Journal of Primary Care & Community Health
Volume 10: 1–8

DOI: 10.1177/2150132719890227
journals.sagepub.com/home/jpc
SAGE

Appropriateness of Medications in Older Adults Living With Frailty: Impact of a Pharmacist-Led Structured Medication Review Process in Primary Care

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Abstract

Background: Older persons with frailty take multiple medications and are vulnerable to inappropriate prescribing. **Objective:** This study assesses the impact of a team-based, pharmacist-led structured medication review process in primary care on the appropriateness of medications taken by older adults living with frailty. **Methods:** This was a quasi-experimental pretest-posttest design in 6 primary care practices within an academic clinic in Edmonton, Alberta, Canada. We enrolled community dwelling older adults 65 years and older with frailty who have polypharmacy and/or 2 or more chronic conditions (ie, high-risk group for drug-related issues). The intervention was a structured pharmacist-led medication review using evidence-based explicit criteria (ie, Beers and STOPP/START criteria) and implicit criteria (ie, pharmacist expertise) for potentially inappropriate prescribing, done in the context of a primary care team-based seniors' program. We measured the changes in the number of medications pre- and postmedication review, number of medications satisfying explicit criteria of START and STOPP/Beers and determined the association with frailty level. Data were analyzed using descriptive and inferential statistics (a priori significance level of $P < .05$). **Results:** A total of 54 participants (61.1% females, mean age 81.7 years [SD = 6.74]) enrolled April 2017 to May 2018 and 52 participants completed the medication review process (2 lost to hospitalization). Drug-related problems noted on medication review were untreated conditions (61.1%), inappropriate medications (57.4%), and unnecessary therapy (40.7%). No significant changes in total number of medications taken by patients before and after, but the intervention significantly decreased number of inappropriate medications (1.15 meds pre to 0.9 meds post; $P = .006$). **Conclusion:** A pharmacist-led medication review is a strategy that can be implemented in primary care to address inappropriate medications.

Keywords

geriatrics, medications, pharmacy, patient-centeredness, primary care

Introduction

Frailty is a heightened state of vulnerability that involves the complex interplay of physical, cognitive, psychological and social domains,[1] and results in social dependency, poor quality of life, and high health care utilization.[2] More than 1.2 million Canadians are living with frailty,[3] including 16% of people older than 65 years and as many as 52% aged 85 years and older.[4] Older individuals with frailty often have a myriad of chronic illnesses and take multiple medications.[5] Frailty combined with polypharmacy increases the likelihood of potential inappropriate prescribing (PIP)[6] in older adults, and in turn their risk for avoidable adverse drug events (ADEs),[7,8] hospitalization,[9] and morbidity.[10]

PIP is a collective term that includes potential inappropriate medications (PIMs) and potential prescribing omissions (PPOs).[11,12] PIMs are drugs that pose a high risk for ADEs, are ineffective for the patient's condition, are used for an inappropriate duration or without an indication.[11,12] PIMs

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also include drugs that are excessively costly where more affordable and effective analogues exist.[11,12] Approximately 42% of community-dwelling older adults are taking a PIM[13-15] and PIM use was estimated to cost $419 million in Canadian health-related expenditures in 2016.[16] On the other hand, PPOs occur when medications are not prescribed despite the absence of contraindication and potential benefits for the patient.[11,12] Prevalence for PPOs in frail older adults in the community has been estimated to be 40% with the most commonly reported omissions of medications for cardiovascular diseases, osteoporosis, and diabetes.[8]

National endorsement of the patient medical home framework and a shift toward team-based care present an opportunity to address PIP in the primary care setting where majority of older adults receive care. Over the past 2 decades, the integration of pharmacists within primary care settings has increased both globally[17-19] and within many Canadian provinces.[20-25] Approximately 50 pharmacists currently practice in Alberta primary care clinics that are part of provincial Primary Care Networks (PCNs). These regional PCNs are comprised of approximately 3800 family physicians and more than 1400 other health practitioners working together to address health care needs of their local community.[26] PCN pharmacists provide patient care; in Alberta, pharmacists may hold advanced prescribing authority,[27] and many have additional credentialing (eg, board-certified geriatrics pharmacists [BCGP], certified diabetes educator [CDE]).[28,29] Pharmacists working within primary health care teams have the required expertise and are ideally placed to help address drug-related problems such as inappropriate medication use in community dwelling frail older adults.[30,31]

