



4-2015

## A comparison of Beers criteria and STOPP criteria in reducing polypharmacy in the elderly.

Gayla A. Barker

[How does access to this work benefit you? Let us know!](#)

Follow this and additional works at: <https://commons.und.edu/theses>

---

### Recommended Citation

Barker, Gayla A., "A comparison of Beers criteria and STOPP criteria in reducing polypharmacy in the elderly." (2015). *Theses and Dissertations*. 6083.  
<https://commons.und.edu/theses/6083>

This Independent Study is brought to you for free and open access by the Theses, Dissertations, and Senior Projects at UND Scholarly Commons. It has been accepted for inclusion in Theses and Dissertations by an authorized administrator of UND Scholarly Commons. For more information, please contact [und.common@library.und.edu](mailto:und.common@library.und.edu).

SP.COL.  
GT2015  
B2554

A comparison of Beers criteria and STOPP criteria in reducing polypharmacy  
in the elderly.

Gayla Ann Barker

University of North Dakota

Independent Study 997



PERMISSION

Title A comparison of Beers criteria and STOPP criteria in reducing polypharmacy in the elderly.

Department Nursing

Degree Master of Science

In presenting this independent study in partial fulfillment of the requirements for a graduate degree from the University of North Dakota, I agree that the College of Nursing of this University shall make it freely available for inspection. I further agree that permission for extensive copying or electronic access for scholarly purposes may be granted by the professor who supervised my independent study work or, in her absence, by the chairperson of the department or the dean of the Graduate School. It is understood that any copying or publication or other use of this independent study or part thereof for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to the University of North Dakota in any scholarly use which may be made of any material in my independent study.

Signature

*Gayla Ann Barker*

Date

4-27-2015

### Abstract

The elderly population is expected to double by the year 2050; currently the elderly are the largest consumer of prescription drugs and over the counter drugs (Ortman, Velkoff & Hogan, 2014). Research shows that one-third of the medications prescribed to the elderly in the United States may be unnecessary and using multiple medications increases the risk of adverse drug reactions (ADRs) in the elderly (Gokula & Holmes 2012). ADRs put a patient at higher risk of hospitalization, which increases cost and can be avoided by decreasing the number of medications prescribed and by decreasing the use of inappropriate medications in the elderly population. The elderly are more prone to adverse reactions from medications due to multiple comorbid conditions, taking multiple medications and an increased sensitivity to medications due to age related changes in their body (Clyne, Bradley, Hughes, Fahey & Lapane, 2012). Appropriate prescribing to the elderly can be challenging and can be improved by using various prescribing tools such as Beers criteria and STOPP (Screening Tool of Older Persons' potentially inappropriate Prescriptions). This paper focuses on a review of the literature that compares Beers criteria and STOPP in reducing polypharmacy in the elderly. Ten articles were reviewed that compared Beers and STOPP, the research articles reviewed were from the United States and other countries. The studies took into account various settings from hospital, emergency department, long term nursing facilities and primary care.

*Keywords:* polypharmacy, Beers criteria, STOPP, adverse drug reactions (ADRs), potentially inappropriate medications (PIMs), potentially inappropriate prescriptions (PIPs), drug related problems (DRP).



### Background

The fastest growing age group in the United States is the elderly, considerable growth is expected to occur in this population up to 2050 in the United States. In 2050, close to 84 million people will be aged 65 or older; almost doubling since 2012 (Ortman, Velkoff & Hogan, 2014). Presently the largest consumers of prescription medications, over-the-counter (OTC) medications and dietary supplements in the United States are older adults. One survey showed that medication use increases with age and approximately 90% of adults over 65 years of age use a minimum of one medication a week. Additionally 44% of men and 57% of women age 65 and older use five or more medications per week, and 12% of men and women older than 65 use in excess of 10 medications per week (Hayes, Schwartz & Barrueto, 2007). Furthermore, reports state that close to 50 new medications are released to the market each year, therefore, older adults will likely remain the largest users of medications due to the increase in marketing directly to the consumer and the focus on living longer; both could increase the dependence on medication therapy (Gokula & Holmes 2012). According to Gokula & Holmes (2012), approximately one-third of the drugs prescribed in the United States may be unnecessary. The number of unnecessary prescription drugs can lead to increased risk of polypharmacy among older adults. Some reasons older adults are at a higher risk of polypharmacy are: use of more medications compared to younger adults, increase comorbid conditions and more physicians are involved in their care.

Patients that use multiple medications have an increased risk of adverse drug events and adverse health outcomes. As the number of medications increase; the risk of adverse drug reactions (ADRs) continues to rise. Adverse drug reactions stem from drug-drug interactions, drug-disease interactions and when inappropriate medications are prescribed in the elderly.

