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REVIEW ARTICLE

# Polypharmacy concerns in the geriatric population

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With the geriatric population steadily increasing and receiving primary care, it is important for the osteopathic family physician to have knowledge about safely prescribing to the geriatric patient. Polypharmacy, the use of 5 or more medications or the use of any medication that is not clinically warranted, presents many risks to the elderly patient and increases morbidity and mortality. Irrespective of a patient's medical problems, polypharmacy has proven to be associated with an increased risk of falls as well as fracture. Drug-related cognitive changes as well as worsening of underlying dementia may be attributable to polypharmacy. Certain types of medications are more likely to cause cognitive changes, but any medication may cause a status change in the geriatric patient. Safe prescribing to the geriatric patient involves understanding the physiological changes of aging and adjusting the dosages accordingly, to avoid adverse events such as acute renal failure. Many resources (including the Beers Criteria, screening tool to alert doctors to right treatments [START] tool, and screening tool of older persons' potentially inappropriate prescriptions [STOPP] tool) exist to assist the osteopathic family physician in safely prescribing to the geriatric patient. Utilizing these resources for a thorough medication review for each geriatric patient would enable the osteopathic family physician to implement safe prescribing practices thus decreasing risks to the patient.

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“I want quality not quantity.” These words expressed by a geriatric patient, succinctly describe the goal that is important to most geriatric patients and is becoming ever more apparent to family medicine physicians. In focusing on a geriatric patient's quality of life, it is vital for family medicine physicians to carefully review the patient's medications and how they may be affecting the patient's function, cognition, bodily systems, and overall safety. Although there are various guidelines available to assist physicians when prescribing medications to the elderly, many general practitioners feel overwhelmed or uncomfortable about prescribing to elderly patients with multiple medical conditions.<sup>1</sup> As the baby boomers begin to enter the geriatric population and the numbers of geriatric patients receiving primary care continues to increase, it is ever more

important that osteopathic family physicians understand the aging process and become more comfortable prescribing to the elderly.

## Demographics and challenges

People of the age of 65 years or older presently comprise 12%-13% of the population, and this would be 25% by the year 2040. This population buys 33% of the drugs prescribed and over-the-counter drugs account for 2 out of every 5 medications taken by them. With this population taking multiple medications, more adverse drug events and hospitalizations occur. Adverse drug events account for up to 28% of geriatric hospital admissions and 26 out of every 1000 hospital beds. In the nursing home, \$1.33 is spent for adverse drug events for every \$1.00 spent on medications.<sup>2-4</sup> With the Food and Drug Administration–approval for uses of drugs expanding, more drugs becoming available over

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the counter, and the formularies for drugs ever changing; safely prescribing to the elderly has become increasingly challenging to the osteopathic family physician.

## Polypharmacy defined

A single definition for polypharmacy does not exist. However, there are 2 predominant definitions recognized in the literature. These are the use of 5 or more medications and the use of more medications (even a single medication) than are clinically warranted.<sup>5</sup> According to the second part of this definition, polypharmacy is even the inappropriate use of a single medication. These medications may include prescribed medications, over-the-counter medications, vitamins, or herbals. In studying the use of medication that is not clinically warranted, 1 study found that 60% of 236 ambulatory elderly patients (age 65 years or older) were taking medications with no indication or that were suboptimal.<sup>6</sup> Risk factors for polypharmacy include increased age, frequent healthcare visits and multiple providers, white race, and supplemental insurance.<sup>5</sup> Polypharmacy presents many risks to the patient, including those of inappropriate drug doses, drug-drug interactions, drug-disease interactions, adverse drug events, and nonadherence. Additional consequences of polypharmacy include a higher prevalence of geriatric syndromes, increased morbidity and mortality, and higher medical costs. Studies have also found an association with an increase in hospital admissions and ER visits, functional impairments, malnutrition, dysphagia, an increase risk of falls and fractures, and fatal adverse drug events.<sup>5</sup> One study of community-dwelling older men demonstrated that the use of 6.5 medications was associated with frailty, 5.5 with disability, 4.5 with falls, and 4.5 with mortality.<sup>7</sup>