Evidence supports that polypharmacy and ADEs can be preventable[32,33] if a structured multicomponent approach to assessing patients at high risk (eg, frail seniors) is incorporated into care.[34-36] However, current single-disease focused models of care may not be sufficient in the management of frailty in older populations.[37] Researchers have recommended that readily available evidence-based tools be integrated into care processes.[5] Examples of these tools for medication reviews are: Screening Tool of Older People's Prescriptions (STOPP), Screening Tool to Alert to Right Treatment (START), and the American Geriatrics Society Beers Criteria. STOPP and Beers are explicit criteria used for the identification of PIMs in older adults. STOPP is organized by physiologic system (eg, cardiovascular, central nervous system, respiratory), along with explanations to help clinicians discontinue unnecessary medications. Beers criteria assist clinicians to maximize patient benefits and minimize harms when prescribing to older adults. START criteria act as a reminder to clinicians to consider medications for older adults by physiologic system and can be used for the identification of PPOs.[15,38,39] Despite evidence-based recommendations for medication reviews in older adults with frailty, there is currently no standard of practice in either primary care or community pharmacy settings.

In our PCN, we implemented an integrated seniors' program known as the Seniors' Community Hub (SCH). The SCH builds capacity in primary care by mobilizing available PCN resources and providing a structured process of care, including: (1) *proactive frailty case finding* using a frailty index (eFI) derived from the electronic medical record (EMR) as described elsewhere[40]; (2) interprofessional team-based *modified Comprehensive Geriatric Assessment (mCGA)*; and (3) *person-centered healthy ageing/care & support planning*. The SCH program has won national recognition from the Canadian Frailty Network.[41]

The SCH team is anchored by a geriatric assessment nurse (GAN) who liaisons with the primary care clinics. The GAN supports the team in conducting the mCGA and makes key linkages to community resources or to the Care of the Elderly (CoE) physician consultant as required. Working closely with the GAN is the PCN pharmacist (0.2 FTE [full-time equivalent]) who received additional training in STOPP/ START tools and Beers Criteria, shadowed a senior clinical pharmacist with expertise in geriatrics (author CAS), worked with the CoE physician (author MA), and completed requirements for BCGP.[28]

In this study, we hypothesize that a structured, pharmacist-led medication review process guided by STOPP/ START and Beers criteria, integrated within a team-based primary care seniors' program, will result in improved appropriateness of medications prescribed for older adults living with frailty in the community.

Methods

Study Design

We employed a quasi-experimental one group pretest-posttest design, commonly used to evaluate an intervention without patient randomization.[42] University of Alberta Research and Ethics Board (Pro00062357) approved the study and all participating patients provided written informed consent.

Setting

An academic clinic consisted of 6 family physician practices. The clinic is a member of the Edmonton Oliver Primary Care Network, one of the 41 PCNs in Alberta, and the pilot site for the SCH.[43]

Participants

We included community-dwelling patients aged 65 years or older who were part of the SCH program at the clinic and were identified as being frail (using the eFI) and had polypharmacy (5 or more over-the-counter or prescription medications) and/or had 2 or more chronic conditions.