ADRs cause increased hospitalization in the elderly population which is costly and preventable by decreasing the number of medications prescribed and by decreasing the use of inappropriate medications (Gokula & Holmes 2012).

The elderly are sensitive to inappropriate prescribing of medications, polypharmacy and adverse drug events (ADE). Sixty five percent of the elderly have two or more chronic health conditions which require several medications (Clyne et al., 2012). The elderly are also more sensitive to medications due to age-related changes in physiology and body composition which causes changes to pharmacokinetic and pharmacodynamic processes. Therefore prescribing drugs to the elderly can be challenging. Appropriate medications for the elderly must have an evidence-based indication and be well tolerated overall (Clyne et al., 2012). Potentially inappropriate medications (PIMs) are not indicated based on evidence, have higher risk of adverse effects and are not cost effective. PIMs can include medications that are prescribed more frequently, for longer than indicated, medications that have many drug-drug interactions and the under prescribing of medicines that are clinically indicated. Inappropriate prescribing is high in the elderly; estimates vary according to the criteria used to identify PIMs and according to the study. PIMs reportedly range from 18% to 48.7% in ambulatory care, 25% to 54% in hospitalized patients and 37% to 67% in long term nursing facility patients (Clyne et al., 2012). Prescribing inappropriate medications to the elderly can lead to increased morbidity, adverse drug events, increased hospitalizations and mortality. Polypharmacy is common in the elderly. The prevalence in the United States is estimated at 7%. Even though persons 65 years and older make up less than 15% of the population they use 33% of prescription medications and approximately 40% of over-the-counter medications (Clyne et al., 2012).



Early polypharmacy research concentrated on the concurrent use of up to four drugs. However, as the number of concurrently used drugs has increased over time; the current definition for polypharmacy, is the concurrent use of five or more drugs which can lead to increased morbidity and mortality in the elderly (Hovstadius & Petersson, 2012). Additionally, polypharmacy has been associated with increased risks of falls, fractures and cognitive changes. In order to guarantee safe prescribing to the geriatric patient, a clinician must understand certain physiological changes of aging and make dosage adjustments and proper medication selections to avoid adverse events (Compton, 2013).

There are several screening tools available to help guide the clinician in appropriate drug selection. The purpose of this paper is to compare the Beers Criteria and STOPP criteria to determine which tool is more efficient at classifying inappropriate prescribing or potentially inappropriate medication (PIM) use in the elderly. Developed in 2006, the STOPP criteria, was introduced as an alternative to Beers criteria because the Beers criteria included several medications that were not available in European countries (Oliveira, Amorim, de Jesus, Heine, Coqueriro and Passos (2015). However, a lack of confidence still remains regarding STOPP, as questions remain about whether it is applicable to current clinical practice since the updated Beers 2012 criteria was released (Oliveira et al, 2015). The STOPP criteria are divided according to physiological systems and include a list of 65 clinically significant criteria for potentially inappropriate prescribing (PIM). Corsonello et al. (2013) states that the primary differences between the STOPP criteria and Beers criteria are: (1) STOPP is organized by physiological systems and Beers is not; (2) Beers criteria include several drugs not available in European countries, and STOPP evaluates commonly used current drugs available in Europe; (3) STOPP criteria points out potential adverse drug to drug interactions and prescriptions on

duplicate drug classes, and Beers does not; (4) STOPP criteria list several common PIPs that Beers criteria does not address. Additionally, STOPP identifies risk of certain prescriptions when patients have impaired renal function; STOPP specifically addresses serum creatinine and glomerular filtration rate (Corsonello et al., 2013).

Beers criteria was first published in 1991 as a list of potential inappropriate medications (PIMs) for nursing home residents. Over the years the Beers criteria has been expanded to most geriatric settings and updates to Beers criteria were published in 1997, 2003 and 2012. Despite over 20 years of studies in various geriatric settings, many clinicians continue to prescribe these medications to the elderly (Corsonello et al. 2013).

An article by Corsonello et al. (2013) states that throughout the past 20 years numerous research studies on the Beers list has linked increased mortality, increase use of healthcare services, increased adverse drug events (ADEs), decrease in quality of life and functional decline on users of the medication listed on Beers list. Other studies have not supported these findings or reported mixed or negative findings. The most current update to the Beers criteria has categorized PIMs into three groups: group 1- drugs that should always be avoided, group 2- drugs to be avoided according to specific diseases or syndromes and group 3- drugs to be used with caution. One drawback to the Beers criteria is that the list includes several drugs that are not available in Europe (Corsonello et al. 2013).

