ground or other lower level [1]. Globally, falls are a serious healthcare problem because of their association with increased morbidity, disability, care requirements, and mortality [1–3]. The World Health Organization reports that each year, 37.3 million falls are

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severe enough to require medical attention, with 684,000 deaths annually resulting from falls [1].

Falls risk increases with age, making falls highly prevalent among aged care facility residents [1, 2]. In Australia, people aged 65 years and over residing in aged care facilities are approximately five times more likely to experience a fall and six times more likely to experience a fall-related injury compared to people of the same age in the community [4]. Furthermore, falls and fall-related injuries account for more than a quarter of hospitalisations of aged care residents [5]. Fractures resulting from falls are the most common fall-related injury requiring hospital admission, of which hip fractures are the most clinically significant [6, 7].

One factor contributing to aged care residents' high susceptibility to falls is their high use of medications [2, 8–10]. Adverse effects of medications, such as sedation, dizziness, cognitive impairment, and hypotension, can increase the risk of falling [2, 8, 9, 11]. Medications known to increase the risk of falls are referred to as fall-risk-increasing drugs (FRIDs) [2]. A recent Australian study found that 86.9% of aged care residents admitted to hospital for a fracture took a FRID prior to admission [6]. Therefore, interventions to decrease the use of FRIDs may potentially reduce the occurrence of fall and fracture-related hospital admissions [2, 6, 8, 11]. One intervention promoted to decrease FRID use is medication review [2, 12–16].

Medication reviews are structured evaluations of an individual's medications with the aim of optimising medicine use [13]. In Australia, pharmacists complete medication reviews for aged care residents in association with the resident's physician under the federal government-funded Residential Medication Management Review (RMMR) Program [17, 18]. This program is similar to "clinical medication reviews" in the UK, "comprehensive medication reviews" in the US, and "MedsCheck LTC" in Canada [19, 20]. Under the RMMR program, pharmacists perform the medication review and then provide the physician with a written report detailing identified drug-related problems (DRPs) and recommendations to address these [17, 18]. The RMMR program recommends that pharmacists complete medication reviews and prepare written reports per the 'Guidelines for Comprehensive Medication Management Reviews' developed by the Pharmaceutical Society of Australia [17, 18].

International guidelines for fall prevention strongly endorse medication review and appropriate deprescribing of FRIDs for aged care residents [2]. When completing medication reviews, use of a screening and assessment tool is recommended to aid in the identification of potentially inappropriate FRIDs [2, 12, 17]. One such tool is the Screening Tool of Older Persons Prescriptions in older adults with high fall risk (STOPP-Fall) [21]. This tool was created by an expert Delphi consensus process using evidence from meta-analysis and European fall guidelines, and provides a comprehensive list of FRIDs along with deprescribing guidance to support medication reviews [21, 22].

Despite medication reviews being advocated as a means to identify and deprescribe FRIDs, a retrospective cohort study conducted over a four-year period ($n=11,3909$) found RMMRs did not significantly reduce the use of three medication classes identified as FRIDs by STOPPFall, namely opioids, loop diuretics and antidepressants [23]. Further, a systematic review examining the impact and outcomes of medication reviews in Australian aged care facilities concluded that while they are a valuable strategy to identify DRPs, their impact on clinical and resident-centered outcomes remains unclear [24]. To the best of the author's knowledge, no previous study has explored the content of RMMRs concerning recommendations involving FRIDs.

Therefore, the aim of this study is to analyse the content of pharmacist-identified DRPs and recommendations to address these. Additionally, the use of FRIDs by residents receiving an RMMR will be examined. This will provide insight into aspects of pharmacist medication reviews that can be targeted to improve their impact on FRID use and resident outcomes.

Methods

Data collection

A retrospective cross-sectional study of de-identified medication review reports was conducted. Sample size calculations determined that 980 RMMR reports would provide a representative sample of aged care residents receiving FRIDs. This sample size was based on a 99% confidence interval, 5% margin of error [25], and a previously reported prevalence of FRID use of 92.2% [5], with an allowance for a proportion of reports not to contain all relevant data fields.

The study was open to all RMMR service providers operating in Australia. RMMR service providers can be independent pharmacists or business entities employing pharmacists to complete RMMRs [18]. RMMR service providers enter service agreements with aged care facilities to complete resident medication reviews [18]. Pharmacists and business entities listed as providers of RMMRs on publicly available registers were directly approached to participate. Additionally, snowballing was employed, with participants asked to share study contact details with professional colleagues.

