Potentially Inappropriate Prescribing in Hospitalized Older Adult High-Cost Health Care Users: A Pilot Study

Monica Sanh, Anne Holbrook, Peter D M Macdonald, and Justin Lee

ABSTRACT

Background: High-cost health care users use disproportionate amounts of health care resources relative to the typical patient. It is unclear to what extent poor-quality prescribing, including potentially inappropriate prescribing (PIP), may be contributing to their adverse outcomes and health utilization costs.

Objectives: To evaluate the prevalence of PIP and to explore its impact in older adult high-cost health care users.

Methods: The charts of older adult high-cost health care users admitted to 2 academic hospitals in Ontario, Canada, in fiscal year 2015/16 were reviewed. Eligible patients were at least 66 years old with at least 5 emergency department visits and 3 hospital admissions in the previous year. A total of 243 patients met these criteria, of whom 100 were randomly selected for review. Cases of PIP were identified using explicit prescribing quality indicators, including the STOPP/START criteria. Types of PIP included potentially inappropriate medications (PIMs) and potential prescribing omissions (PPOs). Log–linear regression was used to characterize the relationship between PIP and future health care utilization. Medications were reconciled to determine the proportion of PIP addressed by the time of discharge.

Results: Eighty-nine of the 100 patients had at least 1 instance of PIP. In total, 276 PIMs and 54 PPOs were identified. Of the 271 instances of PIP identified on admission, only 38 (14%) were resolved by the time of hospital discharge. Each additional PPO was associated with a 1.43-fold increase in the rate of future emergency department visits ($p < 0.001$).

Conclusions: The rate of PIP among older adult high-cost health care users was high. Despite frequent interactions with the health care system, many opportunities to improve the quality of prescribing for this vulnerable population were missed. Greater attention to medication optimization is needed.

Keywords: older adults, potentially inappropriate prescribing, high-cost health care users, high-need patients

Note: This article contains supplementary material (Supplements 1 and 2), available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/209

RÉSUMÉ

Contexte : Les grands utilisateurs de soins de santé consomment une proportion disproportionnée des ressources par rapport aux patients moyens. On ne sait pas vraiment dans quelle mesure la prescription de mauvaise qualité, notamment la prescription potentiellement inappropriée (PPI), contribue aux effets indésirables et aux coûts d'utilisation des soins de santé.

Objectifs : Évaluer la prévalence des PPI et étudier ses effets chez les grands utilisateurs des soins de santé âgés.

Méthodes : Les dossiers des grands utilisateurs de soins de santé âgés admis dans 2 hôpitaux universitaires en Ontario, au Canada, pendant l'exercice 2015-2016 ont été examinés. Les patients admissibles étaient âgés d'au moins 66 ans, avaient effectué au moins 5 visites à l'urgence et avaient été admis 3 fois à l'hôpital au cours de l'année précédente. Au total, 243 patients répondaient à ces critères, dont 100 ont été sélectionnés au hasard pour un examen. Les cas de PPI ont été identifiés à l'aide d'indicateurs explicites de la qualité de prescription, notamment les critères STOPP/START. Les types de PPI comprenaient des médicaments potentiellement inappropriés (MPI) et les omissions potentielles de prescription (OPP). La régression log-linéaire a été utilisée pour caractériser la relation entre la PPI et l'utilisation future des soins de santé. Un bilan comparatif des médicaments prescrits a été effectué pour déterminer la proportion de PPI traités au moment de la sortie de l'hôpital.

Résultats : Quatre-vingt-neuf (89 %) des patients présentaient au moins 1 cas de PPI. Au total, 276 MPI et 54 OPP ont été identifiées. Sur les 271 cas de PPI identifiés au moment de l'admission, seuls 38 (14 %) étaient résolus au moment de la sortie de l'hôpital. Chaque OPP supplémentaire était associée à une augmentation de 1,43 fois du taux de futures visites à l'urgence ($p < 0,001$).