A case study will be presented which reveals issues associated with polypharmacy in the elderly. The case study includes a focused history, physical assessment, diagnosis and plan. The case study supports the need for a prescribing criteria when treating patients that have polypharmacy issues and how prescribing inappropriate medications can adversely impact a patient's health. In this case study the medications were evaluated with the Beers criteria,



STOPP as well as analyzed by an online unbiased interaction analyzer. Following the case study there will be a comprehensive review of the literature that will compare the current Beers criteria and STOPP criteria. Finally, there will be a discussion of the patients potentially inappropriate medications and an in depth review on the numerous interactions found with the patients medications when analyzed by Beers, STOPP and an unbiased interaction analyzer, along with a plan on how to deal with the inappropriate medications found in this case study.

### Case Report

Eleanor is an 86 year old female that presented to the office for follow up after a 3 day hospitalization for UTI and fatigue. Patient reports new onset of dizziness with position changes. She reports her UTI symptoms have resolved but she is now experiencing orthostatic dizziness. She reports the dizziness last 2-3 minutes then resolves. Her blood pressure (BP) was 80/40 during office visit. She reports she monitors BP at home and stated BP usually runs 140/55. Additionally the patient also reports a recent weight loss of 5-8 lbs. Past medical history is positive for dementia, COPD, HTN, neuropathy, depression, diabetes, iron deficiency anemia, heart failure and UTI. **Review of system reveals:** recent 5-8 lbs weight loss, 1+ edema in bilateral lower extremities, COPD, denies dyspnea, positive for occasional diarrhea, genital urinary: negative for burning, pain or frequency, currently on fourth day of Nitrofurantoin ER 100 mg po bid x 7 days, admits to arthritis in shoulders and hands/fingers, reports stiffness, pain in hands/fingers and shoulders, positive for dizziness, negative for paraesthesia, admits to diabetes, reports FSBS average 150-160 and reports history of iron deficiency anemia.

**Physical exam revealed:** Vital signs: BP: 80/40, HR 50, R 24. Patient is an 86 year old Caucasian female, well developed, well nourished in no apparent distress. Presenting with a chief complaint of dizziness especially with position changes that last 2-3 minutes then resolves. She

denies dizziness during office visit when she transferred from chair to exam table. Pupils equal, round and react to light. Extraocular movements intact. Mucous membranes pink and moist. Heart regular rate and rhythm, S1, S2, bradycardic, no carotid bruits. No audible murmurs, gallops or rubs. 1+ edema noted in bilateral lower extremities. Lungs clear to auscultation. Abdomen is soft non-tender, non-distended. Bowel sounds normal x 4 quadrants, no tenderness to light or deep palpation. No abdominal bruit or palpable masses. Musculoskeletal: arthritic changes noted in hand/fingers. Active ROM present in extremities. Neurologic: Cranial nerves II-XII grossly intact. Patient is awake, alert and oriented x 4. Mood and affect appear normal.

Eleanor is on the following medications: donepezil 5mg po daily, fluticasone propionate/salmeterol 250/50 1 puff bid, Losartan 50 mg po daily, metoprolol 50 mg po bid, gabapentin 300 mg tid, paroxetine 20 mg po daily, quetiapine 200 mg po bid, furosemide 20 mg po daily, insulin glargine 30 units q hs, nitrofurantoin ER 100 mg po bid x 7 days, multivitamin po daily, iron sulfate 325 mg po bid. Drug analysis was performed by an unbiased source and results showed more than 40 risk ratings of level C and 6 level D risk ratings were found. Risk ratings are defined as follows:

Level C: *Monitor Therapy*: Data demonstrate that the specified agents may interact with each other in a clinically significant manner. The benefits of concomitant use of these two medications usually outweigh the risks. An appropriate monitoring plan should be implemented to identify potential negative effects. Dosage adjustments of one or both agents may be needed in a minority of patients (Lexicomp Online, 2015).

Level D: *Consider Therapy Modification*: Data demonstrate that the two medications may interact with each other in a clinically significant manner. A patient-specific assessment must be conducted to determine whether the benefits of concomitant therapy



outweigh the risks. Specific actions must be taken in order to realize the benefits and/or minimize the toxicity resulting from concomitant use of the agents. These actions may include aggressive monitoring, empiric dosage changes, choosing alternative agents (Lexicomp Online, 2015).

**Diagnosis/Plan:** Hypotension (458.9): adverse effects of medications (995.20), sinus bradycardia (427.8), dehydration (276.51), dizziness (780.4) and UTI (599.0).

**Labs ordered/results:** CMP: glucose 147, BUN 23, potassium 3.7, Cholesterol 209, Triglyceride 184, all other values normal; CBC: normal; UA: normal.