A sample of medication review reports was sought, with the number of reports requested from each provider determined by the number of aged care residents they

service. Consenting providers were instructed to supply retrospective consecutive reports. Data was collected from 1st July 2021 to 30th June 2022. All reports were de-identified in relation to residents, healthcare providers, and aged care facilities by the RMMR service providers before being supplied to the researchers.

Data analysis

Resident age, gender, geographical region, diagnoses, medications, medication experience, identified DRPs and related recommendations were extracted from each report.

Medications were categorised according to the World Health Organization (WHO) anatomical-therapeutic-chemical (ATC) classification system [26]. FRIDs were defined as medications listed in STOPPFall [21]. This tool contains 14 medication classes, namely: benzodiazepines (N05BA, N05CD, N03AE01), antipsychotics excluding lithium (N05A, excluding N05AN01), benzodiazepine-related drugs (N05CF), opioids (N02A), antidepressants (N06A), anticholinergics (A03E, A03AA, A03AB, A03CA, A03DA, N04A, R03AL, R03BB, S01FA), antiepileptics (N03, N02BF, excluding N03AE01), diuretics (C03, C02L, C07B, C07C, C07D, C08G, C09BX01, C09BX03, C09BX06, C09DA, C09DX01, C09DX06, C009DX07, C09DX08), alpha-blockers used as antihypertensives (C02CA), alpha-blockers for prostate hyperplasia (G04CA), centrally acting antihypertensives (CO2A), antihistamines (R06A), vasodilators used in cardiac disease (C01D) and overactive bladder and urge incontinence medications (G04BD). All medication classes identified in the STOPPFall tool were included. As medication review reports do not provide information on the frequency of when required (prn) medication use, only medications prescribed for regular use were included in the analysis.

Medication reviews completed under the RMMR program are intended to be comprehensive [17, 18]. As such, the reviewing pharmacist should complete both an interview with the resident (or their representative) and a clinical assessment of medication use [18]. Pharmacists provide the referring physician with a written report detailing the review findings [17, 18]. This report should include identified DRPs and recommendations to address these, and if appropriate the resident's medicine experience (including their understanding, concerns, preferences, beliefs and behaviour) [17, 18]. Additionally, RMMR guidelines recommend that the resident's clinical situation and relevant clinical background for each identified DRP and associated recommendation be conveyed in the report [17].

The resident's medicine experience, identified DRPs and recommendations to address them were included in the analysis if they involved a FRID. These were explored via content analysis using NVivo Pro 12 [27]. The process of successive summarisation outlined by Schierer [28] was used to develop a data-driven coding framework to classify DRPs, residents' clinical situations, recommendations to address the DRP, and residents' viewpoints (concerns, preferences, and beliefs) regarding the identified DRP.

The STOPPFall tool provides guidance on the clinical situations in which deprescribing FRIDs should be considered [21]. For all 14 medication classes included in the STOPPFall tool, deprescribing is recommended if there is no apparent indication for prescribing the medication or if a medication with a lower fall risk is available. For many medication classes, deprescribing should also be considered if residents are experiencing adverse effects that increase their likelihood of a fall or if the medication is prescribed for an indication for which clinical benefit is likely limited and outweighed by fall risk. For those recommendations advising to deprescribe a FRID, the clinical situation described in the report was compared with clinical situations for which deprescribing is advised in the STOPPFall tool [21].

Two rounds of coding were completed on the first 500 reports to develop and pilot the coding frame. One researcher (CL) performed data extraction and analysis. Regular research team meetings were held to discuss and resolve any issues arising in the development of the framework and data coding. Statistical analysis was completed using the SPSS software package [29].

Ethics

This study was approved by the Human Research Ethics Committee (HREC) at the University of Technology Sydney (ETH22-7751). All RMMR service providers provided written informed consent.

Results

A total of 980 RMMR reports for aged care residents were collected from 13 RMMR service providers (5 business entities and 8 independent pharmacists). These reports were prepared by 41 individual pharmacists. Collectively the RMMR service providers held service agreements with 1465 aged care facilities. As of June 2022, there were 2,671 aged care facilities operating in Australia [30], hence the participating providers serviced 54.8% of Australian aged care facilities.

Fourteen reports were excluded as they did not contain all data fields, resulting in a sample of 966 medication review reports. The residents represented by these reports lived in aged care facilities across Australia, located in metropolitan ($n=740$, 76.6%), regional ($n=73$, 7.6%), and rural ($n=153$, 15.8%) regions.

