American Geriatrics Society 2022 Updated AGS Beers Criteria® for Potentially Inappropriate Medication Use in Older Adults

By the 2022 American Geriatrics Society Beers Criteria® Update Expert Panel

The Beers Criteria were developed by Mark Beers, MD, and colleagues at the University of California Los Angeles in 1991, with the purpose of identifying medications for which potential harm outweighed expected benefit and that should be avoided in nursing home residents.[1] The 1997 update expanded the criteria to apply to all older adults.[2] The 2022 American Geriatrics Society (AGS) Beers Criteria® (AGS Beers Criteria®) for Potentially Inappropriate Medication (PIM) Use in Older Adults is the seventh overall update and fourth since AGS became the criteria's steward in 2012. As with previous updates, the AGS and its expert panel have attempted to preserve the spirit and intent of the original Beers Criteria by providing an explicit list of PIMs that are best avoided by older adults in most circumstances or under specific situations, such as certain diseases, conditions, or care settings.

An interdisciplinary panel reviewed new data published since the 2019 update (beginning in 2017, the cutoff date for the prior update's literature review) to identify evidence that would remove, sustain, or alter existing criteria recommendation, rationale, level of evidence, or strength of recommendation. The panel also considered evidence that would support new criteria. For the first time, the panel considered whether any medications (and resulting criteria) should be removed because of low usage or product availability in the United States by examining national usage data to identify PIMs for which use fell below a specified threshold. All 5 types of criteria were retained from the 2019 update, with the panel consciously consolidating formatting for clarity and space.

OBJECTIVES

The specific aim was to update the 2019 AGS Beers Criteria® using a comprehensive, systematic review and grading of the evidence on drug-related problems and adverse events in older adults. The strategies to achieve this aim were to:

- Convene an interdisciplinary panel of 12 experts in geriatric care and pharmacotherapy who would apply a modified Delphi method, informed by the systematic review and grading, to reach consensus on the 2022 update.
- Incorporate new evidence on PIMs included in the 2019 AGS Beers Criteria® and evidence regarding new criteria being considered for the 2022 update.
- Grade the strength and quality of each PIM statement based on the level of evidence and strength of recommendation.
- Incorporate exceptions in the AGS Beers Criteria® that the panel deemed clinically appropriate. These exceptions would be designed to make the criteria more individualized to clinical practice and more diverse and relevant across settings of care and populations of older adults.

INTENT OF CRITERIA

The primary target audience for the 2022 AGS Beers Criteria® is practicing clinicians. The criteria are intended to be applied to adults 65 years old and older in all ambulatory, acute, and institutionalized settings of care, except hospice and end-of-life care settings. The intention of the AGS Beers Criteria® is to reduce older adults' exposure to PIMs by improving medication selection; to educate clinicians and patients; to reduce adverse drug events; and to serve as a tool for evaluating quality of care, cost, and patterns of drug use of older adults. Others who utilize the criteria include healthcare consumers, researchers, pharmacy benefits managers, regulators, and policymakers. As with previous updates, the panel had discussions and debates in an effort to attain a balance between the multiple uses and users.

The AGS and the panel remind users of the AGS Beers Criteria® that the criteria are not to be used in a punitive manner. Prescribing for older adults is often a complex endeavor involving the consideration of many factors, particularly the preferences and goals of the patient and family. Deprescribing studies have demonstrated how critical patient and family input and buy-in can be to the success of discontinuing medications responsible for actual or potential harm or that provide little to no therapeutic value[3]. Quality measures must be clearly defined, easily applied, and measured with limited information and, thus, although useful, cannot perfectly distinguish appropriate from inappropriate care. The panel's review of evidence at times identified

subgroups of individuals who should be exempt from a given criterion or to whom a specific criterion should apply. Such a criterion may not be easily applied as a quality measure, particularly when such subgroups cannot be easily identified through structured and readily accessible electronic data (for example, when diagnoses, purpose of prescribing, or laboratory measures such as kidney function are not available).

METHODS

Methods used for the 2022 update of the AGS Beers Criteria® were similar to those used in the 2019 update, including the rigor of the evidence review and synthesis process.[4] These methods were adapted from the Grading of Recommendations Assessment, Development and Evaluation (GRADE) guidelines for clinical practice guideline development and are consistent with recommendations from the National Academy of Medicine.[5,6]

Panel Composition

The AGS Beers Criteria® expert update panel comprised 12 clinicians and included physicians, pharmacists, and nurses, 10 of whom had participated in the 2019 update. Panelists had experience in different practice settings, including ambulatory care, home care, acute hospital care, skilled-nursing facility, and long-term care. In addition, the panel included ex-officio representatives from the Center for Medicare & Medicaid Services, the National Committee for Quality Assurance, and the Pharmacy Quality Alliance. Potential conflicts of interest were disclosed at the beginning of the process and before each full panel call and are listed in the disclosures section of this paper. Panelists were recused from discussion in areas in which they had a potential conflict of interest.

Literature Review

Literature searches were conducted in PubMed from June 1, 2017, to May 31, 2022. Search terms for each criterion included individual drugs, drug classes, specific conditions, and combinations thereof, each with a focus on "adverse drug events" and "adverse drug reactions," as well as on any specific focus defined by the Expert Panel. Searches targeted controlled clinical trials, observational studies, and systematic reviews and meta-analyses, with filters for human participants, 65 years old and older, and English language. Clinical reviews and guidelines were

also included to provide context. Case reports, case series, letters to the editor, and editorials were excluded.

Searches identified 33,965 references; 7,352 abstracts were sent to panelists for review, of which 1,364 references were selected for full-text review. Among these, 517 manuscripts were abstracted into evidence tables, and an additional 148 were included as background reports.

Development Process

The full panel convened for a series of conference calls between December 2020 and November 2022. Between the full panel calls, work was conducted via email. In addition, the panel was divided into 4 workgroups, each assigned a subset of the criteria, with each workgroup leading the review and synthesis of evidence for its subset of the criteria.

The panel began its work using an anonymous Delphi process to review the 2019 AGS Beers Criteria®. Using a 5-point Likert scale with anchors of "strongly disagree" and "strongly agree," criteria receiving three or more panel votes of "unsure" or below, were brought back for group discussion and flagged for the individual workgroups to review for possible updating (of note, during the full process, groups reviewed all legacy criteria for accuracy and appropriateness). Panelists also provided input about drugs to be explored further for possible addition.

To guide the evidence selection, review, and synthesis process, each workgroup reviewed and updated worksheets created for the 2019 criteria that identified a priori which clinical outcomes, indications, and comparison groups were most relevant when considering evidence for each criterion, i.e., the "desired evidence" for reviewing each criterion. These discussions were not considered binding but provided guidance for keeping the evidence review and synthesis focused on what was most clinically relevant.

Each workgroup reviewed abstracts from the literature searches for the criteria in its purview and collectively selected a subset for full-text review. This selection process considered the methodologic quality of each study, its relevance to older adults, and its concordance with the desired evidence noted above. After reviewing the full text of each selected article, the

workgroup then decided by consensus which papers represented the best available evidence, based on a balance of these same 3 key criteria (methodologic quality, relevance to older adults, and concordance with desired evidence). Special emphasis was placed on selecting systematic reviews and meta-analyses when available because resource constraints precluded the panel from conducting these types of comprehensive analyses. In general, a study was considered relevant to older adults if the mean or median age of participants was at least 65 years, and especially relevant if most or all participants were older than this age threshold.

Papers comprising the best available evidence were abstracted into evidence tables. These tables summarized the design, study population, and findings of each study, and identified markers of methodologic quality highlighted by the GRADE criteria for clinical trials and observational studies and by the AMSTAR criteria for systematic reviews and meta-analyses.[7-9] Each workgroup then synthesized evidence for each criterion from the 2017–2022 literature reviews informed by GRADE guidelines and the American College of Physicians' evidence grading framework (Table 1).[7,10]

Using evidence from the 2017–2022 literature review, findings from the previous 2012, 2015, and 2019 updates, and clinical judgment, each workgroup presented to the full panel their findings and suggestions for changes (or no change) to the criteria, with ensuing discussion. For most criteria, a consensus emerged: to leave an existing criterion from the 2019 update unchanged, to modify it, to remove it entirely, or to add a new criterion. Possible modifications included which drug(s) to include, the recommendation, the rationale, the quality of evidence, and the strength of recommendation. As noted in the GRADE guidelines, strength of recommendation ratings incorporate a variety of considerations, including expert opinion and clinical judgment and context, and thus do not always align with quality of evidence ratings.