Hypotension, bradycardia, dehydration likely can be attributed to use of metoprolol, paroxetine and furosemide. Plan for this patient is to discontinue her metoprolol tartrate 50mg bid and replace with extended release form metoprolol succinate 25 mg daily, and discontinue furosemide and re-evaluate cardiopulmonary status in 1 week, recheck CMP and draw TSH in 1 week. Additionally, patient should increase her po fluids, staff at assisted living to monitor BP daily for orthostatic changes, monitor fluid intake, and call office if BP remains < 110/60, heart rate < 60, increasing edema, dyspnea or increasing dizziness. Patient is to make slow position changes and use assistive devices (walker/cane) for safety.

### Literature Review

This literature review focuses on studies that specifically compare Beers criteria to STOPP criteria to determine which is most effective at identifying potentially inappropriate medications (PIMs) to reduce the risk of adverse drug reactions in the elderly. This literature review consisted of 10 studies which included comparisons of the Beers criteria to STOPP (Screening Tool of Older Persons' potentially inappropriate Prescriptions).

Two studies concluded that Beers (2012) was superior to STOPP in identifying PIMs. One study concluded that Beers (2012) is more useful than STOPP at identifying PIMs independent of diagnoses/condition but STOPP is more useful in detecting PIMs when taking diagnoses/condition into consideration (Blanco-Reina, Ariza-Zafra, Oca~na-Riola, & Leo' n-Ortiz, 2014) .

On the contrary, five studies concluded that STOPP was superior to Beers (2012) in identifying PIMs or potentially inappropriate prescriptions (PIP). Finally, one study found that there was a high rate of PIMs found in the study and that both Beers and STOPP were effective at identifying PIMs and both are valuable tools.

According to Corsonello et al. (2013), both the STOPP and Beers criteria have been evaluated for identifying PIMs and ADRs in an acute geriatric unit in Ireland. Of the 13% that were identified with adverse drug reactions (ADR), 48% were attributable to Beers criteria and 91% were attributable to the STOPP criteria. STOPP was also able to determine significantly more patients that required hospitalization resulting from PIMs than the Beers criteria (Corsonello et al. 2013). Furthermore, the STOPP PIMs have been shown to be associated with adverse drug events (ADE) which cause more hospitalization or urgent acute care visits when compared to Beers (Corsonello et al. 2013). This indicates that STOPP criteria may have increased sensitivity in identifying PIMs that result in ADE than the Beers criteria, therefore the STOPP criteria is thought to be more useful in the clinical setting (Corsonello et al. 2013).

Another study that supports STOPP over Beers is by Curtain, Bindoff, Westbury & Peterson, 2013; this study compared the frequency and type of potential drug related problems (DRP) by comparing the different prescribing criteria. In addition to using STOPP and Beers criteria, this study included results from pharmacist that performed a medication review for DRP



then the pharmacist findings were compared with the results of Beers and STOPP. This study included medication reviews of 570 community dwelling, elderly Australian patients using the Beers', STOPP/START and Prescribing Indicators in Elderly Australians (PIEA). DRPs were identified and recorded using each criteria. Every DRP found was categorized according to various drug classes and/or diagnoses, and then each category was compared to the frequency and type of DRP identified by Beers and STOPP, then against the original pharmacists' findings. Beers identified 399 DRPs; STOPP/START identified 1,032 DRPs and PIEA identified 1,492 DRPs, the pharmacists assessed 862 DRPs (Curtain et al., 2013). The Beers criteria identified the least amount of problems. The authors suggest that Beers lower detection rate is possibly due to Beers was designed to detect PIMs and not designed to identify prescribing omissions. PIEA identified more problems than Beers. Of the criteria evaluated the STOPP/START identification of DRPs were more closely related to pharmacist findings in scope of problem and frequency. This study found that each set of criteria presented was relevant and agreed on high-risk medication classes in the elderly. The researchers stated that combining the strengths of each prescribing criteria may prove beneficial to detect potentially inappropriate prescribing (Curtain et al., 2013).

The study by O'Sullivan et al. 2012 had 3 objectives: 1. Determine the prevalence of potential inappropriate prescriptions (PIP) in older residents living in long term care units 2. Evaluate the appropriateness of the STOPP and Beers' criteria and compare the prevalence of PIP according to each criteria and 3. Explore the association between the occurrence of PIP determined by both tools and the number of medications prescribed. The study included 732 participants age 65 years and older that resided in 14 long term care facilities. Beers' and STOPP criteria were applied to each participant's medication profile to determine the prevalence of PIP.