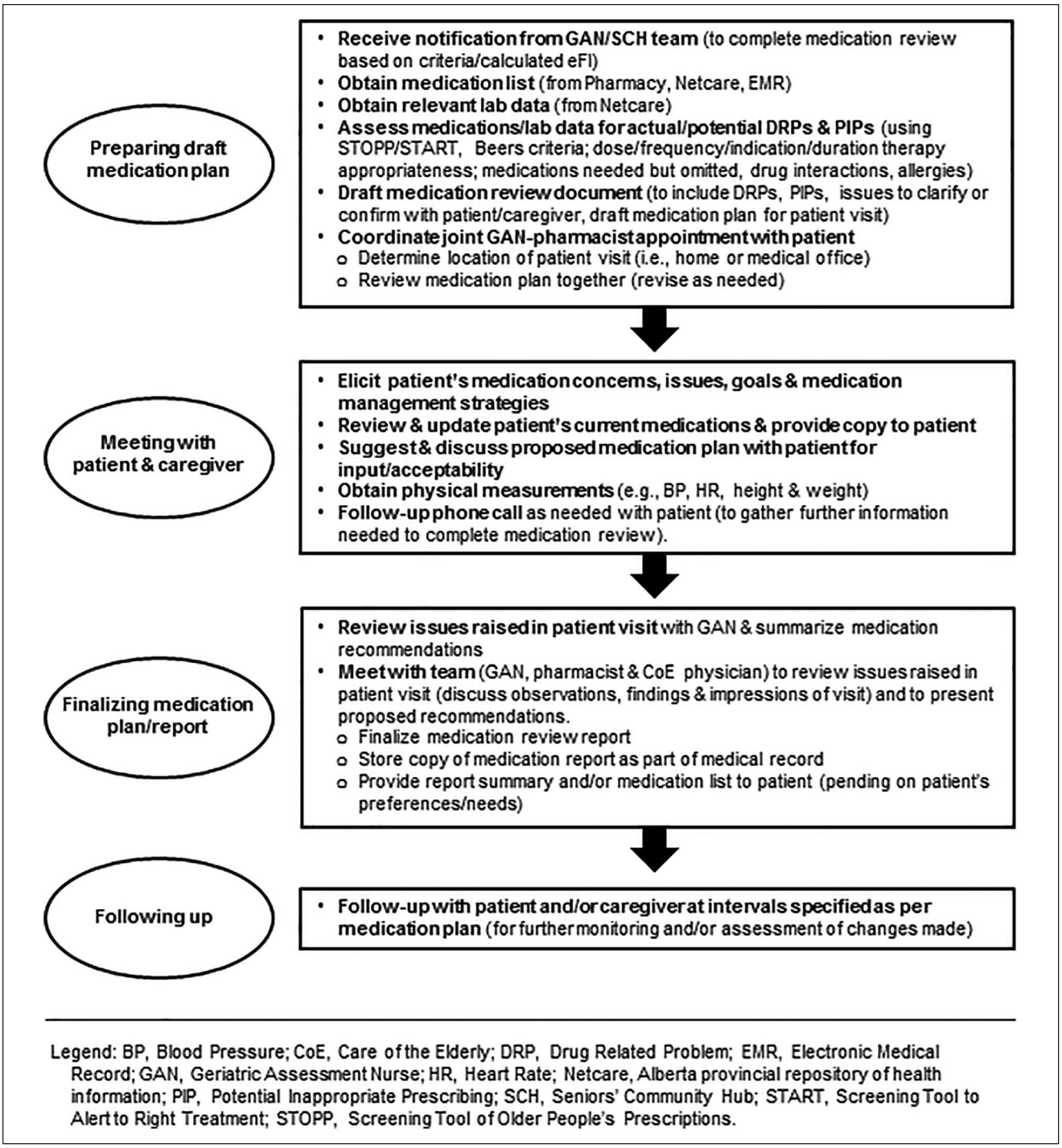

Figure 1. Pharmacist-led structured medication review process.

Data Collection

The process followed by the pharmacist in conducting the medication reviews and collaborating with the primary care team members is depicted in Figure 1. The pharmacist followed a systematic and practical algorithm modeled after Poudel et al[44] that included several steps to identify and discontinue PIP (adapted to include the fifth point): (1) identify high-risk PIMs that tend to cause ADEs in seniors; (2) confirm the diagnosis and indication match the prescribed or used medication; (3) determine the presence of symptomatic benefit from taking the drug; discuss safety or adverse events; (4) consider withdrawal, alteration or

continuation of medications; and (5) discuss the functional aspects of medication management (ie, how patients manage their medications). Appropriateness of medications was determined using the latest versions of STOPP/START Version 2 and Beers 2015. Implicit pharmacist judgment was also applied since explicit criteria do not address all drug-drug interactions, duplicate drug class prescription, and suboptimal prescribing. The pharmacist engaged patients and caregivers, incorporating key patient centric principles of medication review from the NHS Cumbria Medicines Management Team guide.[45] Reviews were primarily done in person, but retained flexibility to meet patient preferences (eg, interactions on the phone, jointly with other care providers, spread over multiple encounters). Final product of the medication review was an agreed-upon medication report, with the patient's values and priorities in the center of this medication management plan. The report was documented in the EMR and a copy given to the patient and/or designated caregiver. The review was done at a minimum once a year, and also at any time of transition (eg, hospital discharge, emergency visit, change in health status).