After proposed changes were drafted, a second anonymous Delphi process was used to ascertain panel consensus on the changes, using the same 5-point Likert scale as was previously used. As a general rule, criteria receiving 3 or more panel votes of "unsure" or disagreement were brought back for group discussion to reach a final consensus decision.

In addition to changes made on the basis of evidence, the panel decided on several modifications to improve clarity and usability of the AGS Beers Criteria®. In selected cases, the panel changed the wording of certain criteria, recommendations, and rationale statements to improve clarity and avoid possible misinterpretations. In addition, the panel voted to remove a number of medications that have low usage in the US, which was defined as <4000 US Medicare beneficiaries age 65 years or older receiving the drug in 2019 based on data from Medicare Part D Public Use Files. These are shown in Table 8. (Based on group consensus, the panel retained some drugs in the criteria despite having <4000 mentions in these files based on over-the-counter availability and concerns that these drugs are still being used commonly enough to pose a population risk, including in settings not ascertainable through Medicare Part D data). Also removed were a number of PIMs that are no longer available in the US because there is no current manufacturer, they have been removed from the market, or available dosage forms limit use to specific uses outside the scope of the criteria. These removals should not be interpreted as condoning use of these medications – they are still considered potentially inappropriate by intent of the criteria – but rather are intended to "declutter" the AGS Beers Criteria® and not distract from information on more commonly used medications. Because medications included in the criteria reflect the US context, adaptations may be warranted in other countries that have different patterns of medication approval and use.

The final set of criteria was reviewed by the AGS Executive Committee and Clinical Practice and Models of Care Committee and subsequently released for public comment. Comments were solicited from the general public and sent to 22 organizations.

RESULTS

Noteworthy Changes to PIMS for Older Adults

The 2022 AGS Beers Criteria® are displayed in Tables 2 through 6. To enhance clarity, a special box that summarizes criteria for anticoagulants (warfarin, rivaroxaban, and dabigatran) has been added. Table 7 is a list of drugs with strong anticholinergic properties referred to in Tables 2, 3, and 5. Table 8 lists drugs that have been removed from the criterion because of low usage, not being currently available in the US, or other reasons. A summary of modifications and additions to the criteria are shown in Tables 9 and 10.

In Table 2, the rationale for anticholinergic drugs to avoid has been expanded to recognize the risks associated with concurrent use (anticholinergic burden) and is also recognized in Tables 3 and 5. The criterion on use of aspirin for primary prevention of cardiovascular disease has been revised and moved from the "use with caution" table (Table 4) to Table 2, with the new recommendation being to avoid initiating aspirin for primary prevention of cardiovascular disease (in agreement with the US Preventive Services Task Force's recommendation).[11] For adults who are already taking aspirin for primary prevention, the panel recommends deprescribing be considered, pending any new data on this issue.

Changes to the criteria involving anticoagulation were discussed at length, including the proposed changes, the supporting literature, and ramifications. The recommendation for rivaroxaban has changed from "use with caution" to "avoid" for long-term treatment of nonvalvular atrial fibrillation and venous thromboembolism (VTE), with the rationale being that observational studies and network meta-analyses find that this drug confers a higher risk of major and gastrointestinal bleeding in older adults than other direct acting oral anticoagulants (DOACs), particularly apixaban, but also dabigatran. The panel recognizes there may be circumstances when rivaroxaban may be a reasonable choice and that all DOACs have a lower risk of intracranial hemorrhage than warfarin.

Warfarin has been added to Table 2 as a medication to be avoided for initial therapy for VTE or nonvalvular atrial fibrillation unless alternatives (eg, DOACs) are contraindicated or there are substantial barriers to the use of an alternative. High out-of-pocket costs that some patients are required to pay for DOACs are a notable concern, and we urge insurers to ensure that out-of-pocket costs are not a barrier to safe and effective anticoagulation. The recommendation for dabigatran remains as "use with caution" for the long-term treatment of nonvalvular atrial fibrillation and VTE (Table 4) because of evidence suggesting an increased risk of gastrointestinal and major bleeding compared with alternatives such as apixaban.

Another change from the 2019 criteria pertains to the initiation and continuation of estrogen to postmenopausal women. The initiation of oral and transdermal estrogen is to be avoided in older

women; topical vaginal estrogen remains appropriate for its major indications of symptomatic vaginal atrophy or urinary tract infection prophylaxis. Deprescribing should be considered for older women already using nonvaginal estrogen replacement. The recommendation for sulfonylureas has been expanded to avoid all sulfonylureas as first- or second-line monotherapy or add on-therapy in recognition of their association with a higher risk of cardiovascular events, all-cause mortality, and hypoglycemia than alternative choices. Here the panel recognizes there may be substantial barriers to or pressures opposing the recommendation, including financial ones, with similar considerations as those discussed above for anticoagulants. If a sulfonylurea must be used, then a short-acting agent is preferred because of the higher risk of prolonged hypoglycemia with longer-acting sulfonylureas (eg, glimepiride, chlorpropramide, or glyburide, which is also known as glibenclamide).

Changes to the criteria involving PIMs exacerbating specific drug-disease and drug-syndromes (Table 3) are relatively minimal. The combination dextromethorphan/quinidine was added to the list of drugs to avoid in patients with heart failure. In the criterion of PIMs to avoid in older adults with a history of falls or fractures, the level of evidence for antidepressants has been lowered to "moderate." Modifications and clarifications were made to the criteria for delirium, dementia, and Parkinson disease, including adding opioids to the list of drugs that can exacerbate delirium. The update continues to stress the need to avoid antipsychotics and other medications for behaviorial problems of dementia and delirium as this is frequently associated with harm and increased during and after the pandemic.[12-14] The use of behavioral interventions and search for modifiable triggers for behavior[12,15] remains the preferred management strategy and should be clearly documented in the health record. Use of antipsychotics and other medications listed in these criteria should be a last resort in collaboration and with the use of shared decision-making with older adults and care partners.

As mentioned above, the criteria on aspirin and rivaroxaban have been moved from Table 4 to Table 2. Ticagrelor has been added to the criterion about prasugrel, advising that it be used with caution, particularly among adults 75 years old and older because of concerns of major bleeding. A new criterion was added advising that sodium glucose co-transporter-2 (SGLT2) inhibitors be used with caution because of increased risk of urogenital infection and ketoacidosis, and

recommends monitoring early during treatment. Of note, the panel recognizes the value of SGLT2-inhibitors but also wishes to emphasize that patients taking these drugs should be monitored actively for possible adverse effects.

The panel worked to clarify and consolidate the clinically important drug-drug interactions (Table 5), most notably the use of multiple agents with anticholinergic activity, the concurrent use of ≥3 CNS-active drugs from specific therapeutic categories (which now include skeletal muscle relaxants), and the addition of SSRIs to the list of warfarin drug-drug interactions. The interactions involving phenytoin and theophylline were removed because of their diminished therapeutic roles.

The anticoagulants also dominated the panel's attention when updating drugs to avoid or reduce dose with varying levels of kidney function (Table 6). The criterion for apixaban has been removed given the evidence for its safe use in patients with end-stage renal disease. Rivaroxaban's dosing in reduced kidney function is variable and is based on indication; thus, the criteria refer to the product label. Baclofen has been added with a recommendation to avoid its use when eGFR is <60 ml/min because of increased risk for encephalopathy in older adults.

DISCUSSION

The AGS Beers Criteria® continues to evolve to address the changing landscape of available medications and emerging data about their harms and benefits. Some of the most notable updates from the 2019 criteria include a series of new and revised criteria regarding anticoagulants and expanding the "avoid" recommendation for sulfonylureas, which previously focused on long-acting sulfonylureas but now includes all medications in this class (in particular, avoiding them as first- or second-line therapy, while still advising that if a sulfonylurea is used, shorter-acting ones pose less risk of hypoglycemia than longer-acting ones).

The introductory section of this article describes the intent of the criteria. In addition, we strongly encourage readers to understand and apply guidance on how to interpret the recommendations, apply them to policy and practice, use best practices for deprescribing, and understand the criteria's strengths and limitations. These are explained below.

Interpreting Recommendations

The original Beers Criteria used "avoid" as a recommendation, meaning "the medication should be avoided except under unusual circumstances."[1] Such circumstances include (but are not limited to) when a safer alternative did not achieve the desired therapeutic outcome. Thus, PIMs "would be chosen infrequently through such careful considerations of benefit and risk."[1] "Avoid" in the 2022 AGS Beers Criteria® has the same meaning. "Avoid" is not defined as an absolute contraindication unless specified in the medication's label. It is the panel's intent that when a PIM is chosen, it is done so with diligence and recognition of its potential harms and applicability to a patient's preferences and goals of care. As in previous updates to the AGS Beers Criteria®, the panel has included caveats about when choosing a PIM would not be inappropriate, eg, a benzodiazepine for ethanol withdrawal.

