Published in final edited form as:
J Am Geriatr Soc. 2012 April ; 60(4): 616–631. doi:10.1111/j.1532-5415.2012.03923.x.

American Geriatrics Society Updated Beers Criteria for Potentially Inappropriate Medication Use in Older Adults:

The American Geriatrics Society 2012 Beers Criteria Update Expert Panel

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Abstract

Potentially inappropriate medications (PIMs) continue to be prescribed and used as first-line treatment for the most vulnerable of older adults, despite evidence of poor outcomes from the use of PIMs in older adults. PIMs now form an integral part of policy and practice and are incorporated into several quality measures. The specific aim of this project was to update the previous Beers Criteria using a comprehensive, systematic review and grading of the evidence on drug-related problems and adverse drug events (ADEs) in older adults. This was accomplished through the support of The American Geriatrics Society (AGS) and the work of an interdisciplinary panel of 11 experts in geriatric care and pharmacotherapy who applied a modified Delphi method to the systematic review and grading to reach consensus on the updated 2012 AGS Beers Criteria. Fifty-three medications or medication classes encompass the final updated Criteria, which are divided into three categories: potentially inappropriate medications and classes to avoid in older adults, potentially inappropriate medications and classes to avoid in older adults with certain diseases and syndromes that the drugs listed can exacerbate, and finally medications to be used with caution in older adults. This update has much strength, including the use of an evidence-based approach using the Institute of Medicine standards and the development of a partnership to regularly update the Criteria. Thoughtful application of the Criteria will allow for (a) closer monitoring of drug use, (b) application of real-time e-prescribing and interventions to decrease ADEs in older adults, and (c) better patient outcomes.

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Conflict of Interest: Drs. Dombrowski, Flanagan, Hanlon, Hollmann, Rehm, Sandhu, and Steinman indicated no conflicts of interest.

Author Contributions: All panel members contributed to the concept, design, and preparation of the manuscript.

PANEL MEMBERS AND AFFILIATIONS The following individuals were members of the AGS Panel to update the 2012 AGS Beers Criteria: Donna Fick, PhD, RN, FGSA, FAAN, School of Nursing and College of Medicine, Department of Psychiatry, Pennsylvania State University, University Park, PA (co-chair); Todd Semla, PharmD, MS, BCPS, FCCP, AGSF, U.S. Department of Veterans Affairs National Pharmacy Benefits Management Services and Northwestern University, Chicago, IL (co-chair); Judith Beizer, PharmD, CGP, FASCP, St. Johns University, New York, NY; Nicole Brandt, PharmD, BCPP, CGP, University of Maryland, Baltimore, MD; Robert Dombrowski, PharmD, Centers for Medicare and Medicaid Services, Baltimore, MD (nonvoting member); Catherine E. DuBeau, MD, University of Massachusetts Medical School, Worcester, MA; Nina Flanagan, CRNP, CS-BC, Binghamton University, Dunmore, PA; Joseph Hanlon, PharmD, MS, BCPS, FASHP, FASCP, FGSA, AGSF, Department of Medicine (Geriatric Medicine) School of Medicine, University of Pittsburgh and Geriatric Education and Research and Clinical Center, Veterans Administration Health System, Pittsburgh, PA; Peter Hollmann, MD, AGSF, Blue Cross Blue Shield of Rhode Island, Cranston, RI; Sunny Linnebur, PharmD, FCCP, BCPS, CGP, Skaggs School of Pharmacy and Pharmaceutical Sciences, University of Colorado, Aurora, CO; David Nau, PhD, RPh, CPHQ, Pharmacy Quality Alliance, Inc, Baltimore, MD (nonvoting member); Bob Rehm, National Committee for Quality Assurance, Washington, DC (nonvoting member); Satinderpal Sandhu, MD, MetroHealth Medical Center and Case Western Reserve University School of Medicine, Cleveland, OH; Michael Steinman, MD, University of California at San Francisco and San Francisco Veterans Affairs Medical Center, San Francisco, CA.

Keywords

Beers list; medications; Beers Criteria; drugs; older adults

Medication-related problems are common, costly, and often preventable in older adults and lead to poor outcomes. Estimates from past studies in ambulatory and long-term care settings found that 27% of adverse drug events (ADEs) in primary care and 42% of ADEs in long-term care were preventable, with most problems occurring at the ordering and monitoring stages of care.[1,2] In a study of the 2000/2001 Medical Expenditure Panel Survey, the total estimated healthcare expenditures related to the use of potentially inappropriate medications (PIMs) was $7.2 billion.[3]

Avoiding the use of inappropriate and high-risk drugs is an important, simple, and effective strategy in reducing medication-related problems and ADEs in older adults. Methods to address medication-related problems include implicit and explicit criteria. Explicit criteria can identify high-risk drugs using a list of PIMs that have been identified through expert panel review as having an unfavorable balance of risks and benefits by themselves and considering alternative treatments available. A list of PIMs was developed and published by Beers and colleagues for nursing home residents in 1991 and subsequently expanded and revised in 1997 and 2003 to include all settings of geriatric care.[4–6] Implicit criteria may include factors such as therapeutic duplication and drug–drug interactions. PIMs determined by explicit criteria (Beers Criteria) have also recently been found to identify other aspects of inappropriate medication use identified by implicit criteria.[7]

As summarized in two reviews, a number of investigators in rigorously designed observational studies have shown a strong link between the medications listed in the Beers Criteria and poor patient outcomes (e.g., ADEs, hospitalization, mortality).[7–14] Moreover, research has shown that a number of PIMs have limited effectiveness in older adults and are associated with serious problems such as delirium, gastrointestinal bleeding, falls, and fracture.[8,12] In addition to identifying drugs for which safer pharmacological alternatives are available, in many instances a safer nonpharmacological therapy could be substituted for the use of these medications, highlighting that a “less-is-more approach” is often the best way to improve health outcomes in older adults.[15]

Since the early 1990s, the prevalence of PIM usage has been examined in more than 500 studies, including a number of long-term care, outpatient, acute care, and community settings. Despite this preponderance of information, many PIMs continue to be prescribed and used as first-line treatment for the most vulnerable of older adults.[16,17] These studies illustrate that more work is needed to address the use of PIMs in older adults, and there remains an important role in policy, research, and practice for an explicit list of medications to avoid in older adults. Because an increasing number of interventions have been successful in decreasing the use of these drugs and improving clinical outcomes,[18,19] PIMs now form an integral part of policy and practice in the Centers for Medicare and Medicaid Services (CMS) regulations and are used in Medicare Part D. They are also used as a quality measure in the National Committee for Quality Assurance (NCQA) Healthcare Effectiveness Data and Information Set (HEDIS). Several stakeholders, including CMS, NCQA, and the Pharmacy Quality Alliance (PQA) have identified the Beers Criteria as an important quality measure. In addition, a few studies have begun to identify nonpharmacological alternatives to inappropriate medications[20] and are incorporating Beers Criteria PIMs into electronic health records as an aid to real-time e-prescribing.[19]

An update of the Beers Criteria should include a clear approach to reviewing and grading the evidence for the drugs to avoid. In addition, the criteria need to be regularly updated as new drugs come to the market, as new evidence emerges related to the use of these medications, and as new methods to assess the evidence develop. Being able to update these criteria quickly and transparently is crucial to their continued use as decision-making tools, because regular updates will improve their relevancy, dissemination, and usefulness in clinical practice.