Results are as follows: 70% of patients had at least one incidence of PIP according to STOPP versus 53.4% according to Beers criteria. STOPP identified 1,289 occurrences of PIP relating to 1,140 potentially inappropriate medications (PIMs), and Beers' criteria identified 833 occurrences of PIP relating to 704 PIMs (O'Sullivan et al. 2012).

An earlier study by Gallagher & O'Mahony (2008), comparing the performance of STOPP with the Beers' criteria in identifying potentially inappropriate medicines (PIMs) and associated adverse drug events (ADEs) in elderly patients on admission to hospital. The study was a prospective study focused on 715 participants with acute admissions to a university teaching hospital over a 4-month period in 2007. The median age of patient was aged 77. The median number of prescriptions prescribed was 6. During this study STOPP identified 336 PIMs involving 247 patients (35%), of these 82 patients presented with a related ADE. Beers' criteria identified 226 PIMs affecting 177 patients (25%), and 43 presented with a related ADE (Gallagher & O'Mahony, 2008). STOPP associated PIMs accounted for 11.5% of all admissions to the hospital and Beers criteria associated PIMs accounted for significantly fewer admissions (6%). Results of the Gallagher & O'Mahony (2008) study show that the STOPP criteria identified a significantly higher percentage of patients requiring hospitalization resulting from a PIM-related adverse events compared to the Beers' criteria. These findings have significant implications for geriatric practice in hospitals, to include but not limited to the following: PIM is highly prevalent in elderly patients admitting to hospital; STOPP identified as least one PIM in 35% of elderly patients presenting for admission; adverse effects of PIMs caused or contributed to the hospital admission in 11.5% of the patients evaluated with the STOPP criteria compared to Beers' 6% (Gallagher & O'Mahony, 2008). Leading to the conclusion that the STOPP criteria is



more sensitive in identifying patients experiencing adverse effects as a result of PIMs when compared to the Beers criteria.

The last study that supports the STOPP criteria over Beers criteria is by Ubeda et al., , 2012. Ubeda and colleagues attempted to identify potentially inappropriate prescribing by comparing the Beers criteria to the STOPP criteria. The study was a descriptive study and reviews of medication and clinical records of 81 participants aged 65 or older. The records were reviewed by the pharmacists in the nursing home. This study concluded that by using STOPP-START criteria to identify potential inappropriate prescribing (PIP) resulted in a significant positive correlation between the number of medicines prescribed and the number of PIP detected in this study (Ubeda et al., 2012). Finally, the STOPP criteria detected higher numbers of PIP medications than the Beers criteria.

A cross-sectional study in a primary care setting was conducted to determine the prevalence of potentially inappropriate medications (PIMs) using a comparative analysis between STOPP, the 2003 Beers criteria and the 2012 Beers criteria. This study included 407 participants, aged 65 years and older, all lived in the community on an island in Lanzarote, Spain. The rate of PIMs were evaluated by examining 1,872 prescriptions with the STOPP, Beers 2003 and Beers 2012 criteria. Multivariate logistic regression was used to determine the factors as related to the PIMs. Findings for PIMs were as follows: 2003 Beers (24.3%), STOPP (35.4%), and 2012 Beers (44%) (Blanco-Reina, Ariza-Zafra, Ocana-Riola, & Leon-Ortiz 2014). The PIMs most frequently reported in both Beers criteria were benzodiazepines and on STOPP was aspirin. This study concluded that the 2012 Beers criteria was superior in identifying more PIMs compared to the STOPP criteria as well as when compared to the 2003 Beers criteria (Blanco-Reina et al., 2014).

Research completed by Oliveira et al (2015) focused on assessment of the prevalence of PIMs using the STOPP criteria compared to the 2012 Beers criteria. The study was a prospective survey and included 142 participants which were randomly selected through systematic sampling. Evaluation for PIMs were applied by using the Beers and STOPP criteria. Since the study was based in Brazil, all medications included were assessed for availability in Brazil. Results showed the prevalence of PIM use in the sample was 33.8% with STOPP and 51.8% with the Beers criteria (Oliveira et al, 2015). The study concluded that the 2012 Beers criteria identified more PIMs than the STOPP criteria. However, the researchers stated that whether the 2012 Beers criteria or STOPP criteria is used, the prevalence of PIM was high, therefore both criteria could be used as a tool to improve the use PIM in the elderly (Oliveira et al, 2015) .