The panel also deliberated about and recognizes that clinicians and patients may face substantial financial pressures to use PIMs – such as when a safer treatment option incurs substantially higher out-of-pocket costs – and that drug affordability is an important consideration for many older adults and their caregivers. In general, the panel did not account for drug costs to different stakeholders when making decisions about which PIMs to include in the criteria. However, costs of care may play an important role in shared decision-making, and the panel strongly encourages policymakers and health plans to ensure that safer alternatives to PIMs are affordable. In addition to drug costs, costs of avoidable drug-related harms should be considered as well.

While most of the criteria (ie, those listed in Tables 2, 3, 5, and 6) generally use the "avoid" recommendation noted above, Table 4 comprises drugs to "use with caution." The intent of this "use with caution" table is to highlight drugs that raise some cause for concern but not to the level of an "avoid" recommendation. This can occur because evidence for the concern is limited or lacks consistency, the degree of harm relative to alternative therapies is not high enough to warrant an "avoid" recommendation, or extenuating clinical circumstances are often present. The panel encourages clinicians to recognize the potential harms of these medications and, as the moniker states, to use them with caution. We also remind readers that drugs removed from the

AGS Beers Criteria® due to low usage or unavailability in the US (Table 8) are still considered potentially inappropriate per recommendations of the 2019 AGS Beers Criteria update.

Unless specified otherwise, the criteria are designed to apply to adults 65 years old and older. The panel recognizes drug-related harms are typically more pronounced in the "old-old" than in the "young-old" and in persons with complex multimorbidity and frailty. Thus, two older adults of the same age can have markedly different risks of drug-related harm. Certain criteria include a specific age cutoff; these are provided when the evidence is specific to that age group. However, for most criteria, the evidence base is insufficient to set a specific age threshold for applying the criteria or to set a threshold for other factors that can increase risk of medication-related harms (eg, functional and cognitive status, burden of multimorbidity, and polypharmacy. We encourage clinicians to use common sense in applying the recommendations.

For some criteria, the panel distinguished between initiating a medication versus continuing one already in longstanding use. Such distinctions were considered by the panel in cases when the evidence suggested differential risk of harm in these two scenarios, when the evidence primarily addressed initiation rather than continuation, and/or when other professional society recommendations made this distinction. In a number of these criteria, the criteria recommend *to avoid* initiating the drug in nonusers, and to *consider deprescribing* among current users.

Applying the Criteria to Policy and Practice

The panel continues to be aware of and discuss the controversaries and misinformation about the proper interpretation of the AGS Beers Criteria®. As such, the panel continues to advise users of the criteria to read and use guidance from companion articles written to accompany the 2015 and 2019 AGS Beers Criteria® that advise patients, providers, and health systems on how to use (and not use) the 2022 AGS Beers Criteria®.[16,17] Key recommendations from those articles are summarized in Table 11. Certain clarifications to items in the table and additional considerations that arose during panel discussion merit special note. First, as noted above, different older adults may have markedly different risks of experiencing severe medication-related harms, with advanced age, cognitive and physical impairment, multimorbid burden, frailty, and a high degree of polypharmacy each conferring risk. A person's underlying risk of experiencing drug-related

harms should inform decisions about using drugs in the criteria. Second, risk of harms arises not just from drugs considered in isolation but in how multiple drugs affect an older adult when given together. Thus, evaluations of medication appropriateness should be made in the context of the totality of a person's medication regimen. Third, the intent of the AGS Beers Criteria® is not simply to swap out a better drug in place of a worse one. In many cases, nonpharmacologic treatments (or no treatment at all) may be preferable. Fourth, the panel affirms the importance of shared decision-making in selecting and changing treatment regimens. There may be situations in which initiating or continuing a drug on the criteria is reasonable because it is consistent with a patient's stated preferences, values, and treatment goals.

Deprescribing

Successful deprescribing of medications on the AGS Beers Criteria® involves much more than a clinician simply telling an older patient to stop the medication. Communication gaps and misunderstandings, patient reluctance and fear of stopping, coordination among multiple clinicians, dosage tapering, withdrawal symptoms, and conveying stop orders to pharmacies are just some of the challenges that can arise. The panel encourages clinicians to be aware of and develop skills to address these challenges. Useful resources include:

- https://deprescribing.org/resources/ – deprescribing resources, especially evidence-based guidelines and easy-to-use algorithms about when and how to stop common types of medications
- https://www.deprescribingnetwork.ca/professionals – resources for health care professionals, including deprescribing-oriented patient handouts about medications that are commonly inappropriate for older adults

Strengths and Limitations

As with previous versions of the AGS Beers Criteria®, this update is subject to the same limitations. First, the evidence available is often plagued by the small number of clinical trials in older adults or by the lack of inclusion of a sufficient number of older adults to conduct an age-specific analysis. The panel often relied on observational studies and meta-analyses for evidence of harm and whether the harm was more common or resulted in more serious outcomes in older

adults.

Second, diversity and inclusion in study populations was another challenge to the panel. Inadequate representation in underrepresented, disproportionately affected, and understudied populations enrolled in clinical trials is a distressingly well-described phenomenon, and a seemingly larger number of studies identified were generated within a specific country, possibly contributing to greater racial and ethnic homogeneity among study participants. Even when more diverse populations were included in a study, there was often inadequate power to determine outcomes by specific groups. Third, the criteria include only medications available in the US. Clinicians outside the US, with access to different medications from the same drug class as those the criteria recommends avoiding, will need to adapt the guidelines to their local context. Fourth, it is possible that our literature search did not identify all published evidence that would have been pertinent. Our search strategy did not include unpublished studies, papers not published in English, white papers, abstracts, technical reports, or other evidence published in the "grey literature."

Despite its limitations, the 2022 AGS Beers Criteria® has its strengths. The panel and staff are highly experienced; most have participated in updating the criteria since 2012, and some since 2003. Their familiarity with the process and modified Delphi technique is an advantage. The panel also included ad hoc members from important institutional stakeholders, namely the Centers for Medicare and Medicaid, the National Committee for Quality Assurance, and the Pharmacy Quality Alliance, who provided valuable insight and feedback throughout the process.

CONCLUSION

The 2022 update of the AGS Beers Criteria® includes 67 modifications, which includes 9 new criteria and 21 significantly modified criteria. It is the hope of the AGS and the 2022 AGS Beers Criteria® panel that the updated criteria will be used as intended – to improve drug therapy and outcomes by identifying and reducing the prescribing of PIMs in older adults.

PANEL MEMBERS AND AFFILIATIONS

The following individuals were members of the AGS Panel to update the 2022 AGS Beers Criteria®: (co-chair) Todd P. Semla, PharmD, MS, BCPG, FCCP, AGSF, U.S. Department of Veterans Affairs National Pharmacy Benefits Management Services (retired) and Northwestern University Feinberg School of Medicine, Chicago, IL; (co-chair) Michael Steinman, MD, University of California San Francisco and San Francisco Veterans Affairs Medical Center, San Francisco, CA; (co-chair) Judith Beizer, PharmD, BCGP, FASCP, AGSF, St. John's University, Queens, NY; Nicole Brandt, PharmD, MBA, BCPP, BCGP, FASCP, University of Maryland, Baltimore, MD; Rachel Digmann, PharmD, Pharmacy Quality Alliance, Alexandria, VA (nonvoting member); Robert Dombrowski, PharmD, Centers for Medicare and Medicaid Services, Baltimore, MD (nonvoting member); Catherine E. DuBeau, MD, Dartmouth-Hitchcock Medical Center, Lebanon, NH; Donna M. Fick, PhD, RN, FGSA, FAAN, College of Nursing and Medicine, The Pennsylvania State University, University Park, PA; Nina Flanagan, PhD, GNP-BC, APHM-BC, Binghamton University, Vestal, NY; Claudene George, MD, MS, RPh, Montefiore Medical Center, The Bronx, NY; Rachel Harrington, PhD, National Committee for Quality Assurance, Washington, DC (nonvoting member); Peter Hollmann, MD, AGSF, Brown Medicine, Providence, RI; Holly Holmes, MD, MS,AGSF, McGovern Medical School at UT Health, Houston, TX; Rosemary Laird, MD, MHSA, AGSF, Winter Park Memorial Hospital, Winter Park, FL; Sunny Linnebur, PharmD, FCCP, BCPS, BCGP, FASCP, University of Colorado, Aurora, CO.