The 2012 update of the Beers Criteria heralds a new partnership with the American Geriatrics Society (AGS). This partnership allows for regular, transparent, systematic updates and support for the wider input and dissemination of the criteria by expert clinicians for their use in research, policy, and practice. To keep this tool relevant, the updated 2012 AGS Beers Criteria must be current with other methods for determining best-practice guidelines. A rigorous systematic review was performed to update and expand the criteria. As in the past, this update will categorize PIMs into two broad groups: medications to avoid in older adults regardless of diseases or conditions and medications considered potentially inappropriate when used in older adults with certain diseases or syndromes. A third group, medications that should be used with caution, has been added. Medications in this group were initially considered for inclusion as PIMs. In these cases, the consensus view of the panel (described below) was that there were a sufficient number of plausible reasons why use of the drug in certain individuals would be appropriate but that the potential for misuse or harm is substantial and thus merits an extra level of caution in prescribing. In some cases, these medications were new to the market, and evidence was still emerging.

OBJECTIVES

The specific aim is to:

Update the previous Beers Criteria using a comprehensive, systematic review and grading of the evidence on drug-related problems and ADEs in older adults.

The strategies to achieve this aim are to:

1. Incorporate new evidence on currently listed PIMs and evidence from new medications or conditions not addressed in the previous (2003) update.
2. Grade the strength and quality of each PIM statement based on level of evidence and strength of recommended grading.
3. Convene an interdisciplinary panel of 11 experts in geriatric care and pharmacotherapy who will apply a modified Delphi method to the systematic review and grading to reach consensus on the updated 2012 AGS Beers Criteria.
4. Incorporate needed exceptions into the criteria as deemed clinically appropriate by the panel. These evidence-based exceptions will be designed to make the criteria more individualized to clinical care and more relevant across settings of care.

INTENT OF CRITERIA

The 2012 AGS Beers Criteria are intended for use in all ambulatory and institutional settings of care for populations aged 65 and older in the United States. The primary target audience is the practicing clinician. Researchers, pharmacy benefit managers, regulators, and policy-makers also use the criteria widely. The intentions of the criteria include improving the selection of prescription drugs by clinicians and patients, evaluating patterns of drug use within populations, educating clinicians and patients on proper drug usage, and evaluating health-outcome, quality of care, cost, and utilization data.

The goal of the 2012 AGS Beers Criteria is to improve care of older adults by reducing their exposure to PIMs. This is accomplished by their use as an educational tool and a quality measure—two uses that are not always in agreement. These criteria are not meant to be applied in a punitive manner. Prescribing decisions are not always clear cut, and clinicians must consider multiple factors. Quality measures must be clearly defined, easily applied, and measured with limited information. The panel considered both roles during deliberations. The panel's review of evidence at times identified subgroups of individuals who should be exempt from the criteria or for whom only a specific criterion applies. Such a criterion may not be easily applied as a quality measure. These applications were balanced with the needs and complexities of the individual. The panel felt that a criterion could not be expanded to include all adults aged 65 and older when only individuals with specific characteristics may benefit or be at greater risk of harm.

METHODS

For this new update, the AGS employed a well-tested framework that has long been used for development of clinical practice guidelines.[6,21–23] Specifically, the framework involved the appointment of an 11-member interdisciplinary expert panel with relevant clinical expertise and experience and an understanding of how the criteria have been previously used. To ensure that potential conflicts of interest are disclosed and addressed appropriately, panelists disclosed potential conflicts of interest with the panel at the beginning. Each panelist's potential conflict of interests are provided toward the end of this article. This framework also involved a development process that included a systematic literature review and evaluation of the evidence base by the expert panel. Finally, the Institute of Medicine's 2011 report on developing practice guidelines,[23] which included a period for public comments, guided the framework. These three framework principles are described in greater detail below.

Literature Search

The literature from December 1, 2001 (the end of the previous panel's search) to March 30, 2011, was searched to identify published systematic reviews and meta-analyses that were relevant to the project. Search terms included adverse drug reactions, adverse drug events, medication problems, polypharmacy, inappropriate drug use, suboptimal drug therapy, drug monitoring, pharmacokinetics, drug interactions, and medication errors. Terms were searched alone and in combination. Search limits included human subjects, English language, and aged 65 and older. Data sources for the initial search included Medline, the Cochrane Library (Cochrane Database of Systematic Reviews), International Pharmaceutical abstracts, and references lists of selected articles that the panel co-chairs identified.

The initial search identified 25,549 citations, of which 6,505 were selected for preliminary review. The panel co-chairs reviewed 2,267 citations, of which 844 were excluded for not meeting the study purpose or not containing primary data. An additional search was conducted with the additional terms drug–drug and drug–disease interactions, pharmacoepidemiology, drug safety, geriatrics, and elderly prescribing. An additional search for randomized clinical trials and postmarketing and observational studies published between 2009 and 2011 was conducted using terms related to major drug classes and conditions, delimited by more-general topics (e.g., adverse drug reactions, Beers Criteria, suboptimal prescribing, and interventions). Previous searches were used to develop additional terms to be included in subsequent searches, such as a list of authors whose work was relevant to the goals of the project. When evidence was sparse on older medications, searches were conducted on drug class and individual medication names and included older search dates for these drugs. The co-chairs continually reviewed the updated search results for articles that might be relevant to the project. Panelists were also asked to forward

pertinent citations that might be useful for revising the previous Beers Criteria or supporting additions to them.

At the time of the panel's face-to-face meeting, the co-chairs had selected 2,169 unduplicated citations for the full panel review. This total included 446 systematic reviews or meta-analyses, 629 randomized controlled trials, and 1,094 observational studies. Additional articles were found in a manual search of the reference lists of identified articles and the panelist's files, book chapter, and recent review articles, with 258 citations selected for the final evidence tables to support the list of drugs to avoid.

Panel Selection

After consultation with the AGS, the co-chairs identified prospective panel members with recognized expertise in geriatric medicine, nursing, pharmacy practice, research, and quality measures. Other factors that influenced selection were the desire to have interdisciplinary representation, a range of medical specialties, and representation from different practice settings (e.g., long-term care, ambulatory care, geriatric mental health, palliative care and hospice). In addition to the 11-member panel, representatives from CMS, NCQA, and PQA were invited to serve as exofficio members.

Each expert panel member completed a disclosure form that was shared with the entire panel before the process began. Potential conflicts of interest were resolved by the panel co-chairs and were available during the open comment period. Panel members who disclosed affiliations or financial interests with commercial entities are listed under the disclosures section of this article.

Development Process

The co-chairs and AGS staff edited the survey used in the previous Beers Criteria development process, excluding products no longer marketed. The resulting survey had three parts: medications currently listed as potentially inappropriate for older adults independent of diseases or conditions, medications currently listed as potentially inappropriate when used in older adults with certain diseases or conditions, and new submissions from the panel. Each panelist was asked to complete the survey using a 5-point Likert scale ranging from strongly agree to strongly disagree (or no opinion). Ratings were tallied and returned to the panel along with each panelist's original ratings. Two conference calls allowed for review of survey ratings, discussion, and consensus building.

The panel convened for a 2-day in-person meeting on August 2 and 3, 2011, to review the second draft of the survey and the results of the literature search. Panel discussions were used to define terms and to address questions of consistency, the inclusion of infrequently used drugs, the best strategies for evaluating the evidence, and the consolidation or expansion of individual criterion. The panel then split into four groups, with each assigned a specific set of criteria for evaluation. Groups were assigned as closely as possible according to specific area of clinical expertise (e.g., cardiovascular, central nervous system). Groups reviewed the literature search, selected citations relevant to their assigned criteria, and determined which citations should be included in an evidence table. During this process, panelists were provided copies of abstracts and full-text articles. The groups then presented their findings to the full panel for comment and consensus. After the meeting, each group met in a conference call to resolve any questions or to include additional supporting literature.