Residents had a mean age of 86.0 (±8.1) years, and 65.1% ($n=629$) were female. Overall, residents were found to have a high level of comorbidities, with an average of 10.0 (±4.4) diagnosis listed in the report. The ten most frequent diagnoses were: hypertension ($n=598$, 61.9%), mood disorders ($n=557$, 57.7%), dementia ($n=472$, 48.9%), osteoarthritis ($n=453$, 46.9%), chronic pain ($n=301$, 31.2%), frequent falls ($n=278$, 28.8%), urinary incontinence ($n=263$, 27.2%), gastroesophageal reflux disease ($n=257$, 26.6%), cardiac arrhythmia ($n=245$, 25.4%) and osteoporosis ($n=244$, 25.3%).

Use of FRIDs

Residents took an average of 7.6 (±3.7) medications and 1.9 (±1.5) FRIDs. As detailed in Table 1, 83.2% ($n=804$) of residents took a FRID, and 31.2% ($n=301$) took 3 or more FRIDs. Antidepressants, diuretics, and opioids were the most frequently used FRIDs (Table 2).

Table 1 Prevalence of Fall-risk-increasing drug (FRID) use

Number of FRIDs	Number of residents ($n=966$)
0	162 (16.8%)
1	259 (26.8%)
2	244 (25.3%)
3	140 (14.5%)
4	94 (9.7%)
5	52 (5.4%)
6	7 (0.7%)
7	7 (0.7%)
8	1 (0.1%)

DRPs and related recommendations

Pharmacists identified 2635 DRPs, an average of 2.7 (±1.5) DRPs per RMMR. Of these, 646 (24.6%) DRPs involved FRIDs. Recommendations to address the DRPs involving FRIDs were classified into two overarching categories: deprescribing and other.

In total there were 520 recommendations to deprescribe a FRID. These recommendations concerned 426 individual residents, equating to 53.0% of residents taking a FRID.

Deprescribing recommendations were subclassified into four categories: medication cessation ($n=221$), change of medication ($n=101$), dose reduction ($n=100$) and ongoing review of continued FRID use, pending additional clinical assessment ($n=98$). The category, change of medication, refers to instances where the pharmacist advised to deprescribe a FRID and replace this with a non-FRID medication. Examples of this were replacing an opioid with paracetamol and replacing a benzodiazepine with melatonin.

As detailed in Table 2, proportionate to medication use, deprescribing was most often recommended for antipsychotics and benzodiazepines. To aid in deprescribing of FRIDs, 43 recommendations suggested the implementation of non-pharmacological strategies. Such strategies were primarily advised to aid in the deprescribing of diuretics with implementation of leg elevation, compression and fluid restrictions ($n=19$). Other non-pharmacological strategies suggested were, behaviour management to support deprescribing of antipsychotics ($n=7$), scheduled toileting and incontinence aids to support deprescribing of overactive bladder and urge incontinence medications ($n=7$),

Table 2 Frequency of Fall-risk-increasing drug (FRID) use and deprescribing recommendations by medication class

Medication class	Number of residents taking ($n=966$)	Number of deprescribing recommendations (% of residents taking medication class)
Antidepressants	419 (43.4%)	97 (23.2%)
Diuretics	291 (30.1%)	90 (30.1%)
Opioids	233 (24.1%)	60 (25.8%)
Antipsychotics, excluding lithium	144 (14.9%)	97 (67.4%)
Antiepileptics	136 (14.1%)	36 (26.5%)
Benzodiazepine and benzodiazepine-related drugs	134 (13.9%)	81 (60.4%)
Anticholinergics	85 (8.8%)	4 (4.7%)
Alpha-blockers for prostatic hyperplasia	51 (5.3%)	5 (9.8%)
Vasodilators used in cardiac disease	45 (4.7%)	10 (22.2%)
Overactive bladder and urge incontinence medications	42 (4.3%)	25 (59.5%)
Antihistamines	28 (2.9%)	12 (42.9%)
Alpha-blockers used as antihypertensives	9 (0.9%)	0 (0%)
Centrally acting antihypertensives	7 (0.7%)	3 (42.9%)

massage to support deprescribing of opioids ($n=4$), psychotherapy to support deprescribing of antidepressants ($n=3$), sleep hygiene to support deprescribing of benzodiazepines/benzodiazepine-related drugs ($n=2$), and use of soap-alternatives to support deprescribing of an antihistamine ($n=1$).