Hudhra and colleagues completed a study to measure the frequency of potential inappropriate prescriptions (PIP) in the elderly at hospital discharge using the 2012 Beers and STOPP criteria. This cross sectional study consisted of a random sample of 624 patients with a median age of 78 years that were discharged from a hospital. Three outcomes measures were obtained: (1) prevalence of PIP according to each criteria and its 95% confidence interval, globally and stratified for the different categories of study variables; (2) the degree of agreement between the two criteria using Kappa statistics and (3) the drugs most commonly found in PIP in both criteria. This study included, the overall frequency of PIP of Beers criteria 22.9% of the patients had at least one PIP and with STOPP 38.4%, patients with prescriptions inappropriate for both criteria was 13.6% (Hudhra et al, 2014). PIP frequencies were found to be higher for patients discharged from internal medicine. PIP were increased with the Charlson Comorbidity Index and with the number of prescribed drugs. PIP did not increase with gender, age or length



of hospital stay (Hudhra et al, 2014). Overall, the study found that according to both the Beers and STOPP criteria, if intervention was taken on the two drugs most often repeated in Beers and STOPP the alpha blockers and NSAIDS could reduce the frequency of PIP by 30% with Beers and 25% with STOPP criteria (Hudhra et al, 2014).

An Indian study compared Beers criteria and STOPP for prevalence, specificity, sensitivity and predictors for PIM use. The study was a prospective active surveillance study from June 2009 through Feb 2010. This study was performed in a teaching hospital Mysore, India. Participants included 540 patients age 60 or older. Patients were reviewed daily for medication use and ADR while hospitalized. Comparisons were made using Pearson's C2 test and Mann-Whitney U-test. Bivariate analysis and subsequent multivariate logistic regression was used to identify the predictors of PIM use. The study concluded that Beers criteria is useful in detecting PIM independent of diagnoses/condition but STOPP is useful in detecting PIMs use when taking diagnoses/condition into account. Overall, the Beers criteria was more sensitive and specific in detecting PIM when compared to STOPP (Vishwas, Harugeri, Parthasarathi & Ramesh, 2012).

The purpose of the study performed by Grace and colleagues was to determine the prevalence of PIM administered in nursing home patients aged 65 years and older presenting to the emergency department using the Beers and STOPP criteria. To compare the Beers and STOPP criteria and to establish the role of PIMs in reason for emergency department visit. The study was carried out in an urban tertiary referral hospital and the participants were acutely ill long term care patients requiring medical care at the emergency department. There were 195 nursing home residents that required visits to ED but 165 participants included in the study. The study was a retrospective cohort study and the information was obtained from the electronic

medical records on all participants that required visits to ED in 2011. Mean age of participants was 82.5, 110 (66.7%) were female and 157 (95.2%) were taking a minimal of 1 PIM based on either criterion. One hundred forty patients (84.8%) were taking PIM according to STOPP criteria and 147(89.1%) according to Beers criteria (Grace et al 2014). Medications that were identified as inappropriate varied according to Beers and STOPP criteria in 148 (89.7%) (Grace et al 2014). According to Grace et al. 2014, a relationship was found in 50 patients (30.3%) between ED visit and the PIM medication they were taking. Seven (4.2%) were found to have a “probable” link and 45(27.3%) a “possible” link (Grace et al 2014). Overall, there were increased rates of PIM found in this cohort, Beers and STOPP are thought to be an effective tool for identifying PIMs and a beneficial for physicians arranging care for nursing home residents and may reduce ED visits (Grace et al., 2014).

### Discussion

In Eleanor’s case there are several moderate to high risk medications and interactions among her medications that puts her at a high risk of adverse drug reactions (ADR). These numerous interactions possibly originate from Eleanor being inappropriately prescribed medications. In addition to the medication risk discussed in the above case study, when Eleanor’s medications were reviewed using the Beers criteria (2012), quetiapine, nitrofurantoin and paroxetine medications were listed as potentially inappropriate medications (PIMs). Rationale given by Beers list was Quetiapine is a second generation antipsychotic, it can increase risk of cerebrovascular accident (CVA) and mortality in persons with dementia. Beers list supports the use of quetiapine for behavioral problems occurring along with dementia, only when other options have failed or patient is a threat to self or others (Campanelli, 2012). Nitrofurantoin is also listed on Beers list as a medication to avoid in the elderly, due to the potential for pulmonary