An independent researcher prepared evidence tables, which were distributed to the four criteria-specific groups. Each panelist independently rated the quality of evidence and strength of recommendation for each criterion using the American College of Physicians'

Guideline Grading System[24] (Table 1), which is based on the Grades of Recommendation Assessment, Development, and Evaluation (GRADE) scheme developed previously.[25] AGS staff compiled the panelist ratings for each group and returned them to that group, which then reached consensus in conference call. Additional literature was obtained and included as needed. When group consensus could not be reached, the full panel reviewed the ratings and worked through any differences until they reached consensus. For some criteria, the panel provided a "strong" recommendation even though the quality of evidence was low or moderate. In such cases, the strength of recommendation was based on potential severity of harm and the availability of treatment alternatives.

RESULTS

Fifty-three medications or medication classes encompass the final updated 2012 AGS Beers Criteria, which are divided into three categories (Tables 2–4). Tables were constructed and organized according to major therapeutic classes and organ systems.

Table 2 shows the 34 potentially inappropriate medications and classes to avoid in older adults. Notable new additions include megestrol, glyburide, and sliding-scale insulin.

Table 3 summarizes potentially inappropriate medications and classes to avoid in older adults with certain diseases and syndromes that the drugs listed can exacerbate. Notable new inclusions are thiazolidinediones or glitazones with heart failure, acetylcholinesterase inhibitors with history of syncope, and selective serotonin reuptake inhibitors with falls and fractures.

Table 4 lists medications to be used with caution in older adults. Fourteen medications and classes were categorized. Two of these involve recently marketed anti-thrombotics for which early evidence suggests caution for use in adults aged 75 and older.

Table 5 is a summary of medications that were moved to another category or modified since the last update, and Tables 6 and 7 summarize medications that were removed or added since the last update. Nineteen medications and medication classes were dropped from the 2003 to the 2012 update of the criteria based on consensus of the panel and evidence or a rationale to justify their exclusion from the list. In several cases, medications were removed because they had been taken off the U.S. market since the 2003 update (e.g., propoxyphene) or because of insufficient or new evidence that was evaluated by the panel (e.g., ethacrynic acid). Table 8 includes a list of the antipsychotics included in the statements. Table 9 is the list of anticholinergic medications to be avoided in older adults compiled from drugs rated as having strong anticholinergic properties in the Anticholinergic Risk Scale,[26] Anticholinergic Drug Scale,[27] and Anticholinergic Burden Scale.[28]

DISCUSSION

The 2012 AGS Beers Criteria is an important and improved update of previously established criteria widely used by healthcare providers, educators, and policy-makers and as a quality measure. Previously, as many as 40% of older adults received one or more medications on this list, depending on the care setting.[29–31] The new criteria are based upon methods for determining best-practice guidelines that included a rigorous systematic literature review, the use of an expert consensus panel, and grading of the strength of evidence and recommendations.

The updated criteria should be viewed as a guideline for identifying medications for which the risks of their use in older adults outweigh the benefits. The medications that have a high risk of toxicity and adverse effects in older adults and limited effectiveness, and all

medications in Table 2 (Independent of Diagnosis or Condition) should be avoided in favor of an alternative safer medication or a nondrug approach. The drug–disease or –syndrome interactions summarized in Table 3 are particularly important in the care of older adults because they often take multiple medications for multiple comorbidities. Their occurrence may have greater consequences in older adults because of age-related decline in physiological reserve. Recent studies in which drug–disease interactions have been shown to be important risk factors for ADEs highlight their importance.[32]

This list is not meant to supersede clinical judgment or an individual patient's values and needs. Prescribing and managing disease conditions should be individualized and involve shared decision-making. The historical lack of inclusion of many older adults in drug trials[33–35] and the related lack of alternatives in some individual instances further complicate medication use in older adults. There may be cases in which the healthcare provider determines that a drug on the list is the only reasonable alternative (e.g., end-of-life or palliative care). The panel has attempted to evaluate the literature and best-practice guidelines to cover as many of these instances as possible, but not all possible clinical situations can be anticipated in such a broad undertaking. In these cases, the list can be used clinically not only for prescribing medications, but also for monitoring their effects in older adults. If a provider is not able to find an alternative and chooses to continue to use a drug on this list in an individual patient, designation of the medication as potentially inappropriate can serve as a reminder for close monitoring so that ADEs can be incorporated into the electronic health record and prevented or detected early. These criteria also underscore the importance of using a team approach to prescribing, of the use of nonpharmacological approaches, and of having economic and organizational incentives for this type of model.

These criteria have some limitations. First, even though older adults are the largest consumers of medication, they are often underrepresented in drug trials.[33,35] Thus, using an evidence-based approach may underestimate some drug-related problems or lead to a weaker evidence grading. As stated previously, the intent of the updated 2012 AGS Beers Criteria, as an educational tool and quality measure, is to improve the care of older adults by reducing their exposure to PIMs. Second, it does not address other types of potential PIMs that are not unique to aging (e.g., dosing of primarily renally cleared medications, drug–drug interactions, therapeutic duplication). Third, it does not comprehensively address the needs of individuals receiving palliative and hospice care, in whom symptom control is often more important than avoiding the use of PIMs. Finally, the search strategies used might have missed some studies published in languages other than English and studies available in unpublished technical reports, white papers, or other “gray literature” sources.

Regardless, this update has many strengths, including the use of an evidence-based approach using the Institute of Medicine standards and the development of a partnership to regularly update the criteria. Thoughtful application of the criteria will allow for closer monitoring of drug use, application of real-time e-prescribing and interventions to decrease ADEs in older adults, and better patient outcomes. Regular updates will allow for the evidence for medications on the list to be assessed routinely, making it more relevant and sensitive to patient outcomes, with the goal of evaluating and managing drug use in older adults while considering the dynamic complexities of the healthcare system.

Acknowledgments

The decisions and content of the 2012 AGS Beers Criteria are those of the AGS and the panelists and are not necessarily those of the U.S. Department of Veterans Affairs.

Sue Radcliff, Independent Researcher, Denver, Colorado, provided research services. Susan E. Aiello, DVM, ELS, provided editorial services. Christine Campanelli and Elvy Ickowicz, MPH, provided additional research and administrative support. The development of this paper was supported in part by an unrestricted grant from the John A. Hartford Foundation.

The following organizations with special interest and expertise in the appropriate use of medications in older adults provided peer review of a preliminary draft of this guideline: American Academy of Family Physicians; American Academy of Nurse Practitioners; American Academy of Nursing; American College of Clinical Pharmacy; American College of Obstetrics and Gynecology; American College of Physicians; American College of Surgeons; American Medical Association; American Medical Directors Association; American Society of Anesthesiologists; American Society of Consultant Pharmacists; Centers for Medicare and Medicaid Services; Gerontological Advanced Practice Nurses Association; Gerontological Society of America; National Academies of Practice, Academy of Pharmacy; National Committee for Quality Assurance; Pharmacy Quality Alliance; Society for General Internal Medicine; Society of Hospital Medicine.