## More medications = more falls

Polypharmacy is well recognized as a risk factor for fall occurrence in the geriatric population. As the number of medications increases in a geriatric patient's regimen, the risk of functional decline, frailty, and falls increases. Although patients on multiple medications have multiple medical problems, there has proven to be an increased risk of falls, irrespective of the patient's medical problems. Kojima et al. have demonstrated in a longitudinal observational study of geriatric outpatients that logistic regression analysis proved that taking 5 or more medications was significantly associated with an increased risk of falls even when an adjustment was made for age, sex, osteoporosis, and the quantity of comorbid conditions.<sup>8</sup> The exact reason for polypharmacy increasing the risk of falls has not been identified. However, several studies have shown that polypharmacy increases the risk of adverse drug events, interactions between drugs, electrolyte abnormalities, problems with balance, and decrease in elimination of the medications from the body.<sup>9</sup> All These factors may increase the risk of falls. A study analyzing the association

between polypharmacy and hip fracture found that the risk of hip fracture was 23 times greater for patients aged 85 years or older who were taking 10 or more drugs than for patients who were 65-74 years old and were taking 0-1 medication.<sup>9</sup> The risk of hip fracture increases in the elderly as the number of medications being used increases. The increase in risk of falls associated with polypharmacy may also be extrapolated to the younger patients in a family physician's practice. A population-based case-control study that investigated polypharmacy in 335 people between 25 and 60 years of age who suffered a serious fall and compared them with a control population of 352 individuals found that patients in this age group who took 2 or more prescribed medications were 2.5 times more likely to suffer an injury fall than those taking fewer medications.<sup>10</sup> The osteopathic family physician should be aware of the increased risk of falls in any patient with polypharmacy.

## Polypharmacy and cognitive changes

Dr Jerry Gurwitz, director of Meyers Primary Care Institute at UMass and a nationally recognized expert on the safe use of medication in the elderly, has previously stated that "when an elderly patient presents with a status change, unless proven otherwise, it should be assumed to be a medication related problem." Cognition changes in the elderly should be thought to be most likely attributable to medications until another cause is identified. In the hospitalized elderly, delirium commonly causes morbidity and mortality. Medications have been found to be the leading cause of delirium in the elderly in up to 39% of cases.<sup>11</sup> Any medication can cause delirium in the elderly, but certain types of medications are more likely to lead to cognitive changes. These include benzodiazepines, anticholinergics, antidepressants, and opioids.<sup>11</sup> Centrally acting agents increase the risk of delirium. Marcantonio et al. demonstrated that patients taking benzodiazepines are approximately 3 times more likely to develop delirium after surgery.<sup>12,13</sup> Some of the commonly used anticholinergics that should be avoided because of the risk of confusion in the elderly include oxybutynin, diphenhydramine, hydroxyzine, ranitidine, and promethazine. It is also important to inquire about the use of any over-the-counter medications in geriatric patients as most of the sleep aids include diphenhydramine.

Patients with polypharmacy are much more likely to have drug-induced delirium than those without. Along with polypharmacy, several risk factors for delirium in the elderly have been identified in research. These risk factors include 9 or more chronic medications, 12 or more doses of medication per day, 6 or more concurrent chronic dosages, history of a previous adverse drug reaction, low body-weight, age greater than 85 years and an estimated creatinine clearance <50 mL/min.<sup>11,14,15</sup> A regular and complete review of medications by the osteopathic family physician is imperative in the care of the geriatric patient.

This can prevent drug-related cognitive decline or worsening of an underlying dementia.

### **Physiological changes of aging and polypharmacy: acute renal failure**

As we age and drug elimination from the body decreases, drug accumulation and toxicity increases. Most medications exit the body via the kidneys and a decrease in glomerular filtration rate heightens the risk of drug toxicity. This risk indicates that proper prescribing of medications to the elderly requires calculation of the patient's creatinine clearance (using the Cockcroft-Gault equation) and adjusting medications that require renal dosing appropriately. Examples of medications requiring this dosage adjustment include levofloxacin, enoxaparin, cefepime, metformin, piperacillin-tazobactam, and memantine. These are only a few of the many medications that require renal adjustment and should be prescribed only after calculating creatinine clearance and adjusting the dose appropriately in the elderly. Many studies have found a relationship between polypharmacy and acute renal failure. The mortality rate of patients who were hospitalized for acute renal failure is close to 45%.<sup>16</sup> Furthermore, an association between the duration of polypharmacy and the occurrence of acute renal failure has been demonstrated.<sup>16</sup> Osteopathic family physicians may prevent acute renal failure in the geriatric patient by avoiding polypharmacy when prescribing, making dosage adjustments based on the patient's renal function, and not prescribing nephrotoxic medications. Other physiological changes with aging, such as decreased intestinal blood flow, decreased gastric motility, decreased albumin and protein, and reduced metabolic clearance by the liver, are also important considerations when prescribing to the geriatric patient.