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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: To be filled in.

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

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

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Table 1. Designations of Quality of Evidence and Strength of Recommendations

Quality of Evidence			
Quality of evidence ratings for each criterion are based on synthetic assessment of 2 complementary approaches to evaluating the quality of evidence.			
ACP-based approach[10]			***GRADE-based approach[5]***
High-quality evidence	"Evidence…obtained from 1 or more well-designed and well-executed randomized, controlled trials (RCTs) that yield consistent and directly applicable results. This also means that further research is very unlikely to change our confidence in the estimate of effect."		Consider the following 5 factors for the studies that comprise the best-available evidence for a given criterion: 1. *Risk of bias:* Severity of threats to studies' internal validity (eg, randomized vs observational design, potential for confounding, bias in measurement, etc) 2. *Inconsistency:* Do different studies provide similar or different estimates of effect size? 3. *Indirectness:* How relevant are the studies to the clinical question at hand (eg, nature of study of population, comparison group, type of outcomes measured, etc)? 4. *Imprecision:* Precision of estimates of effect 5. *Publication bias:* Risk of bias because of selective publication of results
Moderate-quality evidence	"Evidence…obtained from RCTs with important limitations…. In addition, evidence from well-designed controlled trials without randomization, well-designed cohort or case-control analytic studies, and multiple time series with or without intervention are in this category. Moderate-quality evidence also means that further research will probably have an important effect on our confidence in the estimate of effect and may change the estimate."		
Low-quality evidence	"Evidence obtained from observational studies would typically be rated as low quality because of the risk for bias. Low-quality evidence means that further research is very likely to have an important effect on our confidence in the estimate of effect and will probably change the estimate. However, the quality of evidence may be rated as moderate or even high, depending on circumstances under which evidence is obtained from observational studies."		
⬇ ⬇ ⬇ ⬇ ⬇			
Overall quality of evidence that supports a given criterion: high, moderate, low			
Strength of Evidence			
Strength of evidence ratings for each criterion are based on synthetic integration of the quality of evidence, the frequency and severity of potential adverse events and relationship to potential benefits, and clinical judgment.			
Strong	Harms, adverse events, and risks clearly outweigh benefits.		
Weak	Harms, adverse events, and risks may not outweigh benefits.		

Adapted from:
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.
Guyatt G, Oxman AD, Sultan S, et al. GRADE guidelines: 11. Making an overall rating of confidence in effect estimates for a single outcome and for all outcomes. *J Clin Epidemiol.* 2013;66(2):151–157.

Andrews JC, Schünemann HJ, Oxman AD, et al. GRADE guidelines: 15. Going from evidence to recommendation-determinants of a recommendation's direction and strength. *J Clin Epidemiol.* 2013;66(7):726–735.

Table 2. 2022 American Geriatrics Society Beers Criteria® for Potentially Inappropriate Medication Use in Older Adults

Organ System, Therapeutic Category, Drug(s)	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Anticholinergics*				
First-generation antihistamines Brompheniramine Chlorpheniramine Cyproheptadine 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. Cumulative exposure to anticholinergic drugs is associated with increased risk of falls, delirium, and dementia, even in younger adults. Consider total anticholinergic burden during regular medication reviews and be cautious in "young-old" as well as "old-old" adults. 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 or treatment of extrapyramidal symptoms due to antipsychotics; more effective agents available for treatment of Parkinson disease.	Avoid	Moderate	Strong
Antispasmodics Atropine (excludes ophthalmic) Clidinium-chlordiazepoxide Dicyclomine Hyoscyamine Scopolamine	Highly anticholinergic, uncertain effectiveness	Avoid	Moderate	Strong
Antithrombotic				
Dipyridamole, oral short-acting (does not apply to	May cause orthostatic hypotension; more effective alternatives available; IV form acceptable for use in cardiac stress testing	Avoid	Moderate	Strong

extended-release combination with aspirin)				
Anti-infective				
Nitrofurantoin	Potential for pulmonary toxicity, hepatoxicity, and peripheral neuropathy, especially with long-term use; safer alternatives available	Avoid in individuals with CrCl <30 mL/min or for long-term suppression.	Low	Strong
Cardiovascular				
Aspirin for primary prevention of cardiovascular disease	Risk of major bleeding from aspirin increases markedly in older age. Studies suggest lack of net benefit and potential for net harm when initiated for primary prevention in older adults. There is less evidence about stopping aspirin among long-term users, although similar principles as for initiation may apply. *Note:* Aspirin is generally indicated for secondary prevention in older adults with established cardiovascular disease.	Avoid initiating aspirin for primary prevention of cardiovascular disease. Consider deprescribing aspirin in older adults already taking it for primary prevention.	Strong	Strong
Peripheral alpha-1 blockers for treatment of hypertension Doxazosin Prazosin Terazosin	High risk of orthostatic hypotension and associated harms, especially in older adults; not recommended as routine treatment for hypertension; alternative agents have superior risk/benefit profile.	Avoid use as an antihypertensive.	Moderate	Strong
Central alpha-agonists Clonidine for first-line treatment of hypertension Other CNS alpha-agonists Guanfacine	High risk of adverse CNS effects; may cause bradycardia and orthostatic hypotension; not recommended as routine treatment for hypertension	Avoid as first-line antihypertensive. Avoid other CNS alpha-agonists as listed.	Low Low	Strong Strong

Dronedarone	Worse outcomes in patients taking dronedarone who have permanent atrial fibrillation or severe or recently decompensated heart failure. In some circumstances, worse outcomes have also been reported in people with HFrEF (eg, left ventricular ejection fraction ≤35%) who have milder symptoms (NYHA class I and II).	Avoid in individuals with permanent atrial fibrillation or severe or recently decompensated heart failure. Use caution in patients with HfrEF with less severe symptoms (NYHA class I and II).	High	Strong
Digoxin for first-line treatment of atrial fibrillation or heart failure	Use in atrial fibrillation: should not be used as a first-line agent because there are safer and more effective alternatives for rate control. Use in heart failure: evidence for benefits and harms of digoxin is conflicting and of lower quality; most (but not all) the evidence concerns use in HfrEF. There is strong evidence for other agents as first-line therapy to reduce hospitalizations and mortality in adults with HfrEF. In heart failure, higher dosages are not associated with additional benefit and may increase risk of toxicity. Decreased renal clearance of digoxin may lead to increased risk of toxic effects; further dose reduction may be necessary in those with Stage 4 or 5 chronic kidney disease.	Avoid this rate control agent as first-line therapy for atrial fibrillation. Avoid as first-line therapy for heart failure. If used for atrial fibrillation or heart failure, avoid dosages >0.125 mg/day.	Atrial fibrillation: low Heart failure: low Dosage >0.125 mg/day: moderate	Atrial fibrillation: strong Heart failure: strong Dosage >0.125 mg/day: strong
Nifedipine, immediate release	Potential for hypotension; risk of precipitating myocardial ischemia	Avoid	High	Strong
Amiodarone	Effective for maintaining sinus rhythm but has greater toxicities than other antiarrhythmics used in atrial fibrillation; may be reasonable first-line	Avoid as first-line therapy for atrial fibrillation unless	High	Strong

	therapy in patients with concomitant heart failure or substantial left ventricular hypertrophy if rhythm control is preferred over rate control.	patient has heart failure or substantial left ventricular hypertrophy.		
Rivaroxaban for long-term treatment of nonvalvular atrial fibrillation or VTE	At doses used for long-term treatment of VTE or nonvalvular atrial fibrillation, rivaroxaban appears to have higher risk of major bleeding and GI bleeding in older adults than other DOACs, particularly apixaban. Rivaroxaban may be reasonable in special situations, for example when once-daily dosing is necessary to facilitate medication adherence. All DOACs confer lower risk of intracranial hemorrhage than warfarin.	Avoid for long-term treatment of atrial fibrillation or VTE in favor of safer anticoagulant alternatives. See also criteria on warfarin (Table 2) and dabigatran (Table 4) and footnote regarding choice between warfarin and DOACs and among DOACs.	Moderate	Strong
Warfarin for treatment of nonvalvular atrial fibrillation or VTE	Compared with DOACs, warfarin has higher risks of major bleeding (particularly intracranial bleeding) and similar or lower effectiveness for treatment of nonvalvular atrial fibrillation and VTE. DOACs are thus the preferred choice for anticoagulation for most people with these conditions.	Avoid warfarin as initial therapy for treatment of nonvalvular atrial fibrillation or VTE unless alternative options (eg, DOACs) are contraindicated or there are substantial barriers to their use. For older adults who have been	High	Strong

		using warfarin long-term, it may be reasonable to continue this medication, particularly among those with well-controlled INRs (ie, >70% time in therapeutic range) and no adverse effects. See also criteria on rivaroxaban (Table 2) and dabigatran (Table 4) and footnote regarding choice among DOACs.		
Central nervous system				
Antidepressants with strong anticholinergic activity, alone or in combination Amitriptyline Amoxapine Clomipramine Desipramine Doxepin >6 mg/day Imipramine Nortriptyline Paroxetine	Highly anticholinergic, sedating, and cause orthostatic hypotension; safety profile of low-dose doxepin (≤6 mg/day) is comparable to that of placebo.	Avoid	High	Strong
Antipsychotics, first-(conventional) and second-	Increased risk of stroke and greater rate of cognitive decline and mortality in persons with	Avoid, except in FDA approved	Moderate	Strong