Only three (0.6%) reports included a statement regarding the resident's (or their representative's) viewpoint on deprescribing the FRID. Two residents were hesitant for deprescribing to occur. One was taking a benzodiazepine long-term for sleep, and the other had been on an antihistamine long-term for chronic itch with limited response. Both residents were content with their current health status, had not experienced any recent falls, and perceived the medication not to be causing any harm; hence, they preferred not to disrupt their current regimen. In contrast, the third resident was very keen for deprescribing to occur. This resident was prescribed a diuretic (indication unclear) and experienced frequent episodes of incontinence.

Of the 126 recommendations classified as other, FRID commencement ($n=44$) where the pharmacist recommended the initiation of a FRID was the most frequent recommendation, followed by dose increase ($n=35$), adjustment to administration regimen ($n=18$), change of drug formulation ($n=14$), a need to chart indication for the FRID ($n=12$) and commencement of a medication to treat FRID related adverse effects ($n=3$). Commencement or dose increase of an antidepressant was advised in 54 of these recommendations, in the form of a selective serotonin reuptake inhibitor (SSRI), serotonin and noradrenaline reuptake inhibitor (SNRI) or mirtazapine. Eight (0.6%) reports included a statement on the resident's (or their representative's) viewpoint on these recommendations. All were in favour of the recommendation being implemented.

Comparison to STOPPFall deprescribing guidance

The clinical situations presented in the 520 recommendations to deprescribe FRIDs were compared with the STOPPFall deprescribing guidance. Clinical situations were consistent with STOPPFall deprescribing guidance in 390 (75.0%) DRPs and related recommendations (see Table 3). No comparison with the STOPPFall deprescribing guidance could be made for the remaining DRPs and related recommendations ($n=130$, 25.0%), as deprescribing was advised without a clear link to the resident's clinical situation being detailed in the report. Rather pharmacists presented generic statements on the potential adverse effects of these medications.

Discussion

To the authors' knowledge, this is the first study to analyse the content of RMMR reports involving FRIDs. It was found that FRID use is highly prevalent among aged care residents, and recommendations to deprescribe them are frequent. Content analysis of elements of RMMR reports concerning FRIDs identified opportunities to improve the impact of medication reviews on the appropriate use of FRIDs by aged care residents.

FRID use was high among aged care residents, with 83.2% of residents taking at least one FRID and 31.2% taking three or more FRIDs. The use of multiple FRIDs has been shown to increase the occurrence of falls, resulting in significant health outcomes [31, 32]. For instance, an Australian study reported that the adjusted odds ratio for a fall-related hospital admission increased by 16% (95% Confidence Interval (CI) 3–30%) for each additional FRID used [31]. Similarly, a Scottish population-based study involving 246,535 people aged 65 years or older found that the use of three or more FRIDs was strongly correlated with an individual experiencing a fall resulting in a fracture (3 FRIDs Adjusted Odds Ratio (OR) 1.87 (95% CI 1.74–2.02), 4 FRIDs OR 2.29 (95% CI 2.29 (2.08–2.52), ≥ 5 FRIDs OR 2.74 (95% CI 2.42–3.11)) [32]. Accordingly, the high use of FRIDs amongst aged care residents found in this study reinforces the clinical need for medication reviews.

It is important to note that FRID use does not automatically equate with inappropriate use. This was evidenced by pharmacists recommending the commencement or dose increase of FRIDs based on clinical need in some instances. Predominantly, pharmacists made these recommendations for antidepressants. Depression is highly prevalent among aged care residents, and left untreated, it results in poor quality of life, increased morbidity, disability, and mortality [33]. Although pharmacological-resistant depression is common in the elderly, the use of antidepressants can be helpful for some residents when combined with non-pharmacological treatment [33–35]. The use of second-generation antidepressants is advised for the elderly due to their more favourable adverse effect profiles [33]. Accordingly, all pharmacist recommendations to commence antidepressants in this study suggested the use of an SSRI, SNRI, or mirtazapine.

While it is recognised the use of FRIDs may be clinically appropriate in some instances, there is a considerable body of evidence that overuse of FRIDs occurs [14, 36, 37]. One proposed barrier to deprescribing FRIDs is concerns from members of the healthcare team and residents (or their representatives) that deprescribing could threaten the resident's current stable condition [36, 38, 39]. This was evidenced in two of the three resident viewpoints on deprescribing reported in this study.