### **Prescribing to the geriatric patient: tools for safe prescribing and avoiding polypharmacy**

When prescribing to the geriatric patient there are many modifications in prescribing that may be taken by the osteopathic family physician to avoid polypharmacy. Safely prescribing to the geriatric patient with an acute awareness of the adverse effects of polypharmacy can decrease morbidity and mortality. There are several evidence-based tools that are available to the prescriber and can be easily incorporated into daily practice.<sup>17</sup> The most commonly recognized tool is the Beers Criteria. This list of medications that are considered inappropriate for use in the elderly is created by experts and published with the support of the American Geriatrics Society. The list has been proven as easy to use with little time requirement for decision making when utilized in daily, busy clinical practice.<sup>17</sup> Additionally, these criteria have an easy application that can be integrated into the electronic health record.<sup>18</sup> When the prescriber is choosing a medication to prescribe to a geriatric patient, the record may provide real-time feedback about potential inappropri-

ateness of the use of this medication in the elderly and can provide another alternative to prescribe.<sup>18</sup> This serves as an efficient mechanism to avoid polypharmacy in the clinical setting. Not all medications that may harm the elderly are included in the Beers Criteria because in some situations there is no safer alternative. Budnitz et al. found that 4 medications or medication classes (warfarin, insulin, oral antiplatelet agents, and oral hypoglycemic agents) were related to adverse drug events in the elderly.<sup>18</sup> Although most of these medications are not included in the Beers Criteria, knowledge about possible risks when used in the elderly and understanding the need for close monitoring should allow for safer prescribing by the osteopathic family physician.

In addition to the Beers Criteria, other tools exist to assist physicians with prescribing for the elderly. Two of these include the screening tool to alert doctors to right treatments (START) and the screening tool of older persons' potentially inappropriate prescriptions (STOPP). An interdisciplinary team of primary care physicians, geriatricians, pharmacists, geriatric psychiatrists, and pharmacologists created these tools.<sup>17</sup> The START tool has proven to have a high interrater reliability between physicians and pharmacists.<sup>17</sup> The STOPP tool has 65 indicators that are focused mostly on drug-drug and drug-disease interactions. The items are organized by body system and drug class.<sup>17</sup> As a resource, [Table 1](#) lists some of the most common inappropriately used medications in the geriatric patient as assimilated from a review of the Beers Criteria, START, and STOPP tools.

Consistently reviewing a patient's medications may be the most effective method to decreasing polypharmacy. In 1 study that encouraged Medicare patients to participate in a medication review with their physician, 42% of those participated and 20% reported discontinuation of at least 1 medication after the review. Furthermore, 29% reported a change in dosage and 17% reported that they informed their physician of a new medication. A total of 45% of the physicians in the study reported that they changed their prescribing habits after being involved in the medication reviews.<sup>5</sup>

In conclusion, safe prescribing to the geriatric patient involves an awareness of polypharmacy, recognizing it when it exists, and taking precautions to prevent it. It is important to keep medication regimens as simple as possible with less frequent dosing. Knowing the potential adverse effects of medications and ensuring that there is an indication for each medication being taken by a patient are both important in reducing polypharmacy. Time must be allowed for a thorough review of medications during an office visit and prescriptions must be individualized to the patient with consideration of the pharmacokinetics of the drug, the patient's medical problems, and the patient's hepatic and renal function. The patient or caregiver or both must be educated regarding the treatment, and drug-drug and drug-disease interactions must also be considered. The principle that is taught in geriatric medical education of "start low and go slow" is critical in ensuring that the geriatric patient is on the lowest effective dose of the drug and titrations

**Table 1** Guide to potentially inappropriate medication use in the geriatric patient: some of the most common inappropriately used medications assimilated from the Beers Criteria, START, and STOPP tools<sup>18,19</sup>