(atypical) generation	dementia. Additional evidence suggests association of increased risk between antipsychotic medication and mortality independent of dementia. Avoid antipsychotics for behavioral problems of dementia or delirium unless documented nonpharmacologic options (eg, behavioral interventions) have failed and/or the patient is threatening substantial harm to self or others. If used, periodic deprescribing attempts should be considered to assess ongoing need and/or lowest effective dose.	indications such as schizophrenia, bipolar disorder, Parkinson disease psychosis, adjunctive treatment of major depressive disorder, or for short-term use as antiemetic.		
Barbiturates For example, butalbital, phenobarbital	High rate of physical dependence, tolerance to sleep benefits, greater risk of overdose at low dosages	Avoid	High	Strong
Benzodiazepines *Short- and intermediate-acting:* Alprazolam Estazolam Lorazepam Oxazepam Temazepam Triazolam *Long-acting:* Chlordiazepoxide (alone or in combination with amitriptyline or clidinium) Clonazepam Clorazepate Diazepam Flurazepam	The use of benzodiazepines exposes users to risks of abuse, misuse, and addiction. Concomitant use with opioids may result in profound sedation, respiratory depression, coma, and death. Older adults have increased sensitivity to benzodiazepines and decreased metabolism of long-acting agents; the continued use of benzodiazepines may lead to clinically significant physical dependence. In general, all benzodiazepines increase risk of cognitive impairment, delirium, falls, fractures, and motor vehicle crashes in older adults. May be appropriate for seizure disorders, rapid eye movement sleep behavior disorder, benzodiazepine withdrawal, ethanol withdrawal,	Avoid	Moderate	Strong

Quazepam	severe generalized anxiety disorder, and periprocedural anesthesia			
Meprobamate	High rate of physical dependence; very sedating	Avoid	Moderate	Strong
Nonbenzodiazepine benzodiazepine receptor agonist hypnotics (ie, "Z-drugs") Eszopiclone Zaleplon Zolpidem	Nonbenzodiazepine benzodiazepine receptor agonist hypnotics (ie, "Z drugs") have adverse events similar to those of benzodiazepines in older adults (eg, delirium, falls, fractures); increased emergency room visits/hospitalizations; motor vehicle crashes; minimal improvement in sleep latency and duration	Avoid	Moderate	Strong
Ergoloid mesylates (dehydrogenated ergot alkaloids)	Lack of efficacy	Avoid	High	Strong
Endocrine				
Androgens Methyltestosterone Testosterone	Potential for cardiac problems; contraindicated in men with prostate cancer	Avoid unless indicated for confirmed hypogonadism with clinical symptoms.	Moderate	Weak
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 Evidence indicates that vaginal estrogens for the treatment of vaginal dryness are safe and effective; women with a history of breast cancer who do not respond to nonhormonal therapies are advised to discuss the risks and benefits of low-dose vaginal estrogen (dosages of estradiol <25 mcg twice weekly) with their healthcare provider.	Do not initiate systemic estrogen (eg, oral tablets or transdermal patch). Consider deprescribing among older women already using this medication. Vaginal cream or vaginal tablets:	Oral and patch: high Vaginal cream or vaginal tablets: moderate	Oral and patch: strong Topical vaginal cream or tablets: weak

	For women who start HRT at age 60 and older, the risks of HRT are greater than the benefits, as HRT is linked to a higher risk of heart disease, stroke, blood clots, and dementia.	acceptable to use low-dose intravaginal estrogen for management of dyspareunia, recurrent lower urinary tract infections, and other vaginal symptoms		
Growth hormone	Impact on body composition is small and associated with edema, arthralgia, carpal tunnel syndrome, gynecomastia, impaired fasting glucose	Avoid, except for patients rigorously diagnosed by evidence-based criteria with growth hormone deficiency due to an established etiology.	High	Strong
Insulin, sliding scale (insulin regimens containing only short- or rapid-acting insulin dosed according to current blood glucose levels without concurrent use of basal or long-acting insulin)	Higher risk of hypoglycemia without improvement in hyperglycemia management regardless of care setting. Avoid insulin regimens that include only short- or rapid-acting insulin dosed according to current blood glucose levels without concurrent use of basal or long-acting insulin. This recommendation does not apply to regimens that contain basal insulin or long-acting insulin.	Avoid	Moderate	Strong
Megestrol	Minimal effect on weight; increases risk of thrombotic events and possibly death in older adults	Avoid	Moderate	Strong
Sulfonylureas (all, including short-and longer-acting)	Sulfonylureas have a higher risk of cardiovascular events, all-cause mortality, and hypoglycemia than alternative agents.	Avoid sulfonylureas as first- or second-line	Hypoglycemia: high	Hypoglycemia, CV events, and all-cause

	Sulfonylureas may increase the risk of cardiovascular death and ischemic stroke. Among sulfonylureas, long-acting ones (eg glyburide, glimepiride) confer higher risk of prolonged hypoglycemia than shorter-acting ones (eg, glipizide).	monotherapy or add-on therapy unless there are substantial barriers to use of safer and more effective agents. If a sulfonylurea is used, choose short-acting ones (eg, glipizide) over long-acting ones (eg, glyburide, glimepiride).	CV events and all-cause mortality: moderate CV death and ischemic stroke: low	mortality: strong Ischemic stroke: moderate CV death: low
Gastrointestinal				
Metoclopramide	Can cause extrapyramidal effects, including tardive dyskinesia; risk may be greater in frail older adults and with prolonged exposure	Avoid, unless for gastroparesis with duration of use not to exceed 12 weeks except in rare cases.	Moderate	Strong
Mineral oil, given orally	Potential for aspiration and adverse effects; safer alternatives available	Avoid	Moderate	Strong
Proton-pump inhibitors	Risk of *C difficile* infection, pneumonia, GI malignancies, bone loss and fractures	Avoid scheduled use for >8 weeks unless for high-risk patients (eg, oral corticosteroids or chronic NSAID use), erosive esophagitis, Barrett esophagitis, pathologic hypersecretory	*C difficile*, bone loss and fractures: high Pneumonia and GI malignancies: moderate	Strong

		condition, or demonstrated need for maintenance treatment (eg, because of failure of drug discontinuation trial or H2-receptor antagonists).		
Pain medications				
Meperidine	Oral analgesic not effective in dosages commonly used; may have higher risk of neurotoxicity, including delirium, than other opioids; safer alternatives available.	Avoid	Moderate	Strong
Noncyclooxygenase-selective NSAIDs, oral: Aspirin >325 mg/day Diclofenac Diflunisal Etodolac Ibuprofen Ketoprofen Meloxicam Nabumetone Naproxen Oxaprozin Piroxicam Sulindac	Increased risk of GI bleeding or peptic ulcer disease in high-risk groups, including those >75 years old 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 ~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. Also can increase blood pressure and induce kidney injury. Risks are dose related.	Avoid chronic use unless other alternatives are not effective and patient can take gastroprotective agent (proton-pump inhibitor or misoprostol). Avoid short-term scheduled use in combination with oral or parenteral corticosteroids, anticoagulants, or antiplatelet agents unless other alternatives are not effective and patient can take	Moderate	Strong

		gastroprotective agent (proton-pump inhibitor or misoprostol).		
Indomethacin Ketorolac, includes parenteral	Increased risk of GI bleeding/peptic ulcer disease and acute kidney injury in older adults Indomethacin is more likely than other NSAIDs to have adverse CNS effects. Of all the NSAIDs, indomethacin has the most adverse effects.	Avoid	Moderate	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

When selecting among DOACs and choosing a dose, pay special consideration to kidney function (see Table 6), indication, and body weight.
CNS=central nervous system; CV=cardiovascular; DOACs=direct oral anticoagulants; GI=gastrointestinal; HFrEF=heart failure with reduced ejection fraction; HRT=hormone replacement therapy; NSAIDs=nonsteroidal anti-inflammatory drugs; NYHA=New York Heart Association; SIADH=syndrome of inappropriate antidiuretic hormone secretion; VTE=venous thromboembolism
* See also criterion on antidepressants with strong anticholinergic activity.