Dr. Beizer is an author and editor for LexiComp, Inc. She is on the Pharmacy and Therapeutics Committee for Part D at Medco Health Solutions. Dr. Brandt is on the Pharmacy and Therapeutics Committees at Omnicare and receives grants from Talyst (research grant), Econometrics (research grant), Health Resources and Services Administration (educational grant), and the State of Maryland Office of Health Care Quality (educational grant). Dr. Dubeau serves as a consultant for Pfizer, Inc. (urinary incontinence) and the New England Research Institute (nocturia). Dr. Fick is partially supported by the National Institute of Health (NIH) for National Institute of Nursing Research grants R01 NR011042 and R01NR012242. Dr. Hanlon is supported in part by National Institute on Aging grants and contracts (R01AG027017, P30AG024827, T32 AG021885, K07AG033174, R01AG034056), a National Institute of Nursing Research grant (R01 NR010135), and Agency for Healthcare Research and Quality grants (R01 HS017695, R01HS018721). Dr. Linnebur receives an honorarium for serving as a member of the Pharmacy and Therapeutics Committee for Colorado Access (a health plan serving indigent children and adults and Medicare members). Dr. Nau works for the PQA, which has received demonstration project grants from Pfizer, Inc., Merck & Co, Inc, sanofi-aventis, and GlaxoSmithKline. He also has held shares with CardinalHealth in the past 12 months. Dr. Semla receives honoraria from the AGS for his contribution as an author of Geriatrics at Your Fingertips and for serving as a Section Editor for the *Journal of the American Geriatrics Society*. He is a past President and Chair of the AGS Board of Directors. His spouse is an employee of Abbott Laboratories. He serves on the Omnicare Pharmacy and Therapeutics Committee. He is an author and editor for LexiComp, Inc.

Sponsor's Role: AGS staff participated in the final technical preparation and submission of the manuscript.

REFERENCES

1. Gurwitz JH, Field TS, Harrold LR, et al. Incidence and preventability of adverse drug events among older persons in the ambulatory setting. JAMA. 2003; 289:1107–1116. [PubMed: 12622580]
2. Gurwitz JH, Field TS, Judge J, et al. The incidence of adverse drug events in two large academic long-term care facilities. Am J Med. 2005; 118:251–258. [PubMed: 15745723]
3. Fu AZ, Jiang JZ, Reeves JH, et al. Potentially inappropriate medication use and healthcare expenditures in the US community-dwelling elderly. Med Care. 2007; 45:472–476. [PubMed: 17446834]
4. Beers MH, Ouslander JG, Rollingher I, et al. Explicit criteria for determining inappropriate medication use in nursing home residents. Arch Intern Med. 1991; 151:1825–1832. [PubMed: 1888249]
5. Beers MH. Explicit criteria for determining potentially inappropriate medication use by the elderly. An update. Arch Intern Med. 1997; 157:1531–1536. [PubMed: 9236554]
6. Fick DM, Cooper JW, Wade WE, et al. Updating the Beers Criteria for potentially inappropriate medication use in older adults: Results of a US consensus panel of experts. Arch Intern Med. 2003; 163:2716–2724. [PubMed: 14662625]
7. Lund BC, Steinman MA, Chrischilles EA, et al. Beers Criteria as a proxy for inappropriate prescribing of other medications among older adults. Ann Pharmacother. 2011; 45:1363–1370. [PubMed: 21972251]
8. Stockl KM, Le L, Zhang S, et al. Clinical and economic outcomes associated with potentially inappropriate prescribing in the elderly. Am J Manag Care. 2010; 16:e1–e10. [PubMed: 20059286]
9. Dimitrow MS, Airaksinen MS, Kivela SL, et al. Comparison of prescribing criteria to evaluate the appropriateness of drug treatment in individuals aged 65 and older: A systematic review. J Am Geriatr Soc. 2011; 59:1521–1530. [PubMed: 21797829]

10. Jano E, Aparasu RR. Healthcare outcomes associated with Beers' Criteria: A systematic review. Ann Pharmacother. 2007; 41:438–447. [PubMed: 17311835]
11. Chang CM, Liu PY, Yang YH, et al. Use of the Beers Criteria to predict adverse drug reactions among first-visit elderly outpatients. Pharmacotherapy. 2005; 25:831–838. [PubMed: 15927902]
12. Chrischilles EA, VanGilder R, Wright K, et al. Inappropriate medication use as a risk factor for self-reported adverse drug effects in older adults. J Am Geriatr Soc. 2009; 57:1000–1006. [PubMed: 19507293]
13. Dedhiya SD, Hancock E, Craig BA, et al. Incident use and outcomes associated with potentially inappropriate medication use in older adults. Am J Geriatr Pharmacother. 2010; 8:562–570. [PubMed: 21356505]
14. Passarelli MC, Jacob-Filho W, Figueras A. Adverse drug reactions in an elderly hospitalised population: Inappropriate prescription is a leading cause. Drugs Aging. 2005; 22:767–777. [PubMed: 16156680]
15. Garfinkel D, Mangin D. Feasibility study of a systematic approach for discontinuation of multiple medications in older adults: Addressing polypharmacy. Arch Intern Med. 2010; 170:1648–1654. [PubMed: 20937924]
16. Fick D, Semla T. Improving medication use in gerontological nursing: Now is the time for interdisciplinary collaboration and translation. J Gerontol Nurs. 2011; 37:3–4. [PubMed: 21800791]
17. Morandi A, Vasilevskis EE, Pandharipande PP, et al. Inappropriate medications in elderly ICU survivors: Where to intervene? Arch Intern Med. 2011; 171:1032–1034. [PubMed: 21670372]
18. Agostini JV, Zhang Y, Inouye SK. Use of a computer-based reminder to improve sedative-hypnotic prescribing in older hospitalized patients. J Am Geriatr Soc. 2007; 55:43–48. [PubMed: 17233684]
19. Hume AL, Quilliam BJ, Goldman R, et al. Alternatives to potentially inappropriate medications for use in e-prescribing software: Triggers and treatment algorithms. BMJ Qual Saf. 2011; 20:875–884.
20. McCurry SM, Pike KC, Vitiello MV, et al. Increasing walking and bright light exposure to improve sleep in community-dwelling persons with Alzheimer's disease: Results of a randomized, controlled trial. J Am Geriatr Soc. 2011; 59:1393–1402. [PubMed: 21797835]
21. American Geriatrics Society Panel on Pharmacological Management of Persistent Pain in Older Persons. Pharmacological management of persistent pain in older persons. J Am Geriatr Soc. 2009; 57:1331–1346. [PubMed: 19573219]
22. Panel on Prevention of Falls in Older Persons, American Geriatrics Society, British Geriatrics Society. Summary of the updated American Geriatrics Society/British Geriatrics Society clinical practice guideline for prevention of falls in older persons. J Am Geriatr Soc. 2011; 59:148–157. [PubMed: 21226685]
23. Graham, R.; Mancher, M.; Wolman, DM., et al. Institute of Medicine: Clinical Practice Guidelines We Can Trust. National Academies Press; Washington, DC: 2011.
24. Qaseem A, Snow V, Owens DK, et al. The development of clinical practice guidelines and guidance statements of the American College of Physicians: Summary of methods. Ann Intern Med. 2010; 153:194–199. [PubMed: 20679562]
25. Atkins D, Best D, Briss PA, et al. GRADE Working Group. Grading quality of evidence and strength of recommendations. BMJ. 2004; 328:1490–1498. [PubMed: 15205295]
26. Rudolph JL, Salow MJ, Angelini MC, et al. The Anticholinergic Risk Scale and anticholinergic adverse effects in older persons. Arch Intern Med. 2008; 168:508–513. [PubMed: 18332297]
27. Carnahan RM, Lund BC, Perry PJ, et al. The Anticholinergic Drug Scale as a measure of drug-related anticholinergic burden: Associations with serum anticholinergic activity. J Clin Pharmacol. 2006; 46:1481–1486. [PubMed: 17101747]
28. Boustani M, Campbell N, Munger S, et al. Impact of anticholinergics on the aging brain: A review and practical appllication. Aging Health. 2008; 4:311–320.
29. Curtis LH, Ostbye T, Sendersky V, et al. Inappropriate prescribing for elderly Americans in a large outpatient population. Arch Intern Med. 2004; 164:1621–1625. [PubMed: 15302631]

