



## Brief Report

## Potentially inappropriate medication prescribing in the elderly: Is the Beers Criteria relevant in the Emergency Department today?



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## ABSTRACT

**Study objective:** To investigate the frequency of Beers Criteria (BC) medication and opioid use in patients age 65 years and older arriving in the Emergency Department.

**Methods:** We performed a retrospective observational study of a convenience sample of 400 patients, age 65 years and older, arriving to and discharged solely from the Emergency Department. We examined 400 sequential patient charts with visit dates April–July 2017, for the presence of a Beers Criteria medication or opioid prescription. We also examined each chart for nine specific chief complaints, including return visits and subsequent admissions.

**Results:** Of the 400 patients included in this study, 304 patients (76%; 95% confidence interval [CI] 72% to 80%) had at least 1 prescription at the index ED visit for an “avoid” or “use with caution” Beers Criteria medication. Of these patients, 194 (64%; 95% CI 58% to 69%) had  $\geq 2$  Beers medication prescriptions and 122 patients (40%; 95% CI 35% to 46%) had  $\geq 3$  Beers medication prescriptions. We found no difference in the number of patients with a chief complaint of interest between the BC medication list (28%) and lacking a BC medication (29%) ( $p$ -value = 1). No patients returned in the next 7 days for a medication-related complaint.

**Conclusion:** The results of this study call into question the routine application of lists without high-quality evidence to critique the prescribing of certain medications. Further patient-oriented study of the relevance of the Beers Criteria list, especially in light of the changed face of medication profiles and populations, is called for.

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## 1. Introduction

Inappropriate medication prescribing in the elderly has been shown to be a significant and persistent problem [1]. To address this issue, in 1991, Beers and colleagues developed explicit criteria for potentially inappropriate medications thought to have specific adverse effects in the elderly; this became known as the Beers Criteria (BC) [2]. The Beers Criteria contains categories of: avoid, use with caution, adjust based on renal function, and drug-drug interactions [2]. These criteria, however, were initially created based mainly on the consensus of a small group of experts rather than specific scientific evidence and clinical data, therefore not completely taking into account the GRADE framework for providing high quality, evidence-based recommendations [2–5]. Due to this, along with an inconsistent association between BC medications and subsequent adverse events in the elderly (particularly in medications with potentially limited therapeutic benefit), the clinical

relevance of the Beers criteria has been questioned, especially in the setting of the Emergency Department (ED) [6].

In subsequent years, medication prescribing has changed considerably. The U.S. is in the midst of an epidemic of opioid-related deaths that was not present when Beers' group made their list, and at-risk prescribing is felt to be the root cause [7]. Opioid analgesics are known to have a clear therapeutic use in pain relief; however, are accompanied by a long list of adverse effects [8–10]. Polypharmacy in the elderly, though now being examined more closely, remains a significant issue [1].

## 1.1. Goals of this investigation

The three goals of this study are: to examine the frequency of elderly ED patients with outside prescriptions for BC medications, determine which BC medications presented most often, and to investigate the prevalence of opioid use in this population. Although the Beers Criteria does not include a section for opioid analgesics, these medications have been associated with a higher risk of fall and fracture, as well as noted to have increased central nervous system (CNS) effects in the elderly, due

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to age-related pharmacokinetic and pharmacodynamic changes [8–10]. Due to these concerning side effects, we found the prevalence of opioid prescriptions in this population important to examine.

## 2. Methods

### 2.1. Study design and selection of participants

We performed an IRB-approved retrospective observational study of a convenience sample of 400 sequential patients, age 65 years and older, arriving to and discharged solely from the Emergency Department of our Midwestern trauma center from April through July 2017. Patients seen in the ED multiple times within this timeframe were not duplicated in the study data, and only their most recent visit was included. Admitted patients were not included.

### 2.2. Methods of measurement

For each chart, two research assistants independently examined the medication list on file, including medications prescribed according to their ED visit in question, for the presence of medications listed on the 2015 Beers Criteria as well as any opioids. Medications on the Beers Criteria designated as “always avoid” and “use with caution” (aside from medications requiring dosage adjustments based on renal function) were included in this study. If a BC or opioid medication did not appear in the patient’s list of current prescriptions, said patient was documented in our data collection as not taking either medication type. To assess interrater reliability, a random sample of 60 patient charts were reabstracted by an additional research assistant; interrater agreement was found to be 96.7% ( $\kappa = 0.93$ , 95% confidence interval [CI] of 84% to 100%) regarding data collected.

We also examined each chart for 9 specific chief complaints proposed to be adverse effects of BC medications: altered mental status, bradycardia, fall, fatigue, fracture status post fall, hypoglycemia, hypotension, syncope, and weakness [2].