Table 3 Comparison to the Screening Tool of Older Persons Prescriptions in older adults with high fall risk (STOPPFall) deprescribing guidance

Medication class	Deprescribing advised by STOPPFall	Recommendations according with STOPPFall guidance
Benzodiazepines and benzodiazepine related drugs	No apparent indication	2
	Medication with a lower fall risk is available	22
	Resident experiencing daytime sedation, cognitive impairment, or psychomotor impairment	3
	Prescribed for sleep or anxiety disorder	50
Antipsychotics	No apparent indication	7
	Medication with a lower fall risk is available	8
	Resident experiencing extrapyramidal or cardiac side effects, sedations, signs of sedation, dizziness, or blurred vision	1
	Prescribed for Behaviours and Psychological Symptoms of Dementia (BPSD) or sleep disorder	65
Opioids	No apparent indication for prescribing	0
	Medication with a lower fall risk is available	27
	Resident experiencing slow reactions, impaired balance, or sedative symptoms	5
	Prescribed for chronic non-cancer pain	24
Antidepressants	No apparent indication	0
	Medication with a lower fall risk is available	22
	Resident experiencing hyponatremia, orthostatic hypotension, dizziness, sedative symptoms or tachycardia/arrhythmia	9
	Prescribed for depression (dependent on symptom-free time and history of symptoms), sleep disorder, neuropathic pain, or anxiety disorder	33
Anticholinergics	No apparent indication	1
	Medication with a lower fall risk is available	3
Antiepileptics	No apparent indication	5
	Medication with a lower fall risk is available	5
	Resident experiencing ataxia, somnolence, impaired balance, or dizziness	2
	Prescribed for anxiety disorder or neuropathic pain	16
Diuretics	No apparent indication	18
	Medication with a lower fall risk is available	5
	Resident experiencing orthostatic, hypotension, electrolyte disturbance or urinary incontinence	29
	Prescribed for hypertension	0
Alpha-blockers for BPH	No apparent indication	1
	Medication with a lower fall risk is available	1
	Resident experiencing hypotension, orthostatic hypotension, or dizziness	3
Centrally acting antihypertensives	No apparent indication for prescribing	0
	Medication with a lower fall risk is available	0
	Resident experiencing hypotension, orthostatic hypotension or sedative symptoms	1
Antihistamines	No apparent indication	0
	Medication with a lower fall risk is available	1
	Resident experiencing confusion, drowsiness, dizziness, or blurred vision	1
	Prescribed for sedation, chronic itch, or allergic symptoms	9

Table 3 (continued)

Medication class	Deprescribing advised by STOPPFall	Recommendations according with STOPPFall guidance
Vasodilators used in cardiac disease	No apparent indication	3
	Medication with a lower fall risk is available	0
	Resident experiencing hypotension, orthostatic hypotension, or dizziness	4
Overactive bladder and incontinence medications	No apparent indication	2
	Medication with a lower fall risk is available	1
	Resident experiencing dizziness, confusion, blurred vision, drowsiness, or increased QT-interval	1

Additionally, medications may be continued for longer than clinically indicated due to a lack of review, and non-pharmacological treatments can be challenging to implement in this population [36, 38, 39]. These factors likely account for pharmacists in this study frequently identifying deprescribing opportunities for the use of FRIDs for indications for which ongoing use provides limited clinical benefit. Common examples are the use of antipsychotics for Behaviours and Psychological Symptoms of Dementia (BPSD), benzodiazepines for sleep, and opioids for chronic non-cancer pain. Further evidence of the challenges of using non-pharmacological strategies is the 43 recommendations to deprescribe advising commencement of non-pharmacologic strategies, suggesting these were not already utilised. For the deprescribing of FRIDs to be successful, it is essential that inappropriate use is recognised and that the care team has the necessary knowledge and support to implement deprescribing and non-pharmacological management [36, 38, 39].

A key finding of this study was that 25% of DRPs and associated recommendations to deprescribe FRIDs did not provide a direct link to the resident's clinical situation. Furthermore, only three (0.6%) recommendations included the resident's (or their representative's) viewpoint on deprescribing. These findings highlight two crucial aspects of clinical practice to address if the benefits of medication reviews for deprescribing FRIDs are to be realised: that deprescribing recommendations are resident-centered and effectively communicated [36–39].

