Drugs - Real World Outcomes (2023) 10:97–106
https://doi.org/10.1007/s40801-022-00342-2

ORIGINAL RESEARCH ARTICLE

Identification of Potentially Inappropriate Medications in Frail Older Adults Residing in Long-Term Care: A Retrospective Chart Review Study

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Accepted: 30 October 2022 / Published online: 27 November 2022

Abstract

Introduction Deprescribing is associated with positive health outcomes for older adults in long-term care (LTC), however deprescribing is not universally implemented.

Objective The primary aim of this study was to estimate the prevalence of potentially inappropriate medications (PIMs) prescribed to frail older adults in Irish long-term care facilities (LTCFs), as identified by the Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy, version 2 (STOPPFrail v2).

Methods A retrospective chart review was conducted in two publicly funded LTCFs in Ireland. Eligible participants were those (1) ≥ 65 years of age; (2) resident in a LTCF; (3) eligible as per the STOPPFrail v2 criteria by the site's Medical Officer; and (4) receiving regular medication. Data collected included age, sex, drug, dose, frequency, regular/*pro re nata* prescribing and indication/relevant diagnoses. Rates of polypharmacy (taking five or more medications) and excessive polypharmacy (taking 10 or more medications) were calculated. STOPPFrail v2 was used to identify PIMs; however, clinical measurements were not taken. Descriptive and association statistics were calculated.

Results Of the 103 residents, 89 were ≥ 65 years of age and categorised as frail and were therefore eligible for inclusion in the study. Of those eligible, 85 (95.5%) had polypharmacy and 57 (64%) experienced excessive polypharmacy. The mean number of regular medications was 10.8 (± 3.8), total medications 17.7 (± 5) and diagnoses 5.5 (± 2.5). The mean number of PIMs per resident was 4.8 (± 2.6). Of the eligible participants, 59.6% had at least one medicine without a documented indication, while 61.8%, 42.7% and 30.3% had at least one PIM from the vitamin D, antihypertensives and proton pump inhibitors drug classes, respectively.

Conclusion Medication and PIM use was high among LTC residents, with inappropriate polypharmacy of concern. Lack of clear indication for prescribing medications appears to be an issue in LTC, potentially affecting healthcare professionals' engagement with deprescribing. The prevalence of PIMs may be overestimated in the antihypertensives/antidiabetic classes due to the lack of clinical measurements.

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Key Points

The prevalence of polypharmacy and excessive polypharmacy remains high among frail older adults resident in Irish long-term care facilities (LTCFs).

The average number of potentially inappropriate medications regularly prescribed for frail older adults resident in Irish LTCFs was 4.8, as identified using the Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy (STOPPFrail).

Lack of clear indication for prescribed medications is a considerable issue in long-term care, with antihypertensives the largest drug class potentially inappropriately prescribed.

1 Introduction

Globally, the population is ageing; the number of adults aged 60 years or more is predicted to reach 2.1 billion by 2050, increasing exponentially from 1 billion in 2019 [1]. This is reflected in the Irish population, with the number of older adults, aged 65 years or more, expected to double in the same timeframe [2–4]. The ageing population leads to the increased demand for older adults requiring long-term care facilities (LTCFs) [5–7]. In Ireland, the number of older adult residents' in LTCFs rose by 9.4% in 2016, with demand projected to increase by 40–54% from 2015 to 2030 [2, 6]. Both advancing age and long-term care (LTC) requirement is associated with frailty, with 52% of LTC residents classified as frail and 40% classified as pre-frail [8, 9]. Various definitions of frailty exist; however, it is generally defined as a state where an individual's vulnerability for developing increased dependency and adverse outcomes is increased when exposed to physiological or psychological stressors [10, 11].