To investigate an incidence of a new BC medication (prescribed at the index ED visit) creating an adverse event, we examined patient charts for return ED visits within 7 days of discharge from the initial visit, as well as any subsequent admissions.

### 2.3. Primary data analysis

Data were analyzed using descriptive statistics. The 95% confidence intervals were constructed using large sample approximation to normal distribution or exact method in the case of a small sample size. Chi-square test was performed to compare the proportions.  $p$ -Value  $< 0.05$  was considered as statistically significant. Clinical significance was not ascertained.

## 3. Main results

Of the 400 patients included in this study, 304 patients (76%; 95% confidence interval [CI] 72% to 80%) had at least 1 prescription for an “avoid” or “use with caution” Beers medication. Of these 304 patients, 194 (64%; 95% CI 58% to 69%) had  $\geq 2$  Beers medication prescriptions and 122 (40%; 95% CI 35% to 46%) had  $\geq 3$  Beers medication prescriptions.

Among the 724 unique prescriptions of 2015 Beers Criteria medications, the most commonly prescribed medications were: gabapentin (7%), tramadol (7%), lorazepam (4%), ibuprofen (4%), diphenhydramine (3%), and alprazolam (3%) (Fig. 1). All other prescribed BC medications (categories including anticoagulants, antihistamines, hypnotics, proton pump inhibitors, non-opioid analgesics, antidepressants, etc.) made up a smaller percentage of the overall prescriptions.

In examining the patients ( $n = 197$ ) taking BC medications listed as “avoid,” we found that 152 patients (77%; 95% CI 71% to 83%) were

prescribed  $\geq 2$  medications and 106 patients (54%; 95% CI 47% to 61%) were prescribed  $\geq 3$ . Among the 316 prescriptions of “avoid” Beers Criteria medications, the most commonly prescribed were: lorazepam (9%), ibuprofen (9%), diphenhydramine (7%), alprazolam (6%), clonazepam (6%), and meclizine (5%) (Fig. 2). All other prescribed “avoid” BC medications made up a smaller percentage of the overall “avoid” prescriptions.

In the study group, an opioid with concomitant BC medication was more common (115 patients; 29%) than an opioid prescription alone (13 patients; 3%).

We found no difference in the prevalence of a chief complaint of interest between the patients taking a BC medication (28%) versus lacking a BC medication (29%) ( $p$ -value = 1, Fig. 3, Table 1). While 13 patients returned to the ED within 7 days of discharge, no patients returned due to a medication-related complaint.

Of the 128 patients with 1 or more opioid prescriptions, 37 patients (29%; 95% CI 21% to 37%) had a chief complaint of concern, same as the population studied, with 81% of those chief complaints listed as “fall” or “weakness.” Of the 13 opioid-only patients, 4 patients (31%; 95% CI 9.1% to 61%) had a chief complaint of concern, also most commonly “fall” or “weakness.”

## 4. Discussion

Although a major concern for prescribing medications listed as “always avoid” on the Beers Criteria is adverse events, our study found no correlation between chief complaint and Beers Criteria medication prescriptions. In our study population, patients taking Beers Criteria medications did not have more numerous Emergency Department visits compared to those not on such medications, and zero patients prescribed a BC medication upon discharge from the ED returned within 7 days with a newly-prescribed medication-related complaint.

Although the Beers Criteria has been adjusted multiple times since its initial creation, it has yet to be completely overhauled to include scientific evidence for its recommendations [3,4]. These criteria were based solely on the results of surveyed experts (GRADE Evidence Level D), rather than the data of specific scientific studies [2,5]. Several studies have found no significant difference in outcome between patients taking a BC medication and those who are not [11–14]. In a 2013–2014 national study examining Emergency Department visits for adverse drug events, Shehab et al. found that only 1.8% of ED visits for adverse drug events were due to medications identified by the Beers Criteria as “always avoid” [14]. A Canadian study examining the incidence of fall events in patients taking benzodiazepines listed on the Beers Criteria found no significant difference in risk of falls between those patients and the control [11].

The current Beers Criteria appears to have limited applicability to the Emergency Department in particular. Hustey commented on the limited scientific data to support strict use of the Beers Criteria in the ED, especially with regards to one-time doses of BC medications versus long-term prescriptions [6].

### 4.1. Special note on opioids

The landscape of prescribed medications has shifted considerably since the original Beers Criteria list was generated; neuropsychiatric drugs are common and opioid prescribing increased markedly, even in the elderly [15]. Despite data suggesting that opioids are a significant risk for the elderly, a population known to have a high rate of polypharmacy, the Beers Criteria does not include this class of medication [1,2,4,16]. The reasons for this gap are lost to antiquity; theories include previous prescribing habits frowned on the use of opioids in the elderly. Several studies have demonstrated the increased risk of fractures and falls associated with opioid use, particularly in the elderly population [8,17]. Budnitz et al. listed opioid-containing analgesics as one of the top five classes of medications found to be related to adverse drug events as well as hospitalizations due to adverse drug events [12].