30. Fick DM, Mion LC, Beers MH, et al. Health outcomes associated with potentially inappropriate medication use in older adults. Res Nurs Health. 2008; 31:42–51. [PubMed: 18163447]
31. Laroche ML, Charmes JP, Nouaille Y, et al. Is inappropriate medication use a major cause of adverse drug reactions in the elderly? Br J Clin Pharmacol. 2007; 63:177–186. [PubMed: 17166186]
32. Hanlon JT, Sloane RJ, Pieper CF, et al. Association of adverse drug reactions with drug-drug and drug-disease interactions in frail older outpatients. Age Ageing. 2011; 40:274–277. [PubMed: 21177281]
33. Applegate WB, Curb JD. Designing and executing randomized clinical trials involving elderly persons. J Am Geriatr Soc. 1990; 38:943–950. [PubMed: 2387959]
34. Cherubini A, Del Signore S, Ouslander J, et al. Fighting against age discrimination in clinical trials. J Am Geriatr Soc. 2010; 58:1791–1796. [PubMed: 20863340]
35. Hutchins LF, Unger JM, Crowley JJ, et al. Underrepresentation of patients 65 years of age or older in cancer-treatment trials. N Engl J Med. 1999; 341:2061–2067. [PubMed: 10615079]

Table 1

Designations of Quality and Strength of Evidence

Designation	Description
Quality of evidence	
High	Evidence includes consistent results from well-designed, well-conducted studies in representative populations that directly assess effects on health outcomes (≥ 2 consistent, higher-quality randomized controlled trials or multiple, consistent observational studies with no significant methodological flaws showing large effects)
Moderate	Evidence is sufficient to determine effects on health outcomes, but the number, quality, size, or consistency of included studies; generalizability to routine practice; or indirect nature of the evidence on health outcomes (≥ 1 higher-quality trial with > 100 participants; ≥2 higher-quality trials with some inconsistency; ≥2 consistent, lower-quality trials; or multiple, consistent observational studies with no significant methodological flaws showing at least moderate effects) limits the strength of the evidence
Low	Evidence is insufficient to assess effects on health outcomes because of limited number or power of studies, large and unexplained inconsistency between higher-quality studies, important flaws in study design or conduct, gaps in the chain of evidence, or lack of information on important health outcomes
Strength of recommendation	
Strong	Benefits clearly outweigh risks and burden OR risks and burden clearly outweigh benefits
Weak	Benefits finely balanced with risks and burden
Insufficient	Insufficient evidence to determine net benefits or risks

Table 2

2012 American Geriatrics Society Beers Criteria for Potentially Inappropriate Medication Use in Older Adults

Organ System or Therapeutic Category or Drug	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Anticholinergics (excludes TCAs)				
First-generation antihistamines (as single agent or as part of combination products)	Highly anticholinergic; clearance reduced with advanced age, and tolerance develops when used as hypnotic; greater risk of confusion, dry mouth, constipation, and other anticholinergic effects and toxicity.	Avoid	Hydroxyzine and promethazine: high;	Strong
Brompheniramine	Use of diphenhydramine in special situations such as acute treatment of severe allergic reaction may be appropriate		All others: moderate	
Carbinoxamine				
Chlorpheniramine				
Clemastine				
Cyproheptadine				
Dexbrompheniramine				
Dexchlorpheniramine				
Diphenhydramine (oral)				
Doxylamine				
Hydroxyzine				
Promethazine				
Triprolidine				
Antiparkinson agents	Not recommended for prevention of extrapyramidal symptoms with antipsychotics; more-effective agents available for treatment of Parkinson disease	Avoid	Moderate	Strong
Benztropine (oral)				
Trihexyphenidyl				
Antispasmodics	Highly anticholinergic, uncertain effectiveness	Avoid except in short-term palliative care to decrease oral secretions	Moderate	Strong
Belladonna alkaloids				
Clidinium-chlordiazepoxide				
Dicyclomine				
Hyoscyamine				
Propantheline				

Organ System or Therapeutic Category or Drug	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Scopolamine				
Antithrombotics				
Dipyridamole, oral short acting * (does not apply to extended-release combination with aspirin)	May cause orthostatic hypotension; more-effective alternatives available; intravenous 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; safer alternatives available; lack of efficacy in patients with CrCl < 60 ml/min due to inadequate drug concentration in the urine	Avoid for long-term suppression; avoid in patients with CrCl < 60 mL/min	Moderate	Strong
Cardiovascular				
Alpha$_1$ blockers	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
Doxazosin				
Prazosin				
Terazosin				
Alpha agonists, central	High risk of adverse CNS effects; may cause bradycardia and orthostatic hypotension; not recommended as routine treatment for hypertension	Avoid clonidine as a first-line antihypertensive.	Low	Strong
Clonidine	Avoid others as listed			
Guanabenz *				
Guanfacine *				
Methyldopa *				
Reserpine (> 0.1 mg/d) *				
Antiarrhythmic drugs (Class Ia, Ic, III)	Data suggest that rate control yields better balance of benefits and harms than rhythm control for most older adults.	Avoid antiarrhythmic drugs as first-line treatment of atrial fibrillation	High	Strong
Amiodarone				

Organ System or Therapeutic Category or Drug	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Dofetilide				
Dronedarone	Amiodarone is associated with multiple toxicities, including thyroid disease, pulmonary disorders, and QT-interval prolongation			
Flecainide				
Ibutilide				
Procainamide				
Propafenone				
Quinidine				
Sotalol				
Disopyramide *	Disopyramide is a potent negative inotrope and therefore may induce heart failure in older adults; strongly anticholinergic; other antiarrhythmic drugs preferred	Avoid	Low	Strong
Dronedarone	Worse outcomes have been reported in patients taking dronedarone who have permanent atrial fibrillation or heart failure. In general, rate control is preferred over rhythm control for atrial fibrillation	Avoid in patients with permanent atrial fibrillation or heart failure	Moderate	Strong
Digoxin > 0.125 mg/d	In heart failure, higher dosages associated with no additional benefit and may increase risk of toxicity; slow renal clearance may lead to risk of toxic effects	Avoid	Moderate	Strong
Nifedipine, immediate release *	Potential for hypotension; risk of precipitating myocardial ischemia	Avoid	High	Strong
Spironolactone > 25 mg/d	In heart failure, the risk of hyperkalemia is higher in older adults especially if taking > 25 mg/d or taking concomitant NSAID, angiotensin converting-enzyme inhibitor, angiotensin receptor blocker, or potassium supplement	Avoid in patients with heart failure or with a CrCI < 30 mL/min	Moderate	Strong
Central nervous system				
Tertiary TCAs, alone or in combination:	Highly anticholinergic,	Avoid	High	Strong