Ageing is considered the greatest risk factor for the development of most chronic diseases. Ageing, and by extension, chronic disease, also increase morbidity, health complications and mortality [12–14]. Increasing age and multimorbidity contribute to the medication burden often seen in older adults, with 32% of European older adults experiencing polypharmacy, i.e. the use of five or more medications [15, 16]. Polypharmacy or excessive polypharmacy, i.e. the use of 10 or more medications, can be necessary to treat the multiple conditions seen in this cohort; however, the association between polypharmacy and frailty must be considered [17–20]. With the physiological alterations of ageing, some medications may become potentially inappropriate medications (PIMs) as time progresses. This contributes to inappropriate polypharmacy, which could be considered a stressor for a frail older adult as it has negative consequences such as adverse drug reactions, health decline, increased risk of hospitalisation and mortality in older adults [15, 21, 22]. For frail older adults with limited life expectancy, quality of life and symptom control should be prioritised over disease prevention [23].

In Ireland, different types of LTC are available. Services are supplied by publicly employed Health Services Executive staff in publicly funded sites; private-sector agencies who supply approximately 75% of LTC beds; or voluntary facilities, run by charities and religious orders [24, 25]. In 2012, O'Sullivan and colleagues investigated the prevalence of potentially inappropriate prescribing (PIP) in publicly funded Irish LTCFs utilising two tools; the Screening Tool of Older Persons' potentially inappropriate Prescriptions (STOPP) and the Beers' criteria [26–28]. Results identified that 70.8% of LTC residents had PIP, with 13.7% of medications potentially inappropriate. Since this publication, evidence for deprescribing has exponentially increased, supported by resources such as guidelines and algorithms published by the Bruyère Research Institute to support healthcare professionals (HCPs) [29]. In 2017, the Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy (STOPPFrail) was published, a list of explicit criteria for identifying PIMs in frail older adults, pertinent to the LTC population [30]. This was further updated in 2020, producing STOPPFrail, version 2, which included a method to identify older adults approaching the end of life [31]. A randomised control trial conducted in a hospital setting used a STOPPFrail-guided deprescribing plan and identified a mean change of 2.25 medications in the intervention group at 3 months [32]. Considering the health benefits of deprescribing for LTC residents, including reduced PIMs, falls and all-cause mortality, STOPPFrail offers the additional advantage of being concise and having high interrater reliability between different HCPs [32–35]. This suggests that STOPPFrail could be an effective tool to support decision making and interprofessional collaboration, which have been identified as facilitators for deprescribing in LTC [36].

Within public LTC settings in Ireland, medication is prescribed by the sites Medical Officer, supplied to the site by a Pharmacist, and administered by nurses during drug rounds. Medication reviews should be conducted at regular specified intervals by an interdisciplinary team consisting of the Medical Officer and nurse, and Pharmacist services should also be made available. These reviews are suggested to be conducted every 3 months [37, 38].

The aim of this study was to establish the prevalence of PIMs prescribed to frail older adults resident in Irish LTCFs,

as identified by STOPPFrail v2. Secondary outcomes include investigating the prevalence of (1) polypharmacy, and (2) common diagnoses in this cohort, all based on a retrospective chart review of medications.

2 Methods

2.1 Study Design, Setting and Participants

This was a retrospective chart review study conducted in two publicly funded LTCFs. A convenience sample of LTCFs was identified and selected based on location in the Southwest region of Ireland and existing professional relationships between the sites' Medical Officers and the research team. Eligibility criteria for inclusion in the study are (1) age ≥ 65 years; (2) resident in one of two LTCF study sites (referred to as Site 1 and Site 2); (3) deemed eligible as per the STOPPFrail v2 criteria by the site's Medical Officer; and (4) receiving regular prescribed medication. STOPPFrail v2 eligible candidates typically meet all the following criteria as defined in the guidance: (1) activities of daily living dependency and/or severe chronic disease and/or terminal illness; (2) severe irreversible frailty (high risk of acute medical complications and clinical deterioration); and (3) physician perceives patient to have a limited life expectancy of < 12 months [31]. Medical Officers at each site determined severe irreversible frailty based on their clinical assessment of the resident prior to confirming study eligibility, with reference to Rockwood's Clinical Frailty Scale [39].