toxicity and because safer alternatives are available. Eleanor has COPD; therefore, nitrofurantoin would be inappropriate based on this diagnosis alone. Lastly, Beers criteria suggest to avoid paroxetine due to the drug's strong anticholinergic effects, avoid due to CNS effects, may exacerbate or cause SIADH or hyponatremia and sodium levels should be monitored closely when starting or changing doses of paroxetine (Campanelli, 2012). When the STOPP criteria was used to evaluate the medications, metoprolol was listed as PIM. When reviewing Eleanor's medication with the STOPP criteria metoprolol is recommended to be avoided in diabetics due to risk of masking hypoglycemic symptoms (O'Mahony et al., 2014). In reviewing the case study of Eleanor, using the unbiased interaction analyzer; additional interactions were found and put her at even more risk for adverse drug reactions. For example, metoprolol and paroxetine has a risk rating of D, this combination can cause metoprolol toxicity leading to hypotension and bradycardia (Lexicomp Online, 2015). Eleanor presented with both hypotension and bradycardia on exam. According to Parker & Soberman (2011), metabolism of metoprolol is significantly inhibited by paroxetine which can lead to an increase in degree and extent of blockade. Therefore, if paroxetine treatment is needed in a patient that is taking metoprolol, use of the extended release form of metoprolol is recommended and patient should be monitored for adverse effects. Eleanor is most likely taking metoprolol tartrate since she is taking it twice daily. She should be switched to metoprolol succinate the extended release form of metoprolol. Furthermore, quetiapine (highest risk QTc-Prolonging Agents), paroxetine and salmeterol which are both (intermediate risk QTc-Prolonging Agents). Finally, there is a level C risk interaction rating for metoprolol and furosemide which can lead to hypotension, hypokalemia and bradycardia (Parker & Soberman, 2011).

These issues were addressed as follows in Eleanor's plan: discontinue her metoprolol tartrate 50mg bid and replace with extended release form metoprolol succinate 25 mg daily, and discontinue furosemide and re-evaluate cardiopulmonary status and check CMP in 1 week.

### Learning Points

- STOPP criteria identified more PIMs that lead to the patient being hospitalized and STOPP's PIMs were associated with ADE which caused patients to seek urgent care or hospitalization.
- **Differences between Beers 2012 and STOPP**
  - STOPP is organized by physiological systems and Beers is organized by Organ System/ Therapeutic Category/Drug(s).
  - Beers criteria include several drugs not available in European countries, and STOPP evaluates commonly used current drugs available in Europe. Therefore, STOPP may be more versatile and easier to use in European countries.
  - STOPP criteria points out potential adverse drug to drug interactions and prescriptions in duplicate drug classes, and Beers does not.
  - STOPP criteria lists several common PIPs that are absent in the Beers criteria .
  - STOPP identifies risk of certain prescriptions when patient has impaired renal function specifically as related to serum creatinine and glomerular filtration rate (Corsonello, Onder, Abbatecola, Guffanti, Gareri & Lattanzio, 2013).
- Regarding Eleanor's case study: Beers identified 3 medications (quetiapine, nitrofurantoin and paroxetine) compared to STOPP's 1 medication (metoprolol). The unbiased interaction analyzer was found to be very beneficial in identifying specific interactions



along with symptoms associated with the drug-drug interaction and in this case was very valuable in directing the plan of action for Eleanor's case study.

- The prevalence of PIM was high for both criteria, perhaps using both Beers and STOPP would prove to be the best solution to reduce PIMs in the elderly since they complement each other. Beers and STOPP are both effective at identifying PIMs and can be used as valuable tools for prescribers.

### References

- Blanco-Reina, E., Ariza-Zafra, G., Ocana-Riola, R. & Leon-Ortiz, M. (2012). American Geriatrics Society Beers criteria: enhanced applicability for detecting potentially inappropriate medications in European older adults? A comparison with the Screening Tool of Older Person's Potentially Inappropriate Prescriptions. *Journal of Applied Gerontology*, 62(7):1217-23. doi: 10.1111/jgs.12891.
- Campanelli, C. M. (2012). American Geriatrics Society Updated Beers Criteria for Potentially Inappropriate Medication Use in Older Adults: The American Geriatrics Society 2012 Beers Criteria Update Expert Panel. *Journal of the American Geriatrics Society*, 60(4), 616-631. doi:10.1111/j.1532-5415.2012.03923.x
- Curtain, C.M., Bindoff, I.K., Westbury, J.L. & Peterson, G.M. (2013). A comparison of prescribing criteria when applied to older community-based patients. *Drugs Aging*, 30(11):935-43. doi: 10.1007/s40266-013-0116-6.
- Corsonello, A., Onder, G., Abbatecola, A.M., Guffanti, E.E., Gareri, P., & Lattanzio, F. (2013). Explicit criteria for potentially inappropriate medications to reduce the risk of adverse drug reactions in elderly people From Beers to STOPP/START Criteria. *Drug Safety*. 35 (1): 21-28. doi: 10.1007/BF03319100.
- Compton, R. D., (2013). Polypharmacy concerns in the geriatric population. *Osteopathic Family Physician* (2013), 5(4), 147-152. doi:10.1016/j.osfp.2013.02.002