Despite the mounting evidence supporting deprescribing FRIDs, reluctance to implement deprescribing recommendations has been found among physicians, care staff, and residents (or their representatives) [36, 38, 39]. In addition to the drivers for the overuse of FRIDs, this reluctance is contributed to by an inherent underestimation of the potential for FRIDs to contribute to falls [38]. It is, therefore, unsurprising that generic initiatives to deprescribe FRIDs are less effective than resident-centered approaches [36, 39]. Medication reviews present an opportunity to provide a resident-centered approach to deprescribing FRIDs, by providing recommendations that result from a benefit versus risk assessment based on the individual resident's clinical situation [17, 24, 36]. This assessment should consider the resident's comorbidities, concurrent medications, life expectancy, care goals, and personal priorities [17, 37]. Effectively communicating this assessment and, therefore, the clinical grounds to deprescribe FRIDs would likely increase the uptake of these recommendations [39].

Strengths and limitations

The study's strengths include the large number of RMMRs analysed, the fact that the RMMR service providers participating serviced 54.8% of Australian aged care facilities and that residents were located in metropolitan, regional, and rural areas.

Despite the strengths of this study, some limitations must be acknowledged. Firstly, the study cohort is limited to residents who received an RMMR. Although RMMRs are recommended for all residents, only 49.7% of residents are reported to receive one [40]. Therefore, it is possible that FRID use observed in this study may differ from that of the general population of aged care residents, noting that the use of FRIDs itself may have contributed to these residents being referred for an RMMR. Secondly, only FRIDs prescribed for regular use were included in the assessment of FRID use, as it was not possible from medication review reports to determine if when required (prn) medications were being administered. Consequently, the prevalence of FRID use reported may underestimate the actual use of FRIDs in this population. Additionally, the study design relied on medication review reports as the sole source of information regarding residents and recommendations concerning them. Hence, the accuracy of the analysis depends upon pharmacists correctly reporting medication use

and indications. Further, one researcher performed data extraction and analysis. A second researcher cross-checking data extraction and analysis would increase confidence in the results. Finally, the study design did not evaluate the implementation of pharmacist recommendations. Knowledge of the implementation of recommendations would provide greater insight into the factors that influence recommendation uptake.

Conclusion

This study has confirmed the high prevalence of FRID use amongst aged care residents, with 83.2% of residents prescribed at least one FRID and 31.2% of residents prescribed three or more FRIDs. Pharmacists undertaking medication reviews placed a high emphasis on identifying inappropriate use of FRIDs and recommending that these be deprescribed. For those deprescribing recommendations where a comparison of the clinical situation could be made to the guidance provided in STOPPFall, consistency with this guidance was found. However, the clinical situation for deprescribing was not communicated in 25% of recommendations. Further, the resident's (or their representative's) viewpoint on deprescribing was only included in 0.6% of recommendations. Given that physicians can be hesitant to deprescribe FRIDs, presenting a strong case for deprescribing would likely lead to a greater uptake of these recommendations. Accordingly, conveying the clinical situation for deprescribing, instead of generic statements, is advised when preparing medication review reports. Furthermore, informing the physician of the resident's (or their representative's) viewpoint on deprescribing may empower physicians to engage in further discussions. Future research is necessary to establish if equipping pharmacists with effective communication techniques to convey resident-centered deprescribing recommendations, incorporating the resident's clinical situation and viewpoint on deprescribing, increases implementation.

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Authors' contributions
CL was responsible for study design, undertaking data extraction and analysis, and writing the manuscript. HB and KW assisted in the study design and writing the manuscript. All authors read and approved the final manuscript.

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Data availability
The datasets analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
This study was conducted in accordance with the Declaration of Helsinki and was approved by the Human Research Ethics Committee (HREC) at the University of Technology Sydney (ETH22-7751). All RMMR service providers provided written informed consent.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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References