2.2 Data Collection

A retrospective chart review was conducted at each LTCF site by the primary researcher, who was also a Pharmacist. LTCF recruitment began in June 2021 and data collection was conducted between November 2021 and January 2022. No follow-up assessment was included. Prescribing data were extracted from patients' drug charts and entered into a Microsoft Excel© spreadsheet (Microsoft Corporation, Redmond, WA, USA). Diagnoses were obtained from the clinical history in admission notes, medical notes, and psychiatrist assessments without referring to prescribers. The data were collected using a standardised data collection form and included age, sex, drug, dose, frequency, regular/*pro re nata* (PRN) prescribing and indication/relevant diagnoses. For combination pills, the individual drugs and dosages were documented. Short-term medications, consisting of those with an imminent end date, were excluded from the evaluation; for example, a course of antibiotics. Information on nutritional supplements was not collected as this information was not documented in drug charts in Sites 1 and 2.

As this was an observational study as per ethical approval, not all relevant information was available and thus some medicines that may not actually be inappropriate were classified as PIMs. For medications that lacked a documented indication on the admission file, all clinical and nursing notes were reviewed from inception, to help identify an indication. Clinical parameters, including blood pressure, blood lipids or blood glucose (haemoglobin A1C) measurements were not taken in a standardised manner for patients included in the study by the research team, and therefore measurements taken at various points in time prior to the audit could not be included. Proton pump inhibitors (PPIs) and H2 receptor antagonists were only considered PIMs if used at the full therapeutic dose for > 8 weeks. If the drug chart was <8 weeks in duration, an older version was reviewed.

2.3 Data Analysis: Application of Screening Tool of Older Persons Prescriptions in Frail adults with Limited Life Expectancy, Version 2 (STOPPFrail v2) and Classification of Potentially Inappropriate Medications (PIMs)

Data analysis was conducted by the primary researcher using Microsoft Excel© (Microsoft Corporation) and SPSS© version 28.0 (IBM Corporation, Armonk, NY, USA). Data were analysed using the STOPPFrail v2 criteria (Table 1; adapted from Curtin et al. [31]) to identify and classify PIMs. From each site, a 20% proportion of anonymous drug charts were independently analysed by another member of the research team, with any discrepancies discussed and agreed with the entire research team. For drugs that coded to more than one STOPPFrail indicator, the primary code was given to the most clinically relevant criterion; for example, if a drug coded to E1 and A2, E1 was the primary code. Analysis of prevalent PIMs was based on frequency, using the primary STOPPFrail indicator. The overall prevalence of PIMs was calculated as a proportion of all eligible patients. Any medication without a clear primary indication was further analysed to identify which drug classes lacked a documented indication.

Descriptive statistics were used to summarise the population, i.e. mean and standard deviation (SD) for parametric data and median and interquartile range (IQR) for non-parametric data. Association between two groups for scaled data was measured using the *t*-test for parametric data or Mann–Whitney U tests for non-parametric data. Correlation was measured using Spearman's rho. A point prevalence was conducted to establish the prevalence of PIMs, using Poisson regression to examine the association between the number of PIMs identified in each patient's regular medication list as per STOPPFrail and the total number of regular medicines. A probability value of < 0.05 was considered significant.

Table 1 STOPPFrail criteria, adapted from Curtin et al. [31]

Code	STOPPFrail criteria
A1	Fails to take medication
A2	No clear indication for medication
A3	Any drug for which symptoms now resolved
B1	Lipid-lowering therapies
B2	Antihypertensives
B3	Anti-anginal therapy
C1	Antiplatelets for primary cardiovascular prevention
C2	Aspirin for stroke prevention in atrial fibrillation
D1	Neuroleptic antipsychotics in dementia patients
D2	Memantine in moderate–severe dementia
E1	Proton pump inhibitors at full therapeutic dose > 8 weeks
E2	H2 receptor antagonists at full therapeutic dose > 8 weeks
F1	Theophylline and aminophylline
F2	Leukotriene antagonists in COPD
G1	Calcium supplements
G2	Vitamin D: ergocalciferol and colecalciferol
G3	Osteoporosis medications
G4	Non-steroidal anti-inflammatory medications: regularly for ≥ 2 months
G5	Oral corticosteroids: regularly for ≥ 2 months
H1	Benign prostatic hyperplasia medications in catheterised male patients
H2	Overactive bladder medications
I1	Antidiabetic medications
J1	Multivitamin combination supplements
J2	Folic acid
J3	Nutritional supplements

STOPPFrail Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy, *COPD* chronic obstructive pulmonary disease

3 Results

Of the 103 residents, 89 met the STOPPFrail eligibility criteria as identified by the site's Medical Officer. Reasons for exclusion included < 65 years of age ($n = 8$) and not classified as frail ($n = 6$). Of the total LTC population, 86.4% were eligible for inclusion in this study. The demographics of eligible residents are summarised in Table 2.