Drug name	Bodily system or drug category	Rationale	Recommendation
Promethazine Hydroxyzine Diphenhydramine Oxybutynin Others	Anticholinergic	Risk of anticholinergic effects such as urinary retention, confusion or sedation, dry mouth, constipation, and falls. Increased risk of toxicity with age as clearance decreases.	Avoid
Ranitidine Famotidine Cimetidine Others	H2 receptor antagonists	Risk of CNS effects, confusion, and delirium	Avoid
Alprazolam Diazepam Diazepam Clonazepam Others	Benzodiazepines	Increased risk of falls, fractures, cognitive impairment, and delirium	Avoid (may be required for seizure disorder, end-of-life care, or others). Do not use for insomnia, agitation, or delirium.
Dicyclomine Scopolamine Others	Antispasmodics	Anticholinergic effects such as urinary retention, confusion or sedation, dry mouth, constipation, and falls	Avoid unless needed for palliative or end-of-life care
Nitrofurantoin	Antibiotic	Risk of pulmonary toxicity, no proven efficacy in patients with CrCl <60 mL/min	Avoid in patients with CrCl <60 mL/min, do not use as daily UTI suppression therapy
Doxazosin Terazosin Others	Alpha1 blocker	Risk of orthostatic hypotension and falls	Avoid use in treating HTN
Clonidine Methyldopa Others	Alpha agonist	Risk of orthostatic hypotension, bradycardia, and CNS effects	Avoid group, especially do not use Clonidine as a first-line medication for HTN
Amiodarone Propafenone Sotalol Others	Antiarrhythmic	Evidence demonstrates less risk with rate control than rhythm control in geriatric patients, toxicity risk with amiodarone.	Avoid antiarrhythmics as first-line treatment and choose rate control when treating atrial fibrillation instead
Digoxin	Inotropes/ vasopressors	Higher doses increase the risk of toxicity and increased risk of toxicity with higher doses with age because of decreased renal clearance.	Avoid at doses higher than 0.125 mg/d
Nifedipine, IR Amlodipine Others	Calcium channel blockers	Risk of constipation and hypotension	Avoid
Spirolactone	Potassium-sparing diuretic	Risk of hyperkalemia is increased with age, especially when used with ACEI, ARB, K supplement, etc.	Avoid, especially at doses higher than 25 mg/d and in patients with heart failure or CrCl <30 mL/min
Furosemide Bumetanide	Loop diuretic	Dehydration, electrolyte imbalance, falls, and orthostatic hypotension	Avoid unless using for CHF (safer alternatives as first line for HTN & no evidence of efficacy for dependent ankle edema)
Amitriptyline Imipramine Others	Tertiary TCAs	Risk of sedation, orthostatic hypotension, and anticholinergic effects (urinary retention, confusion, falls, etc)	Avoid

**Table 1** (continued)

Drug name	Bodily system or drug category	Rationale	Recommendation
Citalopram Fluoxetine Paroxetine Others	SSRIs	Risk of hyponatremia may be increased in geriatric patients	Use with caution (monitor Na) and avoid in patients with significant medical history of hyponatremia
Zolpidem Eszopiclone Others	Nonbenzodiazepine hypnotics	Risks similar to benzodiazepines (falls, delirium, etc)	Avoid, especially long term
Insulin, sliding scale	Diabetes treatment	Increased risk of hypoglycemia	Avoid
Glyburide Glipizide Others	Sulfonylureas	Severe hypoglycemia	Avoid, especially long acting
Megestrol	Endocrine/metabolism	Stimulates appetite well but has little effect on weight and has severe risk of thrombotic events and potentially death in geriatric patients	Avoid
Metoclopramide	Prokinetic	Risk of EP effects and tardive dyskinesia, increased in geriatric patients, may exacerbate parkinsonism.	Avoid (use only in gastroparesis and with caution)
Loperamide Diphenoxylate/atropine Others	Antidiarrheal	Risk of delayed diagnosis, risk of toxic megacolon, may exacerbate infection	Avoid
Meperidine	Opioid	Risk of dizziness, orthostatic hypotension, falls, and neurotoxicity	Avoid
Ibuprofen Diclofenac Aspirin > 325 mg Meloxicam Naproxen Indomethacin Others	NSAIDs	Risk of GI bleeding and PUD, risk of nephrotoxicity, may exacerbate HTN	Avoid
Cyclobenzaprine Carisoprodol Metaxolone Methocarbamol Others	Muscle relaxants	Risk of sedation, fracture, and anticholinergic effects	Avoid

CNS = central nervous system; UTI = urinary tract infection; HTN = hypertension; ACEI = angiotensin-converting-enzyme inhibitor; ARB = angiotensin receptor blocker; CHF = congestive heart failure; TCAs = tricyclic antidepressants; SSRIs = serotonin-specific reuptake inhibitors; NSAIDs = nonsteroidal anti-inflammatory drugs; GI = gastrointestinal; PUD = peptic ulcer disease; EP = extrapyramidal.

are made slowly with consideration of the physiology of the patient and the avoidance of polypharmacy.