Organ System or Therapeutic Category or Drug	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
	sedating, and cause orthostatic hypotension; safety profile of low-dose doxepin (≥ 6 mg/d) is comparable with that of placebo			
Amitriptyline				
Chlordiazepoxide-amitriptyline				
Clomipramine				
Doxepin > 6 mg/d				
Imipramine				
Perphenazine-amitriptyline				
Trimipramine				
Antipsychotics, first (conventional) and second (atypical) generation (see Table 8 for full list)	Increased risk of cerebrovascular accident (stroke) and mortality in persons with dementia	Avoid use for behavioral problems of dementia unless nonpharmacological options have failed and patient is threat to self or others	Moderate	Strong
Thioridazine	Highly anticholinergic and risk of QT-interval prolongation	Avoid	Moderate	Strong
Mesoridazine				
Barbiturates	High rate of physical dependence; tolerance to sleep benefits; risk of overdose at low dosages	Avoid	High	Strong
Amobarbital *				
Butabarbital *				
Butalbital				
Mephobarbital *				
Pentobarbital *				
Phenobarbital				
Secobarbital *				
Benzodiazepines	Older adults have increased sensitivity to benzodiazepines and slower metabolism of long-acting agents. In general, all benzodiazepines increase risk of cognitive impairment, delirium, falls, fractures, and motor vehicle accidents in older adults	Avoid benzodiazepines (any type) for treatment of insomnia, agitation, or delirium	High	Strong
Short and intermediate acting:				

Organ System or Therapeutic Category or Drug	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Alprazolam				
Estazolam				
Lorazepam				
Oxazepam				
Temazepam				
Triazolam				
Long acting:	May be appropriate for seizure disorders, rapid eye movement sleep disorders, benzodiazepine withdrawal, ethanol withdrawal, severe generalized anxiety disorder, periprocedural anesthesia, end-of-life care			
Clorazepate				
Chlordiazepoxide				
Chlordiazepoxide-amitriptyline				
Clidinium-chlordiazepoxide				
Clonazepam				
Diazepam				
Flurazepam				
Quazepam				
Chloral hydrate *	Tolerance occurs within 10 days, and risks outweigh benefits in light of overdose with doses only 3 times the recommended dose	Avoid	Low	Strong
Meprobamate	High rate of physical dependence; very sedating	Avoid	Moderate	Strong
Nonbenzodiazepine hypnotics	Benzodiazepine-receptor agonists that have adverse events similar to those of benzodiazepines in older adults (e.g., delirium, falls, fractures); minimal improvement in sleep latency and duration	Avoid chronic use (> 90 days)	Moderate	Strong
Eszopiclone				
Zolpidem				
Zaleplon				
Ergot mesylates *	Lack of efficacy	Avoid	High	Strong
Isoxsuprine *				
Endocrine				

Organ System or Therapeutic Category or Drug	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Androgens	Potential for cardiac problems and contraindicated in men with prostate cancer	Avoid unless indicated for moderate to severe hypogonadism	Moderate	Weak
Methyltestosterone*				
Testosterone				
Desiccated thyroid	Concerns about cardiac effects; safer alternatives available	Avoid	Low	Strong
Estrogens with or without progestins	Evidence of carcinogenic potential (breast and endometrium); lack of cardioprotective effect and cognitive protection in older women	Avoid oral and topical patch.	Oral and patch: high	Oral and patch: strong
	Evidence that vaginal estrogens for treatment of vaginal dryness is safe and effective in women with breast cancer, especially at dosages of estradiol < 25 μg twice weekly	Topical vaginal cream: acceptable to use low-dose intravaginal estrogen for the management of dyspareunia, lower urinary tract infections, and other vaginal symptoms	Topical: moderate	Topical: weak
Growth hormone	Effect on body composition is small and associated with edema, arthralgia, carpal tunnel syndrome, gynecomastia, impaired fasting glucose	Avoid, except as hormone replacement after pituitary gland removal	High	Strong
Insulin, sliding scale	Higher risk of hypoglycemia without improvement in hyperglycemia management regardless of care setting	Avoid	Moderate	Strong
Megestrol	Minimal effect on weight; increases risk of thrombotic events and possibly death in older adults	Avoid	Moderate	Strong
Sulfonylureas, long duration	Chlorpropamide: prolonged half-life in older adults; can cause prolonged hypoglycemia; causes syndrome of inappropriate antidiuretic hormone secretion.	Avoid	High	Strong
Chlorpropamide	Glyburide: greater risk of severe prolonged hypoglycemia in older adults			
Glyburide				

Organ System or Therapeutic Category or Drug	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Gastrointestinal				
Metoclopramide	Can cause extrapyramidal effects including tardive dyskinesia; risk may be even greater in frail older adults	Avoid, unless for gastroparesis	Moderate	Strong
Mineral oil, oral	Potential for aspiration and adverse effects; safer alternatives available	Avoid	Moderate	Strong
Trimethobenzamide	One of the least effective antiemetic drugs; can cause extrapyramidal adverse effects	Avoid	Moderate	Strong
Pain				
Meperidine	Not an effective oral analgesic in dosages commonly used; may cause neurotoxicity; safer alternatives available	Avoid	High	Strong
Non–COX-selective NSAIDs, oral	Increases risk of GI bleeding and 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 GI ulcers, gross bleeding, or perforation caused by NSAIDs occur in approximately 1% of patients treated for 3–6 months and in approximately 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
Aspirin > 325 mg/d				
Diclofenac				
Diflunisal				
Etodolac				
Fenoprofen				
Ibuprofen				
Ketoprofen				
Meclofenamate				
Mefenamic acid				

Organ System or Therapeutic Category or Drug	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Meloxicam				
Nabumetone				
Naproxen				
Oxaprozin				
Piroxicam				
Sulindac				
Tolmetin				
Indomethacin	Increases risk of GI bleeding and peptic ulcer disease in high-risk groups. (See above Non-COX selective NSAIDs.) Of all the NSAIDs, indomethacin has most adverse effects	Avoid	Indomethacin: moderate	Strong
Ketorolac, includes parenteral			Ketorolac: high	
Pentazocine *	Opioid analgesic that causes CNS adverse effects, including confusion and hallucinations, more commonly than other narcotic drugs; is also a mixed agonist and antagonist; safer alternatives available	Avoid	Low	Strong
Skeletal muscle relaxants	Most muscle relaxants are poorly tolerated by older adults because of anticholinergic adverse effects, sedation, risk of fracture; effectiveness at dosages tolerated by older adults is questionable	Avoid	Moderate	Strong
Carisoprodo				
Chlorzoxazone				
Cyclobenzaprine				
Metaxalone				
Methocarbamol				
Orphenadrine				

The primary target audience is the practicing clinician. The intentions of the criteria are to improve the selection of prescription drugs by clinicians and patients; evaluate patterns of drug use within populations; educate clinicians and patients on proper drug usage; and evaluate health-outcome, quality of care, cost, and utilization data.

CNS = central nervous system; COX = cyclooxygenase; CrCl = creatinine clearance; GI = gastrointestinal; NSAID = nonsteroidal anti-inflammatory drug; TCA = tricyclic antidepressant.

Correction made after online publication February 29, 2012: Table 2 has been updated.

* Infrequently used drugs.