Conclusions : Le taux de PPI chez les grands utilisateurs de soins de santé âgés était élevé. Malgré des interactions fréquentes avec le système de santé, de nombreuses occasions d'amélioration de la qualité des prescriptions pour cette population vulnérable ont été manquées. Une plus grande attention doit être portée à l'optimisation des médicaments.

Mots-clés : aînés, prescriptions potentiellement inappropriées, grands utilisateurs de soins de santé, patients ayant des besoins élevés

INTRODUCTION

In multiple countries, health care utilization and spending are not evenly distributed across the population.[1] High-cost health care users are those individuals who use a disproportionate share of health care resources relative to the typical patient. Although interventions have traditionally focused on acute care, medication optimization represents an area that could potentially improve the overall health of these high-cost users and reduce their health care costs.[2] Studies have shown that prescription medications represent the most expensive category of health care expenditure in the year before a person becomes a high-cost health care user, but it is unclear to what extent poor-quality prescribing, including potentially inappropriate prescribing (PIP), may be contributing to adverse outcomes and health utilization costs.[3,4]

PIP is a significant risk factor for adverse drug events in older adults, with age itself being associated with increased emergency department (ED) visits, morbidity, and health care costs.[5] For the period 2006 to 2011, the Canadian Institute for Health Information reported that 1 in 200 older adults experienced hospitalization related to adverse drug events, compared with a rate of 1 in 1000 younger adults.[6] Appropriate, evidence-based prescribing is essential to achieve better clinical outcomes and value-based care.

PIP can include medication misuse, overuse, and underuse. Misuse or overuse occurs where the harm associated with medication therapy outweighs the benefit and can include drug interactions, duplicate therapeutic classes, or drugs that adversely affect older adults. Underuse occurs where clinically relevant medications without contraindications are not prescribed; this problem may occur more frequently in patients taking a large number of medications.[7]

Given the association between PIP and adverse drug events, and the unclear influence of prescribing quality on the health of high-cost health care users, our objective was to evaluate the prevalence and types of PIP in hospitalized older adult high-cost health care users and to explore the impact of these factors on health care outcomes.

METHODS

We conducted a retrospective chart review of older adult high-cost health care users admitted to medical wards at 2 academic hospitals in Hamilton, Ontario, from April 1, 2015, to March 31, 2016. The Hamilton Integrated Research Ethics Board approved this study.

High-cost health care users were defined as older adults (at least 66 years of age) who had at least 5 ED visits and 3 admissions in the 365 days before the index ED visit. The index ED visit was the last ED visit during the study period. The hospital admission reviewed for purposes of the study was either the admission that resulted from the

index ED visit or, if the index ED visit did not result in an admission, the most recent admission preceding the index ED visit. This definition aligns with criteria for high-cost health care users at our local institution and those followed by many other hospital groups. The age cut-off of 66 years was intended to capture individuals eligible for the provincial drug plan. Only patients admitted from the ED were included in the study. An independent statistician randomly selected 100 patients meeting these eligibility criteria for review.

PIP Criteria

The Screening Tool of Older People's Prescriptions (STOPP) and Screening Tool to Alert to Right Treatment (START) are validated screening criteria that classify PIP as involving either potentially inappropriate medications (PIMs) or potential prescribing omissions (PPOs).[8] Prehospital medications were reviewed against the STOPP/START criteria[8] and 4 additional prespecified PIP criteria (Supplement 1, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/209). We selected the STOPP/START criteria, rather than the Beers criteria for inappropriate medication use in older adults, because evidence suggests that they may better predict adverse drug events and has shown that use of these criteria can decrease adverse outcomes.[8,9] We added the 4 additional criteria to reflect some common, high-priority adverse prescribing practices that have recently become more prevalent in North America, such as high-dose opioid use.[10,11]