3.1 Prevalence of PIMs

Of all medications prescribed, 27.3% were classified as potentially inappropriate. Almost all patients had at least one PIM and nearly half were taking at least five PIMs. Excluding patients whose only PIM criteria was 'no clear indication', 93.3% ($n = 83$) of the population had at least one PIM. The prevalence of PIMs used by frail LTC residents is summarised below (Fig. 1) and in the electronic supplementary material (Online Appendices 2 and 3). A strong significant relationship existed between the number of PIMs and the number of regular medicines prescribed ($\rho = 0.525$, $p < 0.01$). Poisson regression analysis identified that for every one unit increase in the number of regular medicines, the number of PIMs increases by 8.1% (incidence rate ratio 1.081, 95% confidence interval 1.055–1.107; $p < 0.01$).

In both LTCFs, the most common PIM identified was no clear indication (A2), with some patients prescribed multiple medications without an indication (mean 2.2, SD ±1.3). At least one medication with no clear indication was identified for 60% of residents. Of all regular medicines prescribed, 12% did not have an indication, while only 0.3% of *PRN* medications lacked indications. Of all PIMs identified, 26.6% received a primary classification of 'no clear indication'. Analysis into this cohort of medication identified that the most common drug class lacking indication was PPIs ($n = 21$), followed by lubricant eye drops ($n = 11$) and vitamins and probiotics ($n = 10$).

Antihypertensives were the second most common PIM. Antihypertensives were the largest drug class potentially inappropriately prescribed to 42.5% of the cohort and accounted for 13.9% of all PIMs, with some patients taking

Table 2 Resident demographics

Demographics	Site 1 [*n* = 56]	Site 2 [*n* = 33]	Total [*n* = 89]
Age, years [median (IQR)]	84 (76–91)	83 (79–89)	84 (77–90)
Male [*n* (%)]	24 (42.9)	11 (33.3)	35 (39.3)
Female [*n* (%)]	32 (57.1)	22 (66.7)	54 (60.7)
Mean number of regular medications (SD)	10.5 (±3.8)	11.2 (±3.7)	10.8 (±3.8)
Mean number of total medications (SD)[a]	17.8 (±5.3)	17.8 (±4.7)	17.7 (±5)
Mean number of regular medicines that are PIMs	5.1 (±2.8)	4.3 (±2.4)	4.8 (±2.7)
Mean number of total medicines that are PIMs [*n* (%)][a]	5.2 (±2.9)	4.4 (±2.4)	4.8 (±2.6)
Residents taking at least one PIM[a]			86 (96.6)
Residents taking at least three PIMs[a]			75 (84.3)
Residents taking at least five PIMs[a]			41 (46.1)
Residents taking at least seven PIMs[a]			20 (22.5)
Percentage of residents with polypharmacy (*n*)[b]	94.6 (53)	97 (32)	95.5 (85)
Percentage of residents with polypharmacy after deprescribing all PIMs (*n*)[b]	58.9 (33)	78.8 (26)	66.3 (59)
Percentage of residents with excessive polypharmacy (≥ 10 medicines)[b]	62.5 (35)	66.6 (22)	64 (57)
Percentage of residents with excessive polypharmacy after deprescribing all PIMs (*n*) [b]	7.1 (4)	18.2 (6)	11.2 (10)
Mean number of diagnoses (SD)	5 (±2.2)	6.2(±2.7)	5.5 (±2.5)
Common diagnoses [*n* (% of residents)]			
Constipation			54 (60.7)
Pain			49 (55.1)
Hypertension			31 (34.8)
Dementia			29 (32.6)
Depression			25 (28.1)
Atrial fibrillation			19 (21.3)
Osteoarthritis			17 (19.1)
Anxiety			16 (18)
Type 2 diabetes mellitus			15 (16.9)
Gastroesophageal reflux disease			14 (15.7)