Box: Synthesis of Anticoagulation Recommendations

Explanation	Recommendation
This criterion summarizes recommendations for warfarin (Table 2), rivaroxaban (Table 2), and dabigatran (Table 4) ─ anticoagulants to avoid or to use with caution. A "use with caution" recommendation reflects less concern and/or less clear evidence than an "avoid" recommendation. See individual criteria on these medications for more information about anticoagulant-related recommendations. When selecting among DOACs and choosing a dosage, pay special consideration to kidney function (see Table 6), indication, and body weight.	**Warfarin**: *Avoid* warfarin as initial therapy for treatment of venous thromboembolism (VTE) or nonvalvular atrial fibrillation unless alternative options (eg, DOACs) are contraindicated or there are substantial barriers to their use. For older adults who have been using warfarin long-term, it may be reasonable to continue this medication, particularly among those with well-controlled INRs (ie, >70% time in therapeutic range) and no adverse effects. **Rivaroxaban**: *Avoid* rivaroxaban for long-term treatment of nonvalvular atrial fibrillation or VTE in favor of safer anticoagulant alternatives. **Dabigatran**: *Use caution* in selecting dabigatran over other DOACs (eg, apixaban) for long-term treatment of nonvalvular atrial fibrillation or VTE.

Table 3. 2022 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(s)	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Cardiovascular					
Heart failure	Avoid: Cilostazol Dextromethorphan-quinidine Avoid in heart failure with reduced ejection fraction: Nondihydropyridine CCBs (diltiazem, verapamil) Use with caution in patients with heart failure who are asymptomatic; avoid in patients with symptomatic heart failure: NSAIDs and COX-2 inhibitors Thiazolidinediones (eg, pioglitazone Dronedarone	Potential to promote fluid retention and/or exacerbate heart failure (NSAIDs and COX-2 inhibitors, nondihydropyridine CCBs, thiazolidinediones); potential to increase mortality in older adults with heart failure (cilostazol and dronedarone); concerns about QT prolongation (dextromethorphan-quinidine) *Note:* This is not a comprehensive list of medications to avoid in patients with heart failure.	As noted, avoid or use with caution.	Cilostazol: low Dextromethorphan-quinidine: low Nondihydropyridine CCBs: moderate NSAIDs: moderate COX-2 inhibitors: low Thiazolidinediones: high Dronedarone: high	Cilostazol: strong Dextromethorphan-quinidine: strong Nondihydropyridine CCBs: strong NSAIDs: strong COX-2 inhibitors: strong Thiazolidinediones: strong Dronedarone: strong
Syncope	AChEIs	AChEIs cause bradycardia and should	Avoid	AChEIs, TCAs, and antipsychotics: high	AChEIs and TCAs: strong

	Nonselective peripheral alpha-1 blockers (ie, doxazosin, prazosin, terazosin) Tertiary TCAs Amitriptyline Imipramine Clomipramine Doxepin Antipsychotics Chlorpromazine Thioridazine Olanzapine	be avoided in older adults whose syncope may be due to bradycardia. Nonselective peripheral alpha-1 blockers cause orthostatic blood pressure changes and should be avoided in older adults whose syncope may be due to orthostatic hypotension. Tertiary TCAs and the antipsychotics listed also increase the risk of orthostatic hypotension.		Nonselective peripheral alpha-1 blockers: high	Nonselective peripheral alpha-1 blockers and antipsychotics: weak
Central nervous system					
Delirium	Anticholinergics (see Table 7 in full criteria available on www.geriatricscareonline.org.) Antipsychotics[a] Benzodiazepines Corticosteroids (oral and parenteral)[b] H2-receptor antagonists Cimetidine Famotidine Nizatidine Opioids Nonbenzodiazepine benzodiazepine receptor	Avoid in older adults with or at high risk of delirium because of potential of inducing or worsening delirium. Avoid antipsychotics for behavioral problems of dementia or delirium unless nonpharmacologic options (eg, behavioral interventions) have failed or are not possible and the older adult is threatening	Avoid, except in situations listed under rationale statement.	H2-receptor antagonists: low All others: moderate	Strong

	agonist hypnotics (eg, eszopiclone, zaleplon, zolpidem)	substantial harm to self or others. If used, periodic deprescribing attempts should be considered to assess ongoing need and/or lowest effective dose. Corticosteroids: If needed, use lowest possible dose for the shortest duration and monitor for delirium. Opioids: Emerging data highlights an association between opioid administration and delirium. For older adults with pain, use a balanced approach, including use of validated pain assessment tools and multimodal strategies that include nondrug approaches to minimize opioid use.			
Dementia or cognitive impairment	Anticholinergics (see Table 7 in full criteria available on www.geriatricscareonline.org) Benzodiazepines	Avoid because of adverse CNS effects. See criteria on individual drugs for additional information.	Avoid	Moderate	Strong

	Nonbenzodiazepine benzodiazepine receptor agonist hypnotics (eg, eszopiclone, zaleplon, zolpidem) Antipsychotics, chronic use or persistent as-needed use[a]	Antipsychotics: increased risk of stroke and greater rate of cognitive decline and mortality in patients with dementia. Avoid antipsychotics for behavioral problems of dementia or delirium unless documented nonpharmacologic options (eg, behavioral interventions) have failed and/or the patient is threatening substantial harm to self or others. If used, periodic deprescribing attempts should be considered to assess ongoing need and/or lowest effective dose.			
History of falls or fractures	Antiepileptics Antipsychotics[a] Benzodiazepines Nonbenzodiazepine benzodiazepine receptor agonist hypnotics (eg, eszopiclone, zaleplon, zolpidem) Antidepressants TCAs SSRIs	May cause ataxia, impaired psychomotor function, syncope, additional falls. Benzodiazepines: shorter-acting ones are not safer than long-acting ones. Antidepressants: evidence for risk of falls and fractures is	Avoid unless safer alternatives are not available. Antiepileptics: avoid except for seizure and mood disorders. Opioids: avoid except for pain management in the setting of	Antidepressants: moderate Opioids: moderate All others: high	Strong

	SNRIs Opioids	mixed; newer evidence suggests that SNRIs may confer higher falls risk. If one of the drugs must be used, consider reducing use of other CNS-active medications that increase risk of falls and fractures (ie, antiepileptics, opioid-receptor agonists, antipsychotics, antidepressants, nonbenzodiazepine benzodiazepine receptor agonist hypnotics, sedatives/hypnotics, other anticholinergics) and implement other strategies to reduce fall risk.	severe acute pain.		
Parkinson disease	Antiemetics Metoclopramide Prochlorperazine Promethazine All antipsychotics (except quetiapine, clozapine, pimavanserin)	Dopamine-receptor antagonists with potential to worsen parkinsonian symptoms Exceptions: pimavanserin, clozapine, and quetiapine appear to be less likely to precipitate	Avoid	Moderate	Strong

		worsening of Parkinson disease than other antipsychotics.			
Gastrointestinal					
History of gastric or duodenal ulcers	Aspirin Non-COX-2 selective NSAIDs	May exacerbate existing ulcers or cause new/additional ulcers	Avoid unless other alternatives are not effective and patient can take gastroprotective agent (ie, proton-pump inhibitor or misoprostol).	Moderate	Strong
Kidney/urinary tract					
Chronic kidney disease Stage 4 or higher (CrCl <30 mL/min)	NSAIDs (non-COX and COX-selective, oral and parenteral, nonacetylated salicylates)	May increase risk of acute kidney injury and further decline of kidney function	Avoid	Moderate	Strong
Urinary incontinence (all types) in women	Estrogen oral and transdermal (excludes intravaginal estrogen) Peripheral alpha-1 blockers Doxazosin Prazosin Terazosin	Lack of efficacy (oral estrogen) and aggravation of incontinence (alpha-1 blockers)	Avoid in women See also recommendation on estrogen (Table 2)	Estrogen: high Peripheral alpha-1 blockers: moderate	Estrogen: strong Peripheral alpha-1 blockers: strong
Lower urinary tract symptoms, benign prostatic hyperplasia	Strongly anticholinergic drugs, except antimuscarinics for urinary incontinence (see Table 7 in full criteria available on www.geriatricscareonline.org)	May decrease urinary flow and cause urinary retention	Avoid in men	Moderate	Strong

AChEI=acetylcholinesterase inhibitor; CCBs=calcium channel blockers; CNS=central nervous system; COPD=chronic obstructive pulmonary disease; COX=cyclooxygenase; CrCl=creatinine clearance; NSAIDs=nonsteroidal anti-inflammatory drugs; SSRIs=selective serotonin reuptake inhibitors; TCAs=tricyclic antidepressants

[a] May be required to treat concurrent schizophrenia, bipolar disorder, and other selected mental health conditions but should be prescribed in the lowest effective dose and shortest possible duration.