1. World Health Organisation: Falls fact sheet. 2021. https://www.who.int/news-room/fact-sheets/detail/falls. Accessed 18 Feb 2024.
2. Montero-Odasso M, van der Velde N, Martin FC, Petrovic M, Tan MP, Ryg J, et al. World guidelines for falls prevention and management for older adults: a global initiative. Age Ageing. 2022;51:1–12.
3. James SL, Lucchesi LR, Bisignano C, Castle CD, Dingels ZV, Fox JT, et al. The global burden of falls: global, regional and national estimates of morbidity and mortality from the Global Burden of Disease Study 2017. Inj Prev. 2020;26:i3–11.
4. Wabe N, Siette J, Seaman KL, Nguyen AD, Raban MZ, Close JCT, et al. The use and predictive performance of the Peninsula Health Falls Risk Assessment Tool (PH-FRAT) in 25 residential aged care facilities: a retrospective cohort study using routinely collected data. BMC Geriatr. 2022;22:271.
5. Wang KN, Bell JS, Gilmartin-Thomas JFM, Tan ECK, Cooper T, Robson L, et al. Use of falls risk increasing drugs in residents at high and low falls risk in aged care services. J Appl Gerontol. 2021;40(1):77–86.
6. Kalisch Ellett LM, Kassie GM, Caughey GE, Pratt NL, Ramsay EN, Roughead EE. Medication-related hospital admissions in aged care residents. Australas J Ageing. 2024;40(4):e323–31.
7. Australian Institute of Health and Welfare. Hip fractures incidence and hospitalisation in Australia 2015–16. 2018. https://www.aihw.gov.au/reports/injury/hip-fracture-incidence-in-australia-2015-16/summary. Accessed 18 Feb 2024.
8. Michalcova J, Vasut K, Airaksinen M, Bielakova K. Inclusion of medication-related fall risk in fall risk assessment tool in geriatric care units. BMC Geriatr. 2020;20:454.
9. Milos V, Bondesson Å, Magnusson M, Jakobsson U, Westerlund T, Midlöv P. Fall risk-increasing drugs and falls: a cross-sectional study among elderly patients in primary care. BMC Geriatr. 2014;14: 40.
10. Sterke CS, Verhagen AP, van Beeck EF, van der Cammen TJ. The influence of drug use on fall incidents among nursing home residents: a systematic review. Int Psychogeriatr. 2008;20(5):890–910.
11. World Health Organisation. WHO Global Report on Falls Prevention in Older Age. 2007. https://extranet.who.int/agefriendlyworld/wp-content/uploads/2014/06/WHo-Global-report-on-falls-prevention-in-older-age.pdf Accessed 18 Feb 2024.
12. Seppala LJ, van der Velde N, Masud T, Blain H, Petrovic M, van der Cammen TJ, et al. EuGMS task and finish group on fall-risk-increasing drugs (FRIDs): position on knowledge dissemination, management, and future research. Drugs Aging. 2019;36(4):299–307.
13. Ming Y, Zecevic AA, Hunter SW, Miao W, Tirona RG. Medication review in preventing older adults' fall-related injury: a systematic review & meta-analysis. Can Geriatr J. 2021;24(3):237–50.
14. Andersen CU, Lassen PO, Usman HQ, Albertsen N, Nielsen LP, Andersen S. Prevalence of medication-related falls in 200 consecutive elderly patients with hip fractures: a cross-sectional study. BMC Geriatr. 2020;20(1):121.
15. Duque G, Iuliano S, Close JCT, Fatima M, Ganda K, Bird S, et al. Prevention of osteoporotic fractures in residential aged care: updated consensus recommendations. J Am Med Dir Assoc. 2022;23(5):756–63.