SD standard deviation, *IQR* interquartile range, *PIMs* potentially inappropriate medications, *PRN pro re nata*

[a]Total medicines = regular + *PRN*, excluding short-term medicines

[b]Calculation based on regular medications

Total medications = regular and *PRN* medications

multiple antihypertensives (mean 1.6, SD ±0.9). The antihypertensives prescribed in this setting included angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, dihydropyridine calcium channel blockers, loop diuretics and adrenoceptor antagonists (β-blockers).

Vitamin D supplementation with ergocalciferol/colecalciferol (G2) was the third most common STOPPFrail criterion overall and the most common individual drug prescribed, identified in the largest number of patients (61.8%).

Both sites had similar rates of each STOPPFrail PIM, apart from three criteria: antipsychotics (D1), memantine (D2) and PPIs (E1). For these STOPPFrail PIM criteria, a trend emerged where Site 2, the smaller LTCF, provided a larger contribution to the total figures (Fig. 1).

Considering the mean number of medications and PIMs identified in both sites, full implementation of STOPPFrail could result in a 44% reduction in regular medications and a 27% reduction in total medications consumed by this cohort.

3.2 Prevalence of Polypharmacy

Polypharmacy was prevalent in Irish LTCFs, with almost all residents exposed (95.5%). The mean number of regular medications in both sites was 10.8 (SD ±3.8), indicating excessive polypharmacy, which was identified in 64% of residents. A weak significant negative relationship existed between number of PIMs and age ($\rho = 0.218$, $p < 0.05$), with the number of PIMs decreasing past approximately 90 years (Online Appendix 1). Full implementation of deprescribing STOPPFrail-identified PIMs has the potential to reduce polypharmacy by under 30% and excessive polypharmacy by over 52%.