Data Extraction

A pharmacist (M.S.) reviewed the medical chart for each selected patient to collect clinical and demographic information (using the data collection form shown in Supplement 2, available at https://www.cjhp-online.ca/index.php/cjhp/issue/view/209). If the best possible medication history (BPMH) was not available, information in the chart (e.g., provincial drug reimbursement records) was used to determine home medications. Information in the electronic medical record up to 2 years before admission was used to determine comorbidities and clinical indications for purposes of identifying PIP. For example, absence of renin-angiotensin-aldosterone system (RAAS) inhibitors for patients with heart failure was not considered to represent a PPO if the indication for stopping this type of medication was apparent in the pharmacist's 2-year chart review (e.g., evaluation of patient's renal function, electrolytes, and medical notes). Prehospital medications were reconciled in relation to medications prescribed at discharge to determine the proportion of medications involving PIP that were addressed. The numbers of ED visits and hospital admissions that each patient had after the index admission were collected to determine the association between PIP and future health care utilization.

Pilot Testing and Adjudication

During the calibration phase, 3 investigators (M.S., A.H., J.L.) independently reviewed 5 charts to pilot the chart review process and establish an acceptable level of inter-rater reliability and consistency in identifying PIP. Once the group reached consensus, 1 investigator (M.S.) completed the remainder of the data collection.

Statistical Analysis

We used SPSS (Statistical Package for the Social Sciences, version 20.0 for Windows; SPSS, Inc, an IBM Company) for all descriptive statistical analyses. Log–linear regression models using quasi-Poisson error were applied to describe future health care utilization (R Software, R Core Team [2016], R Foundation for Statistical Computing). The Spearman rho test was used in the post hoc analyses to determine associations between drug classes and future health care utilization. Statistical significance was prespecified by a p value less than 0.05.

RESULTS

Demographic Characteristics

A total of 243 high-cost health care users were identified during fiscal year 2015/16, of whom 100 were randomly selected for review in this study. The mean age was 82.0 (standard deviation [SD] 7.9) years, and 57% were female (Table 1). BPMHs obtained by pharmacy staff were documented in the charts for 27% of these high-cost health care users, and the mean number of home medications was 11.9 (SD 4.4).

Primary Outcome

Eighty-nine of the 100 high-cost health care users had at least 1 medication that involved PIP. In addition, 88 of these high-cost health care users had at least 1 medication involving PIP according to the STOPP/START criteria; as such, the additional PIP criteria (Supplement 1) did not significantly affect the prevalence of PIP. More specifically, 85 and 39 high-cost health care users had at least 1 PIM and at least 1 PPO, respectively. The mean numbers of potentially inappropriate prescriptions, PIMs, and PPOs were 3.7, 3.2, and 1.4 per patient, respectively.

Table 2 lists the most frequent PIMs and PPOs. Among the 276 PIMs, medications without an evidence-based indication were the most frequently identified ($n = 115$, 42%), and docusate and natural health products accounted for 20 and 24 of these PIMs, respectively. Among the 54 PPOs, the absence of RAAS inhibitors for patients with reduced ejection fraction heart failure or coronary artery disease was the most frequently identified ($n = 20$, 37%). The therapeutic classes most frequently implicated in PIP for high-cost health care users were anticoagulants and antiplatelet agents, RAAS inhibitors, benzodiazepines, opioids, and stool softeners.

Secondary Outcomes

According to the log–linear regression model with quasi-Poisson error, PPOs were a significant predictor of ED visits in the next year ($p < 0.001$), but not future hospitalizations ($p = 0.06$). Each additional PPO was associated with a 1.43-fold increase in the rate of future ED visits ($\beta = 0.34$, $p < 0.001$). PIP and PIMs were not a predictor of either ED visits or hospitalizations.