Main Outcome Measures

The main outcome measures in the study were: changes in number of medications pre- and postmedication review, number of medications satisfying explicit criteria of START for PPOs, and STOPP/Beers for PIMs. In addition, we examined any relationship of these measures with frailty level (defined by eFI scores).

Data Analysis

Sociodemographic, health, and medication use variables were analyzed descriptively. Considering the normal distribution on examining skewness and kurtosis of the data, paired *t* test was used to examine changes in number of medications pre- and postmedication review. Pearson correlation analysis was used to examine associations between frailty level (eFI) and other variables. Level of statistical significance was set at $\alpha = .05$. All statistical analysis was conducted using SAS 9.4 (SAS Institute Inc, Cary NC, USA).

Results

Medication reviews were conducted from April 2017 to May 2018. Fifty-four patients (mean age 81.7 years [SD = 6.74], 61.1% female) seen in the SCH program met inclusion criteria and were enrolled in the study. Table 1 shows the main characteristics of the sample. On average, patients had 5 chronic conditions, of which the most common were arthritis (87%), hypertension (68.5%), and hyperlipidemia (66.7%). Of the total patient sample, 66.7% had excessive polypharmacy (ie, taking 10 or more medications); and 63% were defined as at risk of moderate frailty using the eFI. Main reasons for family physician referral to the SCH program in this sample were for falls and decreased mobility (33.3%), cognitive impairment/dementia (29.6%), and only 14.8% for direct concerns of polypharmacy or recognized need for a medication review.

Table 1. Patient Characteristics (N = 54).

Age, years, mean (SD, range)	81.7 (6.74, 65-95)
Female, n (%)	33 (61.1)
Marital status n (%)	
Married/common-law	29 (53.7)
Divorced/separated	4 (7.4)
Single	4 (7.4)
Widowed	17 (31.5)
Education, n (%)	
No formal education	1 (1.9)
Primary (K–grade 9)	9 (16.7)
Secondary (grade 10-12)	25 (46.3)
Postsecondary	19 (35.2)
Living alone, n (%)	15 (27.8)
Accommodation, n (%)	
Independent home living	46 (85.2)
Private supportive living	8 (14.8)
Reason(s) for requesting geriatric assessments, n (%)	
Falls and decreased mobility	18 (33.3)
Cognitive impairment/dementia	16 (29.6)
Chronic pain	10 (18.5)
Depression	10 (18.5)
Caregiver burden	8 (14.8)
Medication review or polypharmacy	8 (14.8)
Medically complex	8 (14.8)
Failure to thrive	1 (1.9)
Number of chronic conditions/patient, mean (SD, range)	5.3 (2.1, 1-11)
Most common chronic conditions, n (%)	
Arthritis	47 (87)
Hypertension	37 (68.5)
Hyperlipidemia	36 (66.7)
Atrial fibrillation	22 (40.7)
Chronic obstructive pulmonary disease	17 (31.5)
Number of prescriptions, n (%)	
<10 medications	18 (33.3)
≥10 medications	36 (66.7)
Frailty level (eFI score), n (%)	
Mild frailty (0.13-0.24)	10 (18.5)
Moderate frailty (0.25-0.36)	34 (63)
Severe frailty (>0.36)	10 (18.5)

Medication Review

Numbers of medications taken per patient, and numbers satisfying START criteria and STOPP/Beers criteria compared

Table 2. Number of Medications Pre- to Postmedication Review.

	Premedication Review, Mean (SD)	Postmedication Review, Mean (SD)	Paired *t* Test
Total sample N = 52[a]			
Total number of medications per patient	12.1 (5.1)	11.7 (5.3)	$P = .254$
Number of medications per patient that satisfy START criteria	4.1 (2.4)	4.2 (2.0)	$P = .554$
Number of medications per patient that satisfy STOPP/Beers criteria	1.15 (1.2)	0.9 (1.1)	$P = .006$
Subjects with PIM N = 30[b]			
Total number of medications per patient	14.2 (4.5)	13.7 (5.7)	$P = .265$
Number of medications per patient that satisfy START criteria	3.7 (2.2)	4.0 (2.2)	$P = .002$
Number of medications per patient that satisfy STOPP/Beers criteria	2.0 (0.97)	1.6 (0.97)	$P = .005$

[a]This (N = 52) section excludes 2 patients who were hospitalized and their postmedication review data could not be collected.
[b]This (N = 30) section includes a subsample of patients with at least 1 potentially inappropriate medication (PIM).