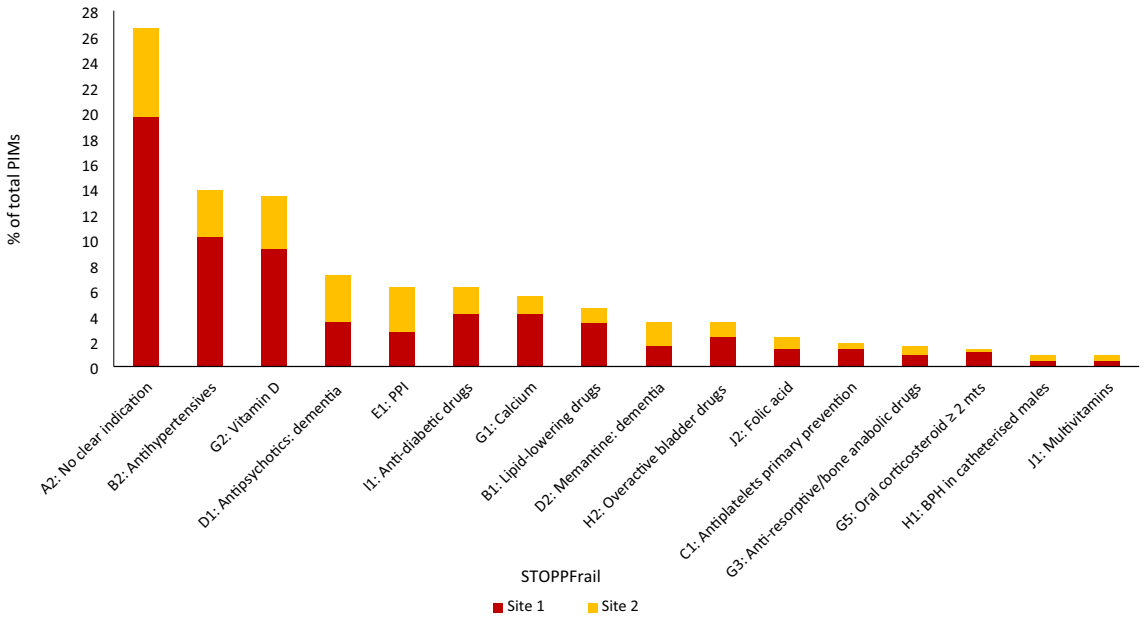

Fig. 1 Percentage of total PIMs identified using STOPPFrail criteria, broken down by site. *PIMs* potentially inappropriate medications, *STOPPFrail* Screening Tool of Older Persons Prescriptions in Frail adults with limited life expectancy, *PPI* proton pump inhibitor, *BPH* benign prostatic hyperplasia

3.3 Common Diagnoses

From both sites, 64 individual clinical conditions were documented, with each patient having a mean of five different comorbidities. Over 60% of all residents experienced constipation and over half of all residents had ongoing pain, which was differentiated from osteoarthritic pain. Hypertension was the third most common clinical diagnosis in this patient cohort. A dementia diagnosis was documented in 29 residents, 25 (86.2%) of whom were taking memantine or neuroleptic antipsychotics.

4 Discussion

To the best of our knowledge, this is the first study to investigate PIM use among frail older adults resident in Irish LTCFs using STOPPFrail v2. In this study, almost all patients were prescribed at least one PIM, with the dominant PIM criterion being medications prescribed with 'no clear indication', followed by antihypertensives and vitamin D, while slight variation existed between sites regarding antipsychotic and memantine use in dementia patients. Residents in LTC experienced multimorbidity, contributing to the need for polypharmacy.

Considering the relationship between number of prescribed medicines and the prevalence of PIMs, future deprescribing interventions could include a screening process to identify patients with polypharmacy or excessive polypharmacy and help prioritise patients for a deprescribing review.

Previous studies investigating PIM rates in Irish LTCFs have used STOPP/START to identify PIP [26]. O'Sullivan et al. identified 70.8% of residents experienced PIP, with PIM rates of 13.7% [28]. Similarly, Ryan et al. documented PIP rates of 59.8%, with 12.9% of medicines potentially inappropriate [40]. The Belgian COME-ON study using STOPPFrail v1 identified 64.1% of residents were prescribed PIMs, accounting for 13.6% of overall medications prescribed [41]. Another Belgian study using STOPPFrail v1 found that 89% of residents were prescribed at least one PIM, reporting results similar to this current study [42]. Using STOPPFrail v2, this study identified PIM rates to be much higher at 96.6%, with PIM rates slightly declining with age, particularly past 90 years. This could suggest that prescribing patterns align with age rather than a patient's condition, supporting research that suggests Irish prescribing patterns are not reflective of the changing clinical condition and treatment priorities when a patient is approaching end of life [43].

The prevalence of polypharmacy among frail older adults resident in LTCFs was high. Over half of residents experienced excessive polypharmacy, aligning with the higher results (8.8–56.7%) reported from an international study of LTCFs from eight different countries [44]. A systematic review investigating the prevalence of polypharmacy in LTCFs identified that between 38% and 91% of residents experience polypharmacy, with 10–65% of residents

experiencing excessive polypharmacy [45]. This was not a meta-analysis, however findings from our study are similar to the upper limits identified in the systematic review. Nearly all residents with polypharmacy were also taking at least one PIM, suggesting inappropriate polypharmacy. This remains an important distinction as the opinion of polypharmacy in the literature has changed. It has shown to not always be harmful, but rather inappropriate polypharmacy is of concern [46]. Full implementation of deprescribing STOPP-Frail-identified PIMs has the potential to reduce polypharmacy and excessive polypharmacy; however, caution must be taken when interpreting such results as deprescribing PIMs requires personalisation to the resident and it may not be safe, feasible or appropriate to do so in all instances.