Post hoc multivariate analyses were conducted to determine associations between individual medications involving

TABLE 1. Baseline Characteristics	
Characteristic	% of Patients[a] (n = 100)
Age (years) (mean ± SD)	82.0 ± 7.9
Sex, female	57
Living situation	
Home	76
Retirement or nursing home	24
No. of home medications (mean ± SD)	11.9 ± 4.4
Serum creatinine on admission (mmol/L) (median and IQR)	106.1 (70.7–176.8)
eGFR (mL/min/1.73 m^2) (median and IQR)	55 (32–84)
Method of medication reconciliation	
BPMH	27
Other	73
Past medical history	
Hypertension	91
Ischemic heart disease	67
Peripheral vascular disease and atherosclerosis	58
Congestive heart failure	51
Cardiac arrhythmias	50
Cancer	42
Arthritis and related disorders	41
Gastroesophageal reflux disease	40
Diabetes	39
COPD	31
Most responsible diagnosis	
Urinary tract infection	12
Heart failure exacerbation	11
Pneumonia	9
COPD exacerbation	8
Ischemic heart disease	7
Sepsis	4
Cancer	4
Renal failure	4
Syncope	4
Other	41

BPMH = best possible medication history, COPD = chronic obstructive pulmonary disease, eGFR = estimated glomerular filtration rate, IQR = interquartile range, SD = standard deviation.
[a]Except where indicated otherwise.

TABLE 2. Most Frequently Identified Types of Potentially Inappropriate Prescribing

Medication	No. (%)
Potentially inappropriate medications	*n* = 276
Any drug prescribed without evidence-based clinical indication	115 (42)
Concomitant use of drugs that interact pharmacodynamically with oral anticoagulants or antiplatelet agents to increase risk of bleeding: • Other oral anticoagulants or antiplatelet agents • Selective serotonin reuptake inhibitors • Select antibiotics (interaction with warfarin only) • Amiodarone (interaction with warfarin only) • NSAID	16 (6)
Benzodiazepines (sedative; may cause reduced sensorium or impair balance)	14 (5)
Benzodiazepines for ≥ 4 weeks	14 (5)
Use of high-dose opioids (dose ≥ 50 mg/day morphine equivalent)	10 (4)
Concomitant use of at least 2 of the following: opioids, benzodiazepines, alcohol	9 (3)
ACE inhibitor or ARB for patient with hyperkalemia	7 (3)
Potential prescribing omissions	*n* = 54
ACE inhibitor or ARB for patient with congestive heart failure and/or documented coronary artery disease	20 (37)
Bone antiresorptive or anabolic therapy for patient with documented osteoporosis (BMD T-score below −2.5 at multiple sites), where no pharmacological or clinical status contraindication exists, and/or previous history of fragility fractures	9 (17)
β-Blocker for patient with ischemic heart disease	6 (11)
Vitamin D supplementation for older patient who is housebound or is experiencing falls or has osteopenia (BMD T-score between −1.0 and −2.5 at multiple sites)	4 (7)
Vitamin D and calcium supplementation for patient with known osteoporosis and/or previous fragility fractures and/or BMD T-score below −2.5 at multiple sites	3 (6)
Antiplatelet therapy for patient with documented history of coronary, cerebral, or peripheral vascular disease	3 (6)

ACE = angiotensin-converting enzyme, ARB = angiotensin receptor blocker, BMD = bone mineral density, NSAID = nonsteroidal anti-inflammatory drug.

PIP and future health care utilization. Using the Spearman rho test, high-dose opioid use was weakly associated with increased ED visits ($\rho = 0.283$, $p = 0.015$), but not hospitalizations.

Thirty-eight (14%) of the 271 instances of PIP in 77 high-cost health care users had been addressed by the time of hospital discharge: more specifically, 17% (37/223) of PIMs were discontinued, and therapy was initiated for 2% (1/48) of PPOs.

DISCUSSION

High-cost health care utilization and PIP are major public health issues facing older adults. In our study, PIMs involving anticoagulants and antiplatelet agents, opioids, benzodiazepines, and docusate, along with PPOs involving RAAS inhibitors, were the most common. The Institute for Safe Medication Practices (US) and the Institute for Safe Medication Practices Canada have designated opioids and anticoagulants as high-alert medications and antiplatelet agents as high-alert medications in older adults,[12-14] so

these medications may represent priority areas to target for improvement efforts, given their prevalence, clinical importance, and potential risks. Although docusate is unlikely to contribute to negative outcomes, it still contributes to wasted resources and represents a missed opportunity to prescribe more evidence-based laxatives.[15]