Table 3. Frequency and Examples of Prescribing Problems Reported by the Pharmacist (N = 54).[a]

Prescribing Problem	n (%)	Example
Untreated condition	33 (61.1)	Osteoporosis, pain, dyslipidemia
Inappropriate drugs based on STOPP/Beers criteria	31 (57.4)	Aspirin for primary prevention, Tylenol #3 for inappropriate indication
Unnecessary therapy	22 (40.7)	Proton pump inhibitor, ASA
Unclear indication	13 (24.1)	Over-the-counter drugs (eg, vitamin supplements), dual anti-platelet therapy
Dosage too high	13 (24.1)	Antihypertensive medication
Dosage too low	12 (22.2)	Pain medication
Adverse drug reaction	9 (16.7)	Iron supplement causing constipation
Noncompliance	9 (16.7)	Diabetes regimen
Drug not effective	6 (11.1)	Warfarin when 50% of INRs outside therapeutic range
Cost-related issues	1 (1.9)	Ranitidine not covered if over-the-counter but is covered if prescribed by MD

Abbreviations: ASA, acetyl salicylic acid; INR, international normalized ratio.
[a]No significant drug-drug or drug-disease interactions were reported.

before and after the medication reviews were completed in 52 patients and are presented in Table 2. Total number of medications per patient decreased from 12.1 to 11.7 ($P = .254$) and the number of medications per patient that satisfy START criteria increased from 4.1 to 4.2 ($P = .554$), pre- to postmedication review. Number of inappropriate medications decreased from 1.15 to 0.9 ($P = .006$). In a subsample of those patients with at least one inappropriate medication, analysis showed statistically significant decrease in the number of inappropriate medications ($P = .005$) and increase in the number of drugs that satisfied START criteria ($P = .002$), while no statistically significant change was noted in the total number of medications ($P = .265$).

Table 3 shows the frequency and examples of prescribing problems noted by the pharmacist. The most common problems were untreated condition (61.1%), use of inappropriate drugs (57.4%), and unnecessary therapy (40.7%). The pharmacist made the following types of recommendations, based on the identified prescribing problems and specific patient health information provided by the mCGA: the discontinuation of inappropriate drugs in 29 (53.7%) patients, new drug initiation for 36 (66.7%) patients, dosage changes in 30 (55.5%) patients, change in medication formulation in 8 (14.8%) patients, and change in timing of medications for 7 (13.0%) patients.

In the sample of 52 patients who completed the medication review process the family physician implemented medication discontinuations for 21 (40.4%) patients and new medication initiations in 29 patients (55.8%). However, 50% and 94.1% of the total sample of patients still had medications that satisfied STOPP/Beers and START criteria, respectively.

Frailty and PIP

The eFI tool stratified patients into increasing levels of frailty. Pearson correlation analysis showed no associations between eFI and total number of medications taken before medication review ($r = -0.233$, $P = .09$), or with number of medications that satisfy START criteria ($r = 0.186$, $P = .117$). There was a weak positive and statistically significant correlation between the number of inappropriate medications and frailty ($r = 0.280$, $P = .040$).

Discussion

This study demonstrated that a pharmacist-led medication review conducted within a primary care team can positively affect appropriateness of medications for community dwelling adults with frailty. While there was no change in total numbers of medications prescribed pre- and postmedication reviews, there was a statistically significant decrease in the number of PIMs for patients. Further examination of the subsample of patients with at least 1 PIM indicated both a statistically significant decrease in number of inappropriate medications and increase in number of drugs that satisfied START criteria. Strength of this study is its description and demonstration of how a structured, systematic and team-based approach can improve medication appropriateness.

