**Supplemental Table 1. Example of 2015 American Geriatrics Society Beers Criteria for Potentially Inappropriate Medication (PIM) Use in Older Adults**

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| --- | --- | --- | --- | --- |
| **Organ System, Therapeutic Category, Drug(s)** | **Rationale** | **Recommendation** | **Quality of Evidence** | **Strength of Recommendation** |
| **Anticholinergics** | | | | |
| First-generation antihistamines:  Brompheniramine  Carbinoxamine  Chlorpheniramine  Clemastine  Cyproheptadine  Dexbrompheniramine  Dexchlorpheniramine  Dimenhydrinate  Diphenhydramine (oral)  Doxylamine  Hydroxyzine  Meclizine  Promethazine  Triprolidine | Highly anticholinergic; clearance reduced with advanced age, and tolerance develops when used as hypnotic; risk of confusion, dry mouth, constipation, and other anticholinergic effects or toxicity  Use of diphenhydramine in situations such as acute treatment of severe allergic reaction may be appropriate | Avoid | Moderate | Strong |
| Antiparkinsonian agents  Benztropine (oral)  Trihexyphenidyl | Not recommended for prevention of extrapyramidal symptoms with antipsychotics; more-effective agents available for treatment of Parkinson disease | Avoid | Moderate | Strong |
| Antispasmodics:  Atropine (excludes ophthalmic)  Belladonna alkaloids  Clidinium-Chlordiazepoxide  Dicyclomine  Hyoscyamine  Propantheline  Scopolamine | Highly anticholinergic, uncertain effectiveness | Avoid | Moderate | Strong |
| **Antithrombotics** | | | | |
| Dipyridamole, oral short-acting (does not apply to the extended-release combination with aspirin) | May cause orthostatic hypotension; more-effective alternatives available; IV form acceptable for use in cardiac stress testing | Avoid | Moderate | Strong |
| Ticlopidine | Safer, effective alternatives available | Avoid | Moderate | Strong |
| **Anti-Infective** | | | | |
| Nitrofurantoin | Potential for pulmonary toxicity, hepatotoxicity, and peripheral neuropathy, especially with long-term use; safer alternatives available | Avoid in individuals with creatinine clearance <30 mL/min or for long-term suppression | Low | Strong |
| **Cardiovascular** | | | | |
| Peripheral alpha-1 blockers  Doxazosin  Prazosin  Terazosin | High risk of orthostatic hypotension; not recommended as routine treatment for hypertension; alternative agents have superior risk/benefit profile | Avoid use as an antihypertensive | Moderate | Strong |
| Central alpha-blockers  Clonidine  Guanabenz  Guanfacine  Methyldopa  Reserpine (>0.1 mg/d) | High risk of adverse CNS effects; may cause bradycardia and orthostatic hypotension; not recommended as routine treatment for hypertension | Avoid clonidine as first-line antihypertensive  Avoid others as listed | Low | Strong |
| Nifedipine, immediate release | Potential for hypotension; risk of precipitating myocardial ischemia | Avoid | High | Strong |
| **Diabetes** | | | | |
| Insulin, sliding scale | Higher risk of hypoglycemia without improvement in hyperglycemia management regardless of care setting; refers to sole use of short- or rapid-acting insulins to manage or avoid hyperglycemia in absence of basal or long-acting insulin; does not apply to titration of basal insulin or use of additional short- or rapid-acting insulin in conjunction with scheduled insulin (i.e., “correction insulin”) | Avoid | Moderate | Strong |
| Sulfonylureas, long-duration  Chlorpropamide  Glyburide | Chlorpropamide: prolonged half-life in older adults; can cause prolonged hypoglycemia; causes SIADH  Glyburide: higher risk of severe prolonged hypoglycemia in older adults | Avoid | High | Strong |
| **Gastrointestinal** | | | | |
| Metoclopramide | Can cause extrapyramidal effects, including tardive dyskinesia; risk may be greater in frail older adults | Avoid, unless for gastroparesis | Moderate | Strong |
| Mineral oil, given orally | Potential for aspiration and adverse effects; safer alternatives available | Avoid | Moderate | Strong |
| Proton-pump inhibitors | Risk of *Clostridium difficile* infection and bone loss and fractures | Avoid scheduled use for >8 weeks unless for high-risk patients (e.g., oral corticosteroids or chronic NSAID use), erosive esophagitis, Barrett esophagitis, pathological hypersecretory condition, or demonstrated need for maintenance treatment (e.g., due to failure of drug discontinuation trial or H2 blockers) | High | Strong |
| **Pain Medications** | | | | |
| Meperidine | Not effective oral analgesic in dosages commonly used; may have higher risk of neurotoxicity, including delirium, than other opioids; safer alternatives available | Avoid, especially in those with chronic kidney disease | Moderate | Strong |
| Noncyclooxygenase-selective NSAIDs, oral:  Aspirin >325 mg/d Diclofenac  Diflunisal  Etodolac  Fenoprofen  Ibuprofen  Ketoprofen  Meclofenamate  Mefenamic acid  Meloxicam  Nabumetone  Naproxen  Oxaprozin  Piroxicam  Sulindac  Tolmetin | Increased risk of gastrointestinal bleeding or peptic ulcer disease in high-risk groups, including those aged >75 or taking oral or parenteral corticosteroids, anticoagulants, or antiplatelet agents; use of proton-pump inhibitor or misoprostol reduces but does not eliminate risk. Upper gastrointestinal ulcers, gross bleeding, or perforation caused by NSAIDs occur in approximately 1% of patients treated for 3–6 months and in ~2%–4% of patients treated for 1 year; these trends continue with longer duration of use | Avoid chronic use, unless other alternatives are not effective and patient can take gastroprotective agent (proton-pump inhibitor or misoprostol) | Moderate | Strong |
| Indomethacin  Ketorolac, includes parenteral | Indomethacin is more likely than other NSAIDs to have adverse CNS effects. Of all the NSAIDs, indomethacin has the most adverse effects  Increased risk of gastrointestinal bleeding/peptic ulcer disease, and acute kidney injury in older adults | Avoid | Moderate | Strong |
| Pentazocine | Opioid analgesic that causes CNS adverse effects, including confusion and hallucinations, more commonly than other opioid analgesic drugs; is also a mixed agonist and antagonist; safer alternatives available | Avoid | Low | Strong |
| Skeletal muscle relaxants  Carisoprodol  Chlorzoxazone  Cyclobenzaprine  Metaxalone  Methocarbamol  Orphenadrine | Most muscle relaxants poorly tolerated by older adults because some have anticholinergic adverse effects, sedation, increased risk of fractures; effectiveness at dosages tolerated by older adults questionable | Avoid | Moderate | Strong |
| **Genitourinary** | | | | |
| Desmopressin | High risk of hyponatremia; safer alternative treatments | Avoid for treatment of nocturia or nocturnal polyuria | Moderate | Strong |

The primary target audience is the practicing clinician. The intentions of the criteria include 1) improving the selection of prescription drugs by clinicians and patients; 2) evaluating patterns of drug use within populations; 3) educating clinicians and patients on proper drug usage; and 4) evaluating health-outcome, quality-of-care, cost, and utilization data.

*Note:* CNS = central nervous system; NSAIDs = nonsteroidal anti-inflammatory drugs; SIADH = syndrome of inappropriate antidiuretic hormone.

* Printed with permission*:* *American Geriatrics Society 2015 Beers Criteria Update Expert Panel. (2015). American Geriatrics Society 2015 updated Beers Criteria for Potentially Inappropriate Medication Use in Older Adults.* Journal of the American Geriatrics Society, 63*(11), 2227–2246.*