[b] Excludes inhaled and topical forms. Oral and parenteral corticosteroids may be required for conditions such as exacerbation of COPD but should be prescribed in the lowest effective dose and for the shortest possible duration.

Table 4. 2022 American Geriatrics Society Beers Criteria® for Potentially Inappropriate Medications: Drugs to Be Used with Caution in Older Adults

Drug(s)	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Dabigatran for long-term treatment of nonvalvular atrial fibrillation or VTE	Increased risk of GI bleeding compared with warfarin (based on head-to-head clinical trials) and of GI bleeding and major bleeding compared with apixaban (based on observational studies and meta-analyses) in older adults when used for long-term treatment of nonvalvular atrial fibrillation or VTE	Use caution in selecting dabigatran over other DOACs (eg, apixaban) for long-term treatment of nonvalvular atrial fibrillation or VTE. See also criteria on warfarin and rivaroxaban (Table 2) and footnote regarding choice among DOACs.	Moderate	Strong
Prasugrel Ticagrelor	Both increase the risk of major bleeding in older adults compared with clopidogrel, especially among those 75 years old and older. However, this risk may be offset by cardiovascular benefits in select patients.	Use with caution, particularly in adults 75 years old and older.	G1: Moderate	G1: Strong
Antipsychotics Carbamazepine Diuretics Mirtazapine Oxcarbazepine SNRIs SSRIs TCAs Tramadol	May exacerbate or cause SIADH or hyponatremia; monitor sodium level closely when starting or changing dosages in older adults.	Use with caution.	Moderate	Strong

Dextromethorphan-quinidine	Limited efficacy in patients with behavioral symptoms of dementia (does not apply to treatment of pseudobulbar affect). May increase risk of falls and concerns with clinically significant drug interactions and with use in those with heart failure (see Table 3).	Use with caution.	Moderate	Strong
Trimethoprim-sulfamethoxazole	Increased risk of hyperkalemia when used concurrently with an ACEI or ARB in presence of decreased CrCl	Use with caution in patients on ACEI or ARB and decreased CrCl.	Low	Strong
Sodium glucose co-transporter-2 (SGLT2) inhibitors	Older adults may be at increased risk of urogenital infections, particularly women in the first month of treatment. An increased risk of ketoacidosis has also been seen in older adults.	Use with caution. Monitor patients for urogenital infections and ketoacidosis.	Moderate	Weak

"Use with caution" recommendations reflect concern about the balance of benefits and harms of a medication compared with alternatives in the situation when those concerns do not rise to the level of "avoid" recommendations in other Tables because of limited evidence, a lesser degree of potential harm compared with alternative therapies, and/or extenuating clinical circumstances.

When selecting among DOACs and choosing a dosage, pay special consideration to kidney function (see Table 6), indication, and body weight.

ACEI= angiotensin-converting enzyme inhibitor; ARB=angiotensin receptor blocker; CrCl=creatinine clearance; GI=gastrointestinal; SIADH= syndrome of inappropriate antidiuretic hormone secretion; SNRIs=serotonin-norepinephrine reuptake inhibitors; SSRIs=selective serotonin reuptake inhibitors; TCA=tricyclic antidepressant; VTE=venous thromboembolism

Table 5. 2022 American Geriatrics Society Beers Criteria® for Potentially Clinically Important Drug–Drug Interactions That Should Be Avoided in Older Adults

Object Drug and Class	Interacting Drug and Class	Risk Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
RAS inhibitor (ACEIs, ARBs, aliskiren) or potassium-sparing diuretics (amiloride, triamterene)	Another RAS inhibitor (ACEIs, ARBs, aliskiren)	Increased risk of hyperkalemia	Avoid routine use in those with chronic kidney disease Stage 3a or higher.	Moderate	Strong
Opioids	Benzodiazepines	Increased risk of overdose and adverse events	Avoid	Moderate	Strong
Opioids	Gabapentin Pregabalin	Increased risk of severe sedation-related adverse events, including respiratory depression and death	Avoid; exceptions are when transitioning from opioid therapy to gabapentin or pregabalin, or when using gabapentinoids to reduce opioid dose, although caution should be used in all circumstances.	Moderate	Strong
Anticholinergic	Anticholinergic	Use of more than one medication with anticholinergic properties increases risk of cognitive decline, delirium, and falls or fractures.	Avoid; minimize number of anticholinergic drugs (Table 7).	Moderate	Strong

Antiepileptics (including gabapentinoids) Antidepressants (TCAs, SSRIs, and SNRIs) Antipsychotics Benzodiazepines and nonbenzodiazepine benzodiazepine receptor agonist hypnotics (ie, "Z-drugs") Opioids Skeletal muscle relaxants	Any combination of ≥3 of these CNS-active drugs[a]	Increased risk of falls and of fracture with the concurrent use of ≥3 CNS-active agents (includes antiepileptics including gabapentinoids, antidepressants, antipsychotics, benzodiazepines, nonbenzodiazepine benzodiazepine receptor agonist hypnotics, opioids, and skeletal muscle relaxants)	Avoid concurrent use of ≥3 CNS-active drugs[a]; minimize number of CNS-active drugs.	High	Strong
Lithium	ACEIs ARBs	Increased risk of lithium toxicity	Avoid; monitor lithium concentrations.	Moderate	Strong
Lithium	Loop diuretics	Increased risk of lithium toxicity	Avoid; monitor lithium concentrations.	Moderate	Strong
Peripheral alpha-1 blockers	Loop diuretics	Increased risk of urinary incontinence in older women	Avoid in older women, unless conditions warrant both drugs.	Moderate	Strong

Warfarin	Amiodarone Ciprofloxacin Macrolides (excluding azithromycin) Trimethoprim-sulfamethoxazole SSRIs	Increased risk of bleeding	Avoid when possible; if used together, monitor INR closely.	Moderate	Strong

[a] Central nervous system (CNS)-active drugs: antiepileptics (including gabapentinoids), antipsychotics; antidepressants (including tricyclic antidepressants [TCAs], selective serotonin reuptake inhibitors [SSRIs], and serotonin-norepinephrine reuptake inhibitors [SNRIs]); benzodiazepines; nonbenzodiazepine benzodiazepine receptor agonist hypnotics; opioids; and skeletal muscle relaxants

ACEIs=angiotensin-converting enzyme inhibitors; ARBs=angiotensin receptor blockers; NSAIDs=nonsteroidal anti-inflammatory drugs; RAS=renin-angiotensin system

Table 6. 2022 American Geriatrics Society Beers Criteria® for Medications That Should Be Avoided or Have Their Dosage Reduced with Varying Levels of Kidney Function in Older Adults

Medication Class and Medication	CrCl (mL/min) at Which Action Is Required	Rationale	Recommendation	Quality of Evidence	Strength of Recommendation
Anti-infective					
Ciprofloxacin	<30	Increased risk of CNS effects (eg, seizures, confusion) and tendon rupture	Dosages used to treat common infections typically require reduction when CrCl <30 mL/min.	Moderate	Strong
Trimethoprim-sulfamethoxazole	<30	Increased risk of worsening of kidney function and hyperkalemia	Reduce dosage if CrCl 15–29 mL/min. Avoid if CrCl <15 mL/min.	Moderate	Strong
Cardiovascular or hemostasis					
Amiloride	<30	Increased potassium and decreased sodium	Avoid	Moderate	Strong
Dabigatran	<30	Lack of evidence for efficacy and safety in individuals with a CrCl <30 mL/min. Label dose for patients with a CrCl 15–30 mL/min based on pharmacokinetic data.	Avoid when CrCl <30mL/min; dose adjustment advised when CrCl >30 mL/min in the presence of drug-drug interactions.	Moderate	Strong