The average number of medications taken in our patient population was 12.1, with 66.7% of patients taking 10 or more medications. The Canadian Institute for Health Information (CIHI) reported that more than 67% and 25% of seniors are taking 5 and 10 or more drug classes, respectively, and the prevalence of excessive polypharmacy increases with age: 20% among those 65 to 74 years old, 32% among those 75 to 84 years old, and 39% among those older than 85 years.[46] Higher prevalence of excessive polypharmacy in our study may be explained by the SCH's intentional targeting of those at risk of frailty (Table 1). Furthermore, the eFI demonstrated a statistically significant, although weak, positive correlation with the number of PIMs. Of note, only a small percentage of patients were referred for geriatric assessment due to concerns about medications, while majority were referred for falls and cognitive impairment (Table 1). However, certain medications, such as sedative hypnotics, contribute to impaired balance, falls, and cognition; and these symptoms are often reversible once medications are halted or tapered. Hence, this finding might emphasize an underrecognized problem of PIP and indicate lack of understanding of the importance of addressing medications in the population of those living with frailty. This could also be due to the referral process and checklist, which may lead the referring physician to focus on the geriatric syndrome rather than the overall medication regimen. Or this emphasis on referrals for issues other than medication may be due to the awareness of the referring physicians that a pharmacist was part of the team, and a medication review would take place as part of standard geriatric assessment.

The absence of a decline in numbers of medications prescribed postmedication review was not unexpected. While numbers of PIMs decreased, PPOs were added. The net result may be unchanged or even increased numbers of appropriate medications per patient postmedication review as noted by other researchers.[47] In fact, our top 3 drug-related problems included untreated condition (61.1%), inappropriate medication (57.4%), and unnecessary therapy (40.7%), which are consistent with results of other studies.[48]

We found no overall changes in the proportion of patients with medications that satisfied START criteria (94.1%) and STOPP/Beers criteria (50%) after the medication reviews were conducted. Although many recommendations were implemented by the family physician, some had not been initiated or had been delayed. Understanding family physicians' rationale for implementing recommendations was not studied in this research. However, others have noted that physicians' acceptance of pharmacist recommendations is higher in situations where physicians and pharmacists share a clinical practice site which allows for relationships and trust in professional competency to develop.[49] Even though the pharmacist was an integral part of the SCH team and shared the patient's assessment (mCGA), the pharmacist did not work directly with the family physician nor exercised prescribing abilities.

Although STOPP/START and Beers criteria are useful tools in identifying PIMs and flagging medications for untreated conditions, they are designed to help raise *awareness* of appropriate medications rather than being dogmatic. The American Geriatric Society advises that clinicians must exercise critical thinking and consider many factors in their prescribing decisions, since strict adherence to these criteria is not always feasible or appropriate.[39] Potential provider obstacles for deprescribing cited in the literature are time constraints, confidence in ability to stop medications safely, concern of unknown consequences of altering medications, and reconciling contradicting disease-specific guidelines.[50] Indeed, we designed our pharmacist-led approach to address these concerns. Additionally, our data showed proton pump inhibitors (PPIs) were one of the most common deprescribed PIM, consistent with results of a recent population based cohort study in primary care.[51] PPIs, along with antidepressants and bisphosphonates, are referred to as "legacy prescriptions," used to describe drugs that should be prescribed for an intermediate period but remain much longer.[51] These drugs exemplify the need for provider- and system-level strategies for appropriate stopping of drug therapy.[51] Possible strategies include detailed documentation and justification for prescribing (eg, duration, reassessment guidance) by all prescribers; better use of shared health records and enhanced prescribing systems; education about PIMs and pharmacokinetics/dynamics in the elderly and; systematic medication reviews in at-risk groups.[52]

The small sample size is a limitation of the study. The academic clinic setting, where physicians may demonstrate potentially different prescribing behaviors, may affect generalizability of results. The strength of the study is its creative mobilization of PCN resources to address an overlooked population of community dwelling frail older adults; an important approach considering global demographic shifts and demands for health care transformation and fiscal responsibility. However, it also highlights the need for research to inform practice standards/clinical guidelines for older adults with complex care needs (ie, frailty), explore various health professionals' mental modeling around prescribing/deprescribing and collaborative practice, and understand patient important outcomes.

Conclusion

A structured pharmacist-led medication review strategy can be implemented within the primary care setting to improve appropriateness of medications. Key features are shared team-based assessments and leveraging pharmacists' expertise, including use of explicit criteria to systematically guide recommendations.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This article recieved funding from Edmonton Zone Medical Staff Association.

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Supplemental Material

Supplemental material for this article is available online.

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