## References

1. Moen J, Norrgard S, Antonov K, Nilsson J, Ring L. GP's perceptions of multiple medicine use in older patients. *J Eval Clin Pract.* 2010;16:69–75
2. Bressler R, Bahl J. Principles of drug therapy for the elderly patient. *Mayo Clin Proc.* 2003;78:1564–1577
3. Milton J, Hill-Smith I, Jackson S, et al: Prescribing for older people. *Br Med J.* 2008;336:606–609
4. Vandegrift D, Datta A. Prescription drug expenditures in the US: the effects of obesity, demographics and new pharmaceutical products. *South Econ J.* 2006;73(2):515–529
5. DeSevo G, Klootwyk J. Pharmacologic issues in management of chronic disease. *Prim Care Clin Office Pract.* 2012;39:345–362
6. Lipton HL, Bero LA, Ja Bird, McPhee SJ. The impact of clinical pharmacists' consultations on physicians' geriatric drug prescribing. A randomized control trial. *Med Care.* 1992;30:646–658

7. Gnjidic D, Hilmer S, Blyth F, Naganathan V, Waite L, Seibel M, et al: Polypharmacy cutoff and outcomes: five or more medicines were used to identify community-dwelling older men at risk of different adverse outcomes. *J Clin Epidemiol*. 2012;65:989–995
8. Kojima T, Akishita M, Nakamura T, Nomura K, Ogawa S, Iijima K, et al: Polypharmacy as a risk for fall occurrence in geriatric outpatients. *Geriatr Gerontol Int*. 2012;12:425–430
9. Lai S, Liao K, Liao C, Muo C, Liu C, Sung F. Polypharmacy correlates with increased risk for hip fracture in the elderly. *Medicine*. 2010;89(5):295–299
10. Slomski A. Falls from taking multiple medications may be a risk for both young and old. *J Am Med Assoc*. 2012;307(11):1127–1128
11. Catic A. Identification and management of in-hospital drug-induced delirium in older patients. *Drugs Aging*. 2011;28(9):737–748
12. Gray S, Lai K, Larson E. Drug-induced cognition disorders in the elderly. *Drug Saf*. 1999;21(2):101–122
13. Marcantonio ER, Juarez G, Goldman L, Mangione CM, Ludwig LE, Lind L, et al: The relationship of postoperative delirium with psychoactive medications. *J Am Med Assoc*. 1994;272(19):1518–1522
14. Hajjar ER, Hanlon JT, Artz ME, Lindblad CI, Pieper CF, Sloane RJ, et al: Adverse drug reaction risk factors in older outpatients. *Am J Geriatr Pharmacother*. 2003;1(2):82–89
15. Hanlon JT, Pieper CF, Hajjar ER, Sloane RJ, Lindblad CI, Ruby CM, et al: Incidence and predictors of all and preventable adverse drug reactions in frail elderly persons after hospital stay. *J Gerontol A Biol Sci Med Sci*. 2006;61(5):511–515
16. Chang Y, Huang S, Tao P, Chien C. A population-based study on the association between acute renal failure (ARF) and the duration of polypharmacy. *BMC Nephrol*. 2012;13:96
17. Gokula M, Holmes H. Tools to reduce polypharmacy. *Clin Geriatr Med*. 2012;28:323–341
18. Fick D, Semla T. 2012 American Geriatrics Society Beers Criteria: new year, new criteria, new perspective. *J Am Geriatr Soc*. 2012;60:614–615
19. Barry PJ, Gallagher P, Ryan D, O'mahoney D, et al: START (screening tool to alert doctors to the right treatment)—An evidence based screening tool to detect prescribing omissions in elderly patients. *Age Ageing*. 2007;36:632–638