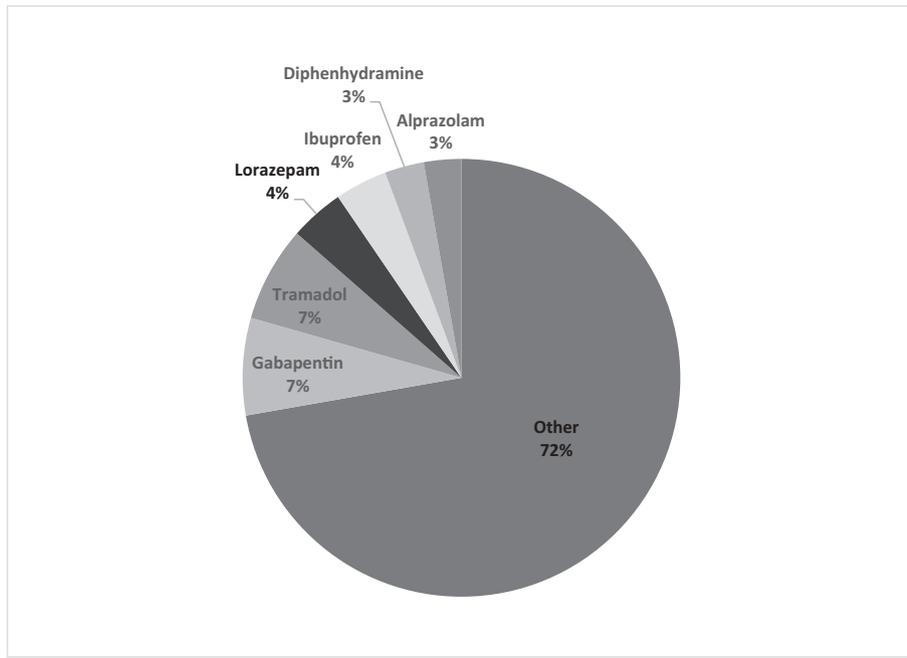


Fig. 1. Most commonly prescribed Beers Criteria medications. The “other” category includes less commonly prescribed Beers Criteria medications seen in our study population.

Shehab et al. noted that among the patients at or above 65 years of age, 59.9% of ED visits in 2013–2014 were due to anticoagulants, diabetic agents, and opioids [14].

Through personal communication, we found that emergency physicians on staff at our hospital frequently and erroneously believed opioids to be included in the Beers Criteria as an “avoid” medication class due to the known increased fall risk for the elderly. In our study population, we found that 32% of patients had at least 1 opioid prescription; this population had their opioid meds prescribed prior to ED attendance.

Limitations to this study include a timeframe of visits within a 4-month period as well as a population of 400 sequential patients from

our Midwestern trauma center. Also, because this was a retrospective chart review, we are unable to verify the accuracy and completeness of the medication reconciliation record for each patient. Additionally, medications may have been prescribed but not listed, resulting in underestimation. Renal function was not separately queried for this study so patients with decreased renal function may have been missed. Although we examined patient charts for return visits within 7 days of discharge, patients may have chosen to be seen at an outside ED, thus potentially altering the study findings.

In summary, with this information, it may be time to reexamine the relevance of the Beers Criteria in medication prescribing, especially in