Table 3

2012 American Geriatrics Society Beers Criteria for Potentially Inappropriate Medication Use in Older Adults Due to Drug–Disease or Drug–Syndrome Interactions That May Exacerbate the Disease or Syndrome

Disease or Syndrome	Drug	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Cardiovascular					
Heart failure	NSAIDs and C0X-2 inhibitors	Potential to promote fluid retention and exacerbate heart failure	Avoid	NSAIDs: moderate	Strong
	Nondihydropyridine CCBs (avoid only for systolic heart failure)			CCBs: moderate	
	Diltiazem			Thiazolidinediones (glitazones): high	
	Verapamil			Cilostazol: low	
	Pioglitazone, rosiglitazone			Dronedarone: moderate	
	Cilostazol				
	Dronedarone				
Syncope	AChEIs	Increases risk of orthostatic hypotension or bradycardia	Avoid	Alpha blockers: high	AChEIs and TCAs: strong
	Peripheral alpha blockers			TCAs, AChEIs, and antipsychotics: moderate	Alpha blockers and antipsychotics: weak
	Doxazosin				
	Prazosin				
	Terazosin				
	Tertiary TCAs				
	Chlorpromazine, thioridazine, and olanzapine				
Central nervous system					
Chronic seizures or epilepsy	Bupropion	Lowers seizure threshold; may be acceptable in patients with well-controlled seizures in whom alternative agents have not been effective	Avoid	Moderate	Strong
	Chlorpromazine				
	Clozapine				
	Maprotiline				
	Olanzapine				

J Am Geriatr Soc. Author manuscript; available in PMC 2013 April 01.

Disease or Syndrome	Drug	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
	Thioridazine				
	Thiothixene				
	Tramadol				
Delirium	All TCAs	Avoid in older adults with or at high risk of delirium because of inducing or worsening delirium in older adults; if discontinuing drugs used chronically, taper to avoid withdrawal symptoms	Avoid	Moderate	Strong
	Anticholinergics (see Table 9 for full list)				
	Benzodiazepines				
	Chlorpromazine				
	Corticosteroids				
	H_2-receptor antagonist				
	Meperidine				
	Sedative hypnotics				
	Thioridazine				
Dementia and cognitive impairment	Anticholinergics (see Table 9 for full list)	Avoid because of adverse CNS effects.	Avoid	High	Strong
	Benzodiazepines	Avoid antipsychotics for behavioral problems of dementia unless nonpharmacological options have failed, and patient is a threat to themselves or others.			
	H_2-receptor antagonists	Antipsychotics are associated with an increased risk of cerebrovascular accident (stroke) and mortality in persons with dementia			
	Zolpidem				
	Antipsychotics, chronic and as-needed use				
History of falls or fractures	Anticonvulsants	Ability to produce ataxia, impaired psychomotor function, syncope, and additional falls; shorter-acting benzodiazepines are	Avoid unless safer alternatives are not available; avoid anticonvulsants	High	Strong

Disease or Syndrome	Drug	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
		not safer than long-acting ones	except for seizure disorders		
	Antipsychotics				
	Benzodiazepines				
	Nonbenzodiazepine hypnotics				
	Eszopiclone				
	Zaleplon				
	Zolpidem				
	TCAs and selective serotonin reuptake inhibitors				
Insomnia	Oral decongestants	CNS stimulant effects	Avoid	Moderate	Strong
	Pseudoephedrine				
	Phenylephrine				
	Stimulants				
	Amphetamine				
	Methylphenidate				
	Pemoline				
	Theobromines				
	Theophylline				
	Caffeine				
Parkinson's disease	All antipsychotics (see Table 8 for full list, except for quetiapine and clozapine)	Dopamine receptor antagonists with potential to worsen parkinsonian symptoms.	Avoid	Moderate	Strong
	Antiemetics	Quetiapine and clozapine appear to be less likely to precipitate worsening of Parkinson's disease			
	Metoclopramide				
	Prochlorperazine				
	Promethazine				
Gastrointestinal					
Chronic constipation	Oral antimuscarinics for urinary incontinence	Can worsen constipation; agents for urinary incontinence: antimuscarinics overall differ in incidence of	Avoid unless no other alternatives	For urinary incontinence: high	Weak

Disease or Syndrome	Drug	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
		constipation; response variable; consider alternative agent if constipation develops			
	Darifenacin			All others: Moderate to low	
	Fesoterodine				
	Oxybutynin (oral)				
	Solifenacin				
	Tolterodine				
	Trospium				
	Nondihydropyridine CCB				
	Diltiazem				
	Verapamil				
	First-generation antihistamines as single agent or part of combination products				
	Brompheniramine (various)				
	Carbinoxamine				
	Chlorpheniramine				
	Clemastine (various)				
	Cyproheptadine				
	Dexbrompheniramine				
	Dexchlorpheniramine (various)				
	Diphenhydramine				
	Doxylamine				
	Hydroxyzine				
	Promethazine				
	Triprolidine				
	Anticholinergics and antispasmodics (see Table 9 for full list of drugs with strong anticholinergic properties)				
	Antipsychotics				
	Belladonna alkaloids				
	Clidinium-chlordiazepoxide				
	Dicyclomine				

Disease or Syndrome	Drug	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
	Hyoscyamine				
	Propantheline				
	Scopolamine				
	Tertiary TCAs (amitriptyline, clomipramine, doxepin, imipramine, and trimipramine)				
History of gastric or duodenal ulcers	Aspirin (>325 mg/d)	May exacerbate existing ulcers or cause new or additional ulcers	Avoid unless other alternatives are not effective and patient can take gastroprotective agent (proton pump inhibitor or misoprostol)	Moderate	Strong
	Non–COX-2 selective NSAIDs				
Kidney and urinary tract					
Chronic kidney disease Stages IV and V	NSAIDs	May increase risk of kidney injury	Avoid	NSAIDs: moderate	NSAIDs: strong
	Triamterene (alone or in combination)			Triamterene: low	Triamterene: weak
Urinary incontinence (all types) in women	Estrogen oral and transdermal (excludes intravaginal estrogen)	Aggravation of incontinence	Avoid in women	High	Strong
Lower urinary tract symptoms, benign prostatic hyperplasia	Inhaled anticholinergic agents	May decrease urinary flow and cause urinary retention	Avoid in men	Moderate	Inhaled agents: strong
	Strongly anticholinergic drugs, except antimuscarinics for urinary incontinence (see Table 9 for complete list)				All others: weak
Stress or mixed urinary incontinence	Alpha blockers	Aggravation of incontinence	Avoid in women	Moderate	Strong
	Doxazosin				
	Prazosin				
	Terazosin				

The primary target audience is the practicing clinician. The intentions of the criteria are to improve the selection of prescription drugs by clinicians and patients; evaluate patterns of drug use within populations; educate clinicians and patients on proper drug usage; and evaluate health-outcome, quality of care, cost, and utilization data.

CCB = calcium channel blocker; AChEI = acetylcholinesterase inhibitor; CNS = central nervous system; COX = cyclooxygenase; NSAID = nonsteroidal anti-inflammatory drug; TCA = tricyclic antidepressant.

Table 4

2012 American Geriatrics Society Beers Criteria for Potentially Inappropriate Medications to Be Used with Caution in Older Adults

Drug	Rationale	Recommendation	Quality of lation Evidence	Strength of Recommendation
Aspirin for primary prevention of cardiac events	Lack of evidence of benefit versus risk in individuals aged ≥80	Use with caution in adults aged ≥80	Low	Weak
Dabigatran	Greater risk of bleeding than with warfarin in adults aged ≥75; lack of evidence for efficacy and safety in individuals with CrCl < 30 mL/min	Use with caution in adults aged ≥75 or if CrCl < 30 mL/min	Moderate	Weak
Prasugrel	Greater risk of bleeding in older adults; risk may be offset by benefit in highest-risk older adults (e.g., with prior myocardial infarction or diabetes mellitus)	Use with caution in adults aged ≥75	Moderate	Weak
Antipsychotics	May exacerbate or cause syndrome of inappropriate antidiuretic hormone secretion or hyponatremia; need to monitor sodium level closely when starting or changing dosages in older adults due to increased risk	Use with caution	Moderate	Strong
Carbamazepine				
Carboplatin				
Cisplatin				
Mirtazapine				
Serotonin norepinephrine reuptake inhibitor				
Selective serotonin reuptake inhibitor				
Tricyclic antidepressants				
Vincristine				
Vasodilators	May exacerbate episodes of syncope in individuals with history of syncope	Use with caution	Moderate	Weak

The primary target audience is the practicing clinician. The intentions of the criteria are to improve the selection of prescription drugs by clinicians and patients; evaluate patterns of drug use within populations; educate clinicians and patients on proper drug usage; and evaluate health-outcome, quality of care, cost, and utilization data.