The prevalence of PIP in this study was higher than in other studies that have applied the STOPP/START criteria.[16,17] There could be several contributory factors. First, previous studies were conducted in general populations, whereas we studied older adult high-cost health care users, who represent a distinct population that may have higher rate of PIP. Our population appeared to be in worse health, as illustrated by 23% of the patients dying in hospital or being transferred to palliative care by the time of discharge, similar to other studies evaluating high-cost health care users.[1] This status may have contributed to the higher number of medications involving PIP that we observed.

In this study, only PPOs were associated with increased ED visits (on the basis of modelling). However, given that

the quasi-Poisson test is conservative, the study might not have had the appropriate sample size and power to demonstrate a relationship between PIP and future health care utilization. In addition, health care utilization among high-cost health care users is likely multifactorial and may not be explained solely by PIP.

Our study suggests that there are missed opportunities to optimize medication therapy for high-cost health care users, despite their frequent exposure to health care settings and providers. Factors such as administrative pressures, high patient load, and hesitancy to change long-term medications may be contributing to these missed opportunities. Further exploration is required to determine the significance of these factors.[18]

This study had some limitations. Generalizability may be limited because of the sample size and geographic setting (a single municipality). There may be potential inaccuracies, given that only 27% of the patients had a BPMH gathered prospectively during their admission; for the remainder of patients, a pharmacist determined the BPMH retrospectively during data collection, including reviewing scanned admission notes and progress notes. Despite the low rate of BPMH at the time of admission, many patients had their medication history documented by other medical professionals, such as physicians and medical clerks. Some of these medication histories may have met the criteria for a BPMH; however, unlike those completed by pharmacy staff, such histories are not routinely labelled as such in the electronic medical record. It is also possible that some PIP that we identified was appropriate, but supporting justification was not evident in the 2-year historical chart review.

To the best of our knowledge, no previous study has analyzed prescribing patterns among older adult high-cost health care users, and thus our findings have implications for future research. In our study, most medication therapy for high-cost health care users was not optimized, and minimal interventions were done during hospital admissions. Opioids, anticoagulants, and antiplatelet agents may represent high-yield areas where targeted interventions can significantly affect outcomes. Given the complexity of medical conditions and required care for high-cost health care users, an interprofessional team with unique clinical expertise should collaborate to optimize their management.

CONCLUSION

In this pilot study, the care of older adult high-cost health care users was not optimized in terms of evidence-based use of medications, and rates of intervention during hospital admissions were low. Larger studies are required to determine the clinical significance of inappropriate prescribing and whether targeted interventions to optimize medication therapy for these high-cost health care users will improve clinical outcomes or reduce health care costs.

Certain classes of medications, including opioids, anticoagulants, and antiplatelet agents, may be high-yield areas for targeted interventions.

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Monica Sanh, PharmD, ACPR, is a Clinical Pharmacist with the University Health Network, Toronto, Ontario.

Anne Holbrook, MD, PharmD, MSc, FRCPC, is a Clinical Pharmacologist and Internal Medicine Specialist with St Joseph's Healthcare Hamilton, and a Professor in the Department of Medicine and Director of the Division of Clinical Pharmacology and Toxicology, McMaster University, Hamilton, Ontario.

Peter D M Macdonald, DPhil, P.Stat., is Professor Emeritus of Mathematics and Statistics, McMaster University, Hamilton, Ontario.

Justin Lee, BScPhm, ACPR, MD, PhD, FRCPC, is a Geriatrician and Internist with St Joseph's Healthcare Hamilton and Hamilton Health Sciences and is an Assistant Professor with the Division of Geriatric Medicine, Department of Medicine, McMaster University, Hamilton, Ontario.

Address correspondence to:
Dr Monica Sanh
Inpatient Pharmacy Department
Toronto General Hospital
200 Elizabeth Street
Toronto ON M5G 2C4

email: sanh.monica@gmail.com

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