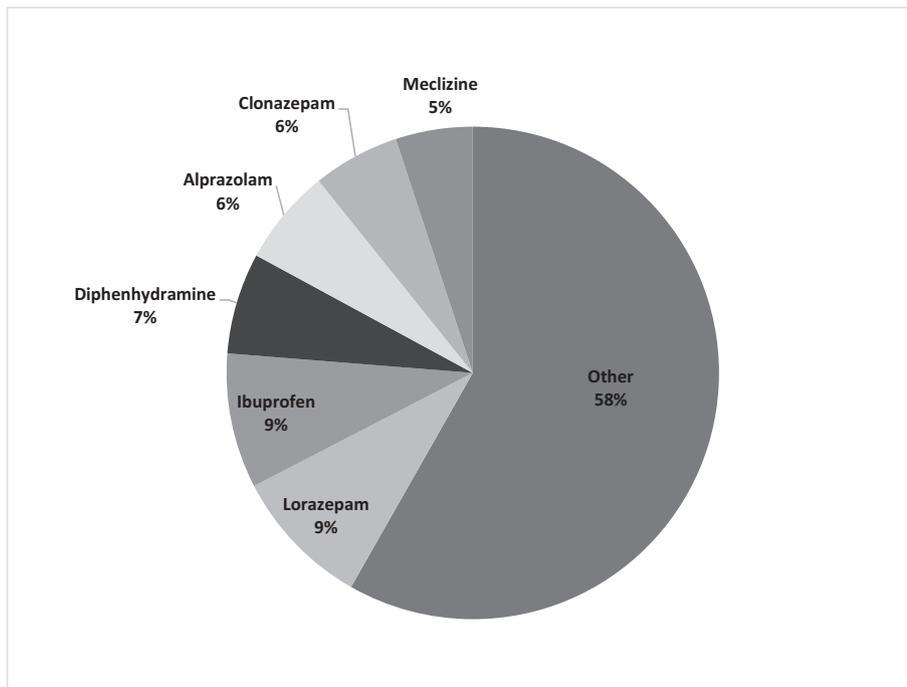
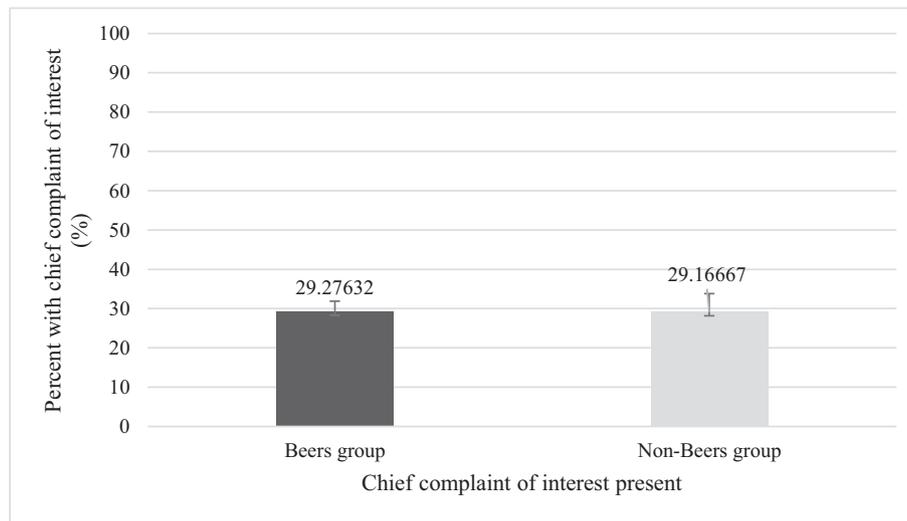


Fig. 2. Most commonly prescribed “avoid” Beers Criteria medications. The “other” category includes less commonly prescribed Beers Criteria medications seen in our study population.



**Fig. 3.** Chief complaint prevalence between groups. The prevalence of the nine selected chief complaints of interest were compared among patients with and without a Beers Criteria medication prescription. No statistical significance ( $p$ -value = 1) was identified.

the ED. Despite the Beers Criteria being widely disseminated, it appears to be equally widely ignored. We were unable to document harm from this flaunting of the recommendations, but the study is underpowered to draw this conclusion with great confidence. Because Emergency Physicians are in the unique position of providing one-time or very short-term BC medications, those medications defined “potentially inappropriate” may indeed be an appropriate choice after all. Other medications not identified by the BC as potentially harmful, such as opioid analgesics, should still be used with caution in the elderly population. Although the medications on the Beers Criteria may still have potentially concerning side effects in the elderly, this list may not have the occurrence of side effects as previously believed by the Beers Criteria founders. A future longitudinal prospective study is indicated to ascertain whether the Beers Criteria is relevant, especially in light of the changed face of medication profiles and given current population-level consumption of pharmaceuticals.

#### Author contributions

RM and TB conceived the study. RM and CHR advised the study design and supervised the data collection. LH and EO performed data collection and ensured quality control. CJ performed data analysis. LH drafted the manuscript. All authors contributed significantly to manuscript revision. RM takes responsibility for the manuscript overall.

**Table 1**

Chief complaints of interest compared with presence of Beers Criteria medication prescription.

Chief complaint	Number of patients taking 1+ Beers medication with chief complaint	Number of patients not taking any Beers medication with chief complaint
AMS	13	2
Fall	38	14
Fatigue	5	0
Fracture s/p fall	7	3
Syncope	8	5
Weakness	18	4
<b>Total</b>	<b>89 (of 304 total patients) (28%)</b>	<b>28 (of 96 total patients) (29%)</b>

AMS = altered mental status.

Zero patients in either group presented with complaints of bradycardia, hypoglycemia, or hypotension. The prevalence of the remaining six selected chief complaints of interest were compared between patients taking any Beers Criteria medication or not. No statistical significance ( $p$ -value = 1) was identified.

#### Declaration of Competing Interest

None of the authors have conflicts of interest to declare in regards to this manuscript.

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