CrCl = creatinine clearance.

Table 5

Medications Moved to Another Category or Modified Since 2003 Beers Criteria

Independent of Diagnoses or Condition	Considering Diagnoses
Amphetamines (excluding methylphenidate hydrochloride and anorexics)	Fluoxetine, citalopram, fluvoxamine, paroxetine, and sertraline with syndrome of inappropriate antidiuretic hormone secretion
All barbiturates (except phenobarbital) except when used to control seizures	Olanzapine with obesity
Naproxen, oxaprozin, and piroxicam	Vasodilators with syncope
Nitrofurantoin	
Non-cyclooxygenase selective nonsteroidal anti-inflammatory drugs (excludes topical)	
Oral short-acting dipyridamole; does not apply to the extended-release combination with aspirin	
Oxybutynin	
Reserpine in doses <0.25 mg	

Table 6

Medications Removed Since 2003 Beers Criteria

Independent of Diagnoses	Considering Diagnoses
Cimetidine (H_2 antihistamines added as a class; see Table 7)	Antispasmodics and muscle relaxants; CNS stimulants: dextroamphetamine, methylphenidate, methamphetamine, pemoline, with cognitive impairment
Cyclandelate	CNS stimulants: dextroamphetamine, methylphenidate, methamphetamine, pemoline, and fluoxetine with anorexia and malnutrition
Daily fluoxetine	Clopidogrel with blood clotting disorders or receiving anticoagulant therapy
Ferrous sulfate <325 mg/d	Guanethidine with depression
Guanadrel	High-sodium content drugs with heart failure
Guanethidine	Monoamine oxidase inhibitors with insomnia
Halazepam	Oxybutynin and tolterodine with bladder outlet obstruction
Long-term use of stimulant laxatives: bisacodyl, cascara sagrada, and neoloid except in the presence of opiate analgesic use	Pseudoephedrine and diet pills with hypertension
Mesoridazine	Tacrine with Parkinson's disease
Propoxyphene and combination products	
Tripelennamine	

CNS = central nervous system.

Table 7

Medications Added Since 2003 Beers Criteria

	Considering Diagnoses	
Independent of Diagnoses Medication	**Corresponding Diagnosis or Syndrome**	
Aspirin for primary prevention of cardiac events	Acetylcholinesterase inhibitors	Syncope
Antiarrhythmic drugs, Class 1a, 1c, III	Anticonvulsants	History of falls or fractures
Belladonna alkaloids	H_1 and H_2 antihistamines	Delirium
Benztropine (oral)	Aspirin >325 mg	History of gastric or duodenal ulcers
Brompheniramine	Brompheniramine	Chronic constipation
Carbinoxamine	Caffeine	Insomnia
Chloral hydrate	Carbamazepine	SIADH or hyponatremia
Clemastine	Carbinoxamine	Chronic constipationa
Clomipramine	Carboplatin	SIADH or hyponatremia
Clonazepam	Clemastine (various)	Chronic constipation
Dabigatran	Clozapine	Chronic seizures or epilepsy
Desiccated thyroid	Cisplatin	SIADH or hyponatremia
Dexbrompheniramine	Cyclooxygenase-2 inhibitors	Heart failure
Doxylamine	Darifenacin	Chronic constipation
Dronedarone	Desipramine	Falls and fractures
Estazolam	Dexbrompheniramine	Chronic constipation
Eszopiclone	Dexchlorpheniramine	Chronic constipation
First- and second-generation antipsychotics	Doxylamine	Chronic constipation
Flurazepam	Estrogen, transdermal	Urinary incontinence (all types) in women
Glyburide	Eszopiclone	History of falls or fractures
Growth hormone	Fesoterodine	Chronic constipation
Guanabenz	Inhaled anticholinergics	Lower urinary tract symptoms and benign prostatic hyperplasia
Guanfacine	Maprotiline	Chronic seizures or epilepsy
Insulin, sliding scale	Mirtazapine	SIADH or hyponatremia
Megestrol	Nondihydropyridine calcium channel blockers	Heart failure
Metoclopramide	Nortriptyline	Falls and fractures
Oral doxepin >6 mg/d	Pioglitazone	Heart failure
Phenobarbital	Prochlorperazine	Parkinson disease
Prasugrel	Rosiglitazone	Heart failure
Prazosin	Scopolamine	Chronic constipation
Scopolamine	Serotonin-norepinephrine reuptake inhibitors	SIADH or hyponatremia
Spironolactone	Solifenacin	Chronic constipation
Testosterone	Thiothixene	Chronic seizures or epilepsy
Trihexyphenidyl	Thioridazine	Syncope
Trimipramine	Triamterene	Chronic kidney disease Stages IV and V
Triprolidine	Triprolidine	Chronic constipation

	Considering Diagnoses	
Independent of Diagnoses Medication	**Corresponding Diagnosis or Syndrome**	
Zaleplon	Trospium	Chronic constipation
Zolpidem	Vincristine	SIADH or hyponatremia
	Zaleplon	History of falls or fractures
	Zolpidem	Dementia and cognitive impairment

SIADH = syndrome of inappropriate antidiuretic hormone secretion.

Table 8

First- and Second-Generation Antipsychotics

First-Generation (Conventional) Agents	Second-Generation (Atypical) Agents
Chlorpromazine	Aripiprazole
Fluphenazine	Asenapine
Haloperidol	Clozapine
Loxapine	Iloperidone
Molindone	Lurasidone
Perphenazine	Olanzapine
Pimozide	Paliperidone
Promazine	Quetiapine
Thioridazine	Risperidone
Thiothixene	Ziprasidone
Trifluoperazine	
Triflupromazine	

Table 9

Drugs with Strong Anticholinergic Properties

Antihistamines	Antiparkinson agents	Skeletal Muscle
Brompheniramine	Benztropine	Relaxants
Carbinoxamine	Trihexyphenidyl	Carisoprodol
Chlorpheniramine		Cyclobenzaprine
Clemastine		Orphenadrine
Cyproheptadine		Tizanidine
Dimenhydrinate		
Diphenhydramine		
Hydroxyzine		
Loratadine		
Meclizine		
Antidepressants	Antipsychotics	
Amitriptyline	Chlorpromazine	
Amoxapine	Clozapine	
Clomipramine	Fluphenazine	
Desipramine	Loxapine	
Doxepin	Olanzapine	
Imipramine	Perphenazine	
Nortriptyline	Pimozide	
Paroxetine	Prochlorperazine	
Protriptyline	Promethazine	
Trimipramine	Thioridazine	
	Thiothixene	
	Trifluoperazine	
Antimuscarinics (urinary incontinence)	Antispasmodics	
Darifenacin	Atropine products	
Fesoterodine	Belladonna alkaloids	
Flavoxate	Dicyclomine	
Oxybutynin	Homatropine	
Solifenacin	Hyoscyamine products	
Tolterodine	Propantheline	
Trospium	Scopolamine	