Dofetilide	<60	QT_c prolongation and torsades de pointes	Reduce dose if CrCl 20–59 mL/min. Avoid if CrCl <20 mL/min.	Moderate	Strong
Edoxaban	15–50 <15 or >95	Lack of evidence of efficacy or safety in patients with a CrCl <30 mL/min	Reduce dose if CrCl 15–50 mL/min. Avoid if CrCl <15 or >95 mL/min.	Moderate	Strong
Enoxaparin	<30	Increased risk of bleeding	Reduce dose.	Moderate	Strong
Fondaparinux	<30	Increased risk of bleeding	Avoid	Moderate	Strong
Rivaroxaban	<50	Lack of efficacy or safety evidence in patients with a CrCl <15 mL/min; limited evidence if CrCl 15–30 mL/min	Avoid if CrCl <15 mL/min. Reduce dose if CrCl 15–50 mL/min following manufacturer dosing recommendations based on indication-specific dosing.	Moderate	Strong
Spironolactone	<30	Increased potassium	Avoid	Moderate	Strong
Triamterene	<30	Increased potassium and decreased sodium	Avoid	Moderate	Strong
CNS and analgesics					
Duloxetine	<30	Increased GI adverse effects (nausea, diarrhea)	Avoid	Moderate	Weak
Gabapentin	<60	CNS adverse effects	Reduce dose	Moderate	Strong
Levetiracetam	≤80	CNS adverse effects	Reduce dose	Moderate	Strong

Pregabalin	<60	CNS adverse effects	Reduce dose	Moderate	Strong
Tramadol	<30	CNS adverse effects	Immediate release: reduce dose Extended release: avoid	Low	Weak
Gastrointestinal					
Cimetidine	<50	Mental status changes	Reduce dose	Moderate	Strong
Famotidine	<50	Mental status changes	Reduce dose	Moderate	Strong
Nizatidine	<50	Mental status changes	Reduce dose	Moderate	Strong
Hyperuricemia					
Colchicine	<30	GI, neuromuscular, bone marrow toxicity	Reduce dose; monitor for adverse effects	Moderate	Strong
Probenecid	<30	Loss of effectiveness	Avoid	Moderate	Strong
Pain medications					
Baclofen	eGFR <60	Increased risk of encephalopathy requiring hospitalization in older adults with an eGFR <60 mL/min or who require chronic dialysis.	Avoid baclofen in older adults with impaired kidney function (eGFR <60 mL/min). When baclofen cannot be avoided, use the lowest effective dose and monitor for signs of CNS toxicity, including altered mental status.	Moderate	Moderate

CNS=central nervous system; CrCl=creatinine clearance; eGFR=estimated glomerular filtration rate; GI=gastrointestinal

Table 7. Drugs with Strong Anticholinergic Properties
Antidepressants
Amitriptyline
Amoxapine
Clomipramine
Desipramine
Doxepin (>6 mg)
Imipramine
Nortriptyline
Paroxetine
Antiemetics
Prochlorperazine
Promethazine
Antihistamines (first-generation)
Brompheniramine
Chlorpheniramine
Cyproheptadine
Dimenhydrinate
Diphenhydramine (oral)
Doxylamine
Hydroxyzine
Meclizine
Promethazine
Triprolidine

Antimuscarinics (urinary incontinence)
Darifenacin
Fesoterodine
Flavoxate
Oxybutynin
Solifenacin
Tolterodine
Trospium
Antiparkinsonian agents
Benztropine
Trihexyphenidyl
Antipsychotics
Chlorpromazine
Clozapine
Loxapine
Olanzapine
Perphenazine
Thioridazine
Trifluoperazine
Antispasmodics
Atropine (excludes ophthalmic)
Clidinium-chlordiazepoxide
Dicyclomine
Homatropine (excludes ophthalmic)
Hyoscyamine

Scopolamine (excludes ophthalmic)
Skeletal muscle relaxants
Cyclobenzaprine
Orphenadrine

Table 8. Medications/Criteria Removed Since 2019 American Geriatrics Society Beers Criteria®

Medication/Criterion	Reason for Removal
Independent of Diagnosis or Condition (Table 2)	
Carbinoxamine*	Low use
Clemastine*	Low use
Dextrobromphiniramine*	Not on US market
Dexychlorpheniramine*	Low use
Pyrilamine*	Not on US market
Belladonna alkaloids*	Not on US market
Methscopolamine*	Low use
Propantheline*	Not on US market
Guanabenz	Not on US market
Methyldopa	Not on US market
Reserpine (>0.1 mg/day)	Not on US market
Disopyramide*	Low use
Protriptyline*	Low use
Trimipramine*	Low use
Amobarbital	Low use, available only as injection
Butobarbital	Low use
Mephobarbital	Not on US market
Pentobarbital	Not on US market
Secobarbital	Not on US market
Isoxsuprine	Not on US market
Chlorpropamide	Not on US market
Fenoprofen	Low use
Meclofenamate	Low use
Mefenamic acid	Low use
Tolmetin	Not on US market
Considering Disease and Syndrome Interactions (Table 3)	
Heart failure Rosiglitazone	 Not on US market
Delirium Meperidine Ranitidine	 Meperidine: Specific mention of meperidine was removed from this criterion because it is subsumed under the general category of opioids, which was added to this criterion. Ranitidine: removed from US market
Use with Caution (Table 4)	
Aspirin for primary prevention of cardiovascular disease and colorectal cancer	Moved to Table 2 and updated
Rivaroxaban	Moved to Table 2 and updated
Clinically Important Drug-Drug Interactions (Table 5)	
Corticosteroids, oral or parenteral + NSAIDs	Incorporated into oral NSAIDs criterion in Table 2

Phenytoin + trimethoprim-sulfamethoxazole	Removed because of phenytoin's diminished therapeutic role
Theophylline + cimetidine	Removed because of theophylline's diminished therapeutic role
Theophylline + ciprofloxacin	Removed because of theophylline's diminished therapeutic role
Warfarin + NSAIDs	Incorporated into oral NSAID criterion in Table 2 (ie, avoid short-term regular, scheduled use of NSAIDs in older adults taking an anticoagulant)
Medications in Older Adults with Varying Levels of Kidney Function (Table 6)	
Apixaban in patients with CrCl <25 mL/min	Emerging evidence and clinical experience supporting safe use at lower levels of renal function.
Ranitidine	Removed from the US market

CrCl= creatinine clearance; NSAIDs=nonsteroidal anti-inflammatory drugs
Not on US market = no product is currently marketed in the US (although a product could be marketed in the future); this is not the same as being removed from the US market.
*Removed from Table 7 as well.
Note: Drugs removed from the criteria on account of low usage or unavailability in the US are still considered potentially inappropriate per recommendations in the 2019 AGS Beers Criteria® update. Enhanced attention to these drugs may be necessary in countries outside the US, where they may be more widely used.

Table 9. Medications/Criteria Added Since 2019 American Geriatrics Society Beers Criteria®

Medication/Criterion	Reason for Addition
Independent of Diagnosis or Condition (Table 2)	
Warfarin	Emerging data and changes in national recommendations/expert guidance
Considering Disease and Syndrome Interactions (Table 3)	
Heart failure Dextromethorphan-quinidine	Supported by package insert
Delirium Opioids	Emerging data
Use with Caution (Table 4)	
Ticagrelor	Emerging data
Sodium glucose co-transporter-2 (SGLT2) inhibitors	Emerging data and clinical concern
Clinically Important Drug-Drug Interactions (Table 5)	
Skeletal muscle relaxants added to any combination of ≥3 of these CNS-active drugs	Concern for adverse effects when used in combination with other CNS-active drugs
Lithium + ARBs	Supported by data and reference sources
Warfarin + SSRIs	Supported by data
Medications That Should be Avoided or Have Their Dosage Reduced with Reduced Kidney Function (Table 6)	
Baclofen	Data supporting concern

ARBs=angiotensin receptor blockers; CNS=central nervous system; SSRIs= selective serotonin reuptake inhibitors

Table 10. Medications/Criteria Modified Since 2019 American Geriatrics Society Beers Criteria®

Medication/Criterion	Reason for Modification
Independent of Diagnosis or Condition (Table 2)	
Aspirin	Moved from Table 4 to Table 2
Dronedarone	Clarified to reflect data about potential risks in people with non-severe forms of heart failure
Rivaroxaban	Moved from Table 4 to Table 2
Antidepressants with strong anticholinergic activity	Clarified that this criterion refers to antidepressants with strong anticholinergic activity
Antipsychotics	Updated language to reflect new evidence and enhance clarity
Benzodiazepines	Clarified language
Estrogens, systemic	Supported by data
Sulfonylureas	Data supporting adverse outcomes for all sulfonylureas
Proton pump inhibitors	Data supporting additional adverse outcomes
NSAIDs, oral	Clarified application in high-risk scenarios for short-term use (ie, including drug-drug interactions