This study showed the lack of indication documentation for regularly prescribed medications in LTC. This gap has also been highlighted both internationally and nationally, in studies conducted in both LTC and the hospital setting [31, 47, 48]. To support deprescribing, clear indication documentation is important, to understand the appropriateness of drug therapy within the context of the patient's clinical condition(s) [49]. This lack of clinical information available for the wider MDT has the potential to limit deprescribing efforts during medication reviews. Having access to clinical information was identified as a facilitator for Pharmacists to engage efficiently with medication reviews in LTC [50]. Given that a lack of clinical patient information is considered a barrier to deprescribing, documenting indications could help GPs and Pharmacists identify deprescribing targets, as consideration should be given to incorporating a dedicated section for documenting the indication for each medication into the 'regular' prescribing chart and standardising this across LTCFs [51]. A designated space to document indication was only present in the *PRN* medication section in both sites. The 'indication' element of the *PRN* prescribing chart was complete in most cases, and these medications did not majorly contribute to the prevalence of PIMs.

Antihypertensives can be considered potentially inappropriate when used in frail older adults with a systolic blood pressure (SBP) of < 130 mmHg [31]. Findings from a systematic review demonstrated that for people with frailty, there was no mortality difference associated with SBP < 140 mmHg versus SBP > 140 mmHg [52]. During this study, all antihypertensives were flagged as potentially inappropriate as SBP was not measured, therefore the results reported are reflective of all possible PIMs in this drug class and may overestimate the rate of this PIM. The same is true for antidiabetic drugs, as HbA1C levels were not measured. With this limitation in mind, antihypertensives were the largest drug class identified as potentially inappropriate. The rate of antihypertensive prescribing was similar to the international literature [53]. A study reviewing PIP in older adults with hypertension identified that over half of all hypertensive patients had at least one potentially inappropriate antihypertensive treatment [54]. Further research is required to confirm the appropriateness of prescribed antihypertensives in the frail older adult population. Evidence to support the safe deprescribing of antihypertensives exists, with Gulla et al. conducting a multicentred, cluster-randomised controlled trial that achieved a 32% reduction in antihypertensive prescribing for nursing home residents, with no effect of SBP at 9 months [53]. Similarly, a Cochrane review reported that there is no evidence that deprescribing antihypertensives used for hypertension or primary prevention of cardiovascular disease in older adults affects all-cause mortality and myocardial infarction [55]. Considering the evidence, a potential strategy for future studies could include incorporating a routine blood pressure assessment into the 3-monthly medication review to identify residents with SBP measurements that require revision of antihypertensive therapy, similar to the study by Gulla and colleagues [53].

Vitamin D was the PIM prescribed to the greatest number of patients. While research has shown positive outcomes from level correction in particular patient cohorts [56], there is a lack of clear evidence to support its use to prevent falls, fractures, cardiovascular events, or cancers in frail older adults [31]. In this population, treatment propriety remains on quality of life and symptom control [47], and HCPs should focus on reducing unnecessary medication burden. Considering its widespread use in Irish LTCFs, future studies should trial deprescribing vitamin D, documenting the clinical outcomes in this patient cohort with limited life expectancy.

Levels of antipsychotic prescribing in patients with a diagnosis of dementia were higher than previous studies [48]. Discontinuing inappropriate antipsychotics and memantine prescribed to those without an appropriate indication, evidence of continued benefit, or where dementia has progressed to end-stage can potentially relieve patients of the associated adverse effects, improving quality of life and reducing medication burden [57]. Comparing levels of antipsychotic and memantine prescribing between the sites, Site 1 had a Specialist Care Unit for people living with dementia, whereas Site 2 did not. These units are designed to cater for a smaller number of residents and employ staff with additional specialised training in dementia care to help residents feel safe and manage potentially challenging behaviours. These units focus on psychosocial stimulation and meaningful activities to improve quality of life [58]. This may account for the lower level of antipsychotics identified in Site 1, as an appropriate environment is a documented facilitator for antipsychotic deprescribing [59]. A Cochrane review concluded that antipsychotics could be safely deprescribed for older people with dementia; however, for people with more severe neuropsychiatric symptoms at baseline, such as psychosis, aggression or agitation, who responded

well to long-term use of antipsychotics, withdrawal might not be recommended [60]. Detailed documentation of a dementia diagnosis and the severity of symptoms could help to identify patients who could benefit from deprescribing. Internationally, implementing guidelines, supported by education and mobilisation strategies, has proven to effectively facilitate antipsychotic deprescribing in LTC [61]. Therefore, consideration should be given to incorporating such strategies when designing an intervention for the Irish context. This could help to overcome the barriers of insufficient deprescribing knowledge and HCPs' negative beliefs about their capabilities, both barriers to deprescribing, as identified in a systematic review on LTCFs [36].