- Clyne, B., Bradley, M.C., Hughes, C., Fahey, T., Lapane, K.L. (2012). Electronic prescribing and other forms of technology to reduce inappropriate medication use and polypharmacy in older people: A review of current evidence. *Clinical in Geriatric Medicine*, 28: 301–322. doi: 10.1016/j.cger.2012.01.009.
- Gallagher, P. & O'Mahony, D. (2008). STOPP (Screening Tool of Older Persons' potentially inappropriate Prescriptions): application to acutely ill elderly patients and comparison with Beers' criteria. *Age Ageing* (2008) 37 (6): 673-679 first doi:10.1093/ageing/afn197
- Gokula M, H. H. (2012). Tools to reduce polypharmacy. *Clinics in Geriatric Medicine.*, 28(2), 323. doi: 10.1016/j.cger.2012.01.011
- Grace, A.R., Briggs, R., Kieran, R.E., Corcoran, R.M., Romero-Ortuno, R., Coughlan, T.L., O'Neill, D., Collins, R., & Kennelly, S. P. (2014). A comparison of beers and STOPP criteria in assessing potentially inappropriate medications in nursing home residents attending the emergency department. *Journal of the American Medical Directors Association*. 15(11):830-4. doi: 10.1016/j.jamda.2014.08.008.
- Hayes, B.D., Schwartz, W., & Barreto, F. (2007). Polypharmacy and the geriatric patient *Clinics in Geriatric Medicine* (2007) 23: 371–390
- Hudhra, K., García-Caballos, M., Jucja B, Casado-Fernández E., Espigares-Rodriguez, E., & BuenoCavanillas,A.(2014).Frequency of potentially inappropriate prescriptions in older people at discharge according to Beers and STOPP criteria. *International Journal of Clinical Pharmacy*. 36(3):596-603. doi: 10.1007/s11096-014-9943-8.



Hovstadius, B, & Petersson, G. (2012). Factors leading to excessive polypharmacy. *Clinical in Geriatric Medicine*, 28(2):159-72. doi: 10.1016/j.cger.2012.01.001.

Lexicomp Online, Interaction Analysis, Hudson, Ohio: Lexi-Comp, Inc.; 2015; April 2, 2015.

Oliveira, M.G., Amorim, W.W., de Jesus, S.R., Heine, J.M., Coqueiro, H.L., & Passos, L.C.

(2015). A comparison of the Beers and STOPP criteria for identifying the use of potentially inappropriate medications among elderly patients in primary care. *Journal of Evaluations in Clinical Practice*, 21(2):320-5. doi: 10.1111/jep.12319.

O'Mahony, D., O'Sullivan, D., Byrne, S., O'Connor, M. N., Ryan, C., & Gallagher, P. (2014).

STOPP/START criteria for potentially inappropriate prescribing in older people: version 2. *Age and ageing*, 44(2):213-8. doi: 10.1093/ageing/afu145. O'Sullivan, D. P.,

O'Mahony, D., Parsons, C., Hughes, C., Murphy, K., Patterson, S., & Byrne, S.

(2013). A prevalence study of potentially inappropriate prescribing in Irish long-term care residents. *Drugs & Aging*, 30(1), 39-49. DOI 10.1007/s40266-012-0039-7.

Ortman, Jennifer M., Victoria A. Velkoff, and Howard Hogan (2014). *An Aging Nation: The Older Population in the United States*, Current Population Reports, 25-1140. U.S. Census Bureau, Washington, DC. Retrieved from <http://www.census.gov/prod/2014pubs/p25-1140.pdf>

Parker, R.B. & Soberman, J.E. (2011). Effects of paroxetine on

the pharmacokinetics and pharmacodynamics of immediate-release and extended-release metoprolol. *Pharmacotherapy*, 31 (7): 630-41. doi: 10.1592/phco.31.7.630.

Ubeda, A., Ferrándiz, L., Maicas, N., Gomez, C., Bonet, M., Peris, J.E. (2012). Potentially

inappropriate prescribing in institutionalized older patients in Spain: the STOPP-START criteria compared with the Beers criteria. *Pharmacy Practice (Granada)* (2012), 10(2):83-91. doi:10.1093/ageing/afn197

Vishwas, H.N., Harugeri, A., Parthasarathi, G., & Ramesh, M. (2012). Potentially inappropriate medication use in Indian elderly: comparison of Beers' criteria and Screening Tool of Older Persons' potentially inappropriate Prescriptions. *Geriatrics & Gerontology International*, 12(3):506-14. doi: 10.1111/j.1447- 0594.2011.00806.x.