16. Seppala LJ, Kamkar N, van Poelgeest EP, Thomsen K, Daams JG, Ryg J, et al. Medication reviews and deprescribing as a single intervention in falls prevention: a systematic review and meta-analysis. Age Ageing. 2022;51:1–12.
17. Pharmaceutical Society of Australia. Guidelines for comprehensive medication management reviews. 2020. https://my.psa.org.au/s/article/guidelines-for-comprehensive-mmr. Accessed 12 Aug 2023.
18. Pharmacy Programs Administrator. Program rules: residential medication management review. 2023. https://www.ppaonline.com.au/wp-content/uploads/2020/04/RMMR-Program-Rules-COVID-19.pdf. Accessed 11 Aug 2023.
19. Haider I, Naunton M, Davey R, Peterson GM, Baqir W, Kosari S. How do pharmacists practice in aged care? A narrative review of models from Australia, England, and the United States of America. Int J Environ Res Public Health. 2021;2021(18):12773.
20. Houle SK, Grindrod KA, Chatterley T, Tsuyuki RT. Paying pharmacists for patient care: A systematic review of remunerated pharmacy clinical care services. Can Pharm J (Ott). 2014;147(4):209–32.
21. Seppala LJ, Petrovic M, Ryg J, Bahat G, Topinkova E, Szczerbińska K, et al. STOPPFall (Screening Tool of Older Persons Prescriptions in older adults with high fall risk): a Delphi study by the EuGMS Task and Finish Group on Fall-Risk-Increasing Drugs. Age Ageing. 2020;50(4):1189–99.
22. Damoiseaux-Volman BA, Raven K, Sent D, Medlock S, Romijn JA, Abu-Hanna A, et al. Potentially inappropriate medications and their effect on falls during hospital admission. Age Ageing. 2022;51:1–8.
23. Sluggett JK, Caughey GE, Air T, Moldovan M, Lang C, Martin G, et al. Medicines use before and after comprehensive medicines review among residents of long-term care facilities: a retrospective cohort study. BMC Geriatr. 2022;(1):493.
24. Chen EYH, Wang KN, Sluggett JK, Ilomäki J, Hilmer SN, Corlis M, et al. Process, impact and outcomes of medication review in Australian residential aged care facilities: A systematic review. Australas J Ageing. 2019;38(Suppl 2):9–25.
25. Daniel WW. Biostatistics: A Foundation for Analysis in the Health Sciences. 7th ed. New York: John Wiley & Sons; 1999.
26. WHO Collaborating Centre for Drug Statistics Methodology. Anatomical Therapeutics Chemical Classification System. 2023. https://www.whocc.no/atc_ddd_index/ Accessed 1 Mar 2023.
27. Lumivero. NVivo 12 Pro [software] 2017. https://www.lumivero.com/products/nvivo/.
28. Schreier M. Qualitative content analysis. In Uwe F, editor. The SAGE handbook of qualitative data analysis. London: SAGE Publications; 2013. p.170-183.
29. IBM Corp. IBM SPSS Statistics for Windows. Version 29.0 [software]. 2022. https://www.ibm.com/products/spss-statistics.
30. Australian Institute of Health and Welfare. GEN Aged Care Data: Aged care data snapshot-2022. 2022. https://www.gen-agedcaredata.gov.au/resources/access-data/2022/october/aged-care-data-snapshot%E2%80%942022. Accessed 10 Dec 2024.
31. Ryan-Atwood TE, Hutchinson-Kern M, Ilomäki J, Dooley MJ, Poole SG, Kirkpatrick CM, et al. Medication use and fall-related hospital admissions from long-term care facilities: a hospital-based case-control study. Drugs Aging. 2017;34(8):625–33.
32. Hauff J, Rottenkolber M, Oehler P, Fischer S, Gensichen J, Drey M, et al. Single and combined use of fall-risk-increasing drugs and fracture risk: a population-based case–control study. Age Ageing. 2023;52:1–9.
33. Devita M, De Salvo R, Ravelli A, De Rui M, Coin A, Sergi G, et al. Recognizing depression in the elderly: practical guidance and challenges for clinical management. Neuropsychiatr Dis Treat. 2022;18:2867–80.
34. Stefens DC. Treatment-resistant depression in older adults. N Engl J Med. 2024;390(7):630–9.
35. Wang SC, Yokoyama JS, Tzeng NS, Tsai CF, Liu MN. Treatment resistant depression in elderly. Prog Brain Res. 2023;281:25–53.
36. Sawan M, Reeve E, Turner J, Todd A, Steinman MA, Petrovic M, et al. A systems approach to identifying the challenges of implementing deprescribing in older adults across different health-care settings and countries: a narrative review. Expert Rev Clin Pharmacol. 2020;13(3):233–45.
37. Sloane PD, Brandt NJ, Cherubini A, Dharmarajan TS, Dosa D, Hanlon JT, et al. Medications in Post-Acute and Long-Term Care: Challenges and Controversies. J Am Med Dir Assoc. 2021;22(1):1–5.
38. Clemens S, Iglseder B, Alzner R, Kogler M, Rose O, Kutschar P, et al. Effects of medication management in geriatric patients who have fallen: results of the EMMA mixed-methods study. Age Ageing. 2024;53:afae070.
39. Okeowo DA, Zaidi STR, Fylan B, Alldred DP. Barriers and facilitators of implementing proactive deprescribing within primary care: a systematic review. Int J Pharm Pract. 2023;31(2):126–52.
40. Sluggett JK, Bell JS, Lang C, Corlis M, Whitehead C, Wesselingh SL, et al. Residential medication management reviews in Australian residential aged care facilities. Med J Aust. 2021;214(9):432–3.

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