4.1 Strengths and Limitations

This study took into consideration the important methodological features of retrospective chart review studies as identified by Matt and Matthew [62]. The initial frailty assessment was conducted by Medical Officers at each LTCF, who have an in-depth knowledge and accurate assessment of residents' clinical condition to determine eligibility. A proportion of the STOPPFrail assessment was carried out independently by two researchers to ensure the accuracy of PIM identification. This study was conducted in two publicly funded sites with different Medical Officers increasing the generalisability of the findings. As this study was only conducted in publicly funded LTCFs, these findings may not be true of private LTCFs that have different organisational structures, which is a limitation of this study. Another limitation is the potential for selection bias, as recruitment was based on LTCFs with which the researcher had an existing professional relationship. However, the researcher did not have an in-depth knowledge of medications prescribed and the Medical Officers played no role in data collection or analysis, therefore this should not have affected the study's integrity. Lack of full information on indications and clinical measurements such as blood pressure was a limitation of this study. Many drugs were marked as PIMs due to the lack of data on clinical measurements; for example, antihypertensives marked as a PIM due to the lack of information collected on blood pressure measurements as a result of the observational nature of this study. This poses a risk of overestimating the level of potentially inappropriately prescribed antihypertensives. This gives an indication of the types of measurements a multidisciplinary team may need to consider getting, to perform a full medication review and assess the appropriateness of medications in a frail older population.

5 Conclusion

Medication and PIM use is extensive among LTC residents. The prevalence of polypharmacy and excessive polypharmacy remains high, with inappropriate polypharmacy of concern. Lack of clear indication for prescribing medications is a considerable issue in LTC, potentially affecting HCPs' engagement with deprescribing. Adding an indication element to drug charts would offer clarity regarding the prescribing rationale and could help to identify targets for deprescribing. 'Antihypertensives' was the most common drug class prescribed, which could potentially be inappropriate depending on the individual resident's SBP. Incorporating a blood pressure assessment to check if measurements and drug therapy are in line with the appropriate international guidelines as part of the 3-monthly medication review process could be an option to promote antihypertensive deprescribing. Similar interventions could be adopted for antidiabetic drugs. Intervention options to support deprescribing could also include adding prompts and deprescribing guidelines for specific drug classes to encourage HCP engagement.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s40801-022-00342-2.

Acknowledgements CHH would like to acknowledge Ms. Margaret Cole, Statistician, University College Cork and Dr. Éilis O'Reilly, School of Public Health, for their statistical support during this research project. She would also like to thank healthcare staff of the two LTCFs for their support and co-operation during the study.

Declarations

Funding CHH is funded by the School of Pharmacy, University College Cork, and SMcH is funded by a Health Research Board Research Leader Award (RL-2020-004). The funders had no part in the design of this study, analysis or interpretation of the data, writing of the report, or decision to submit this article for publication.

Conflicts of interest Clara H. Heinrich, Suzanne McCarthy, Sheena McHugh and Maria D. Donovan declare they have no potential conflicts of interest that might be relevant to the contents of this manuscript.

Ethical approval Ethical approval for this study was obtained from Cork's Clinical Research Ethics Committee Review [reference number: ECM 3 (o), 16 November 2021].

Consent for publication All parties consented to the publication of this manuscript.

Availability of data and material All relevant data are available throughout the manuscript. Any further requests should be sent to the corresponding author (cheinrich@ucc.ie)

Code availability Not applicable.

Authors' contributions All authors contributed to the study conception and design. Material preparation and data collection and analysis were performed by CHH. The first draft of the manuscript was written by CHH. All authors commented on previous versions of the manuscript, and read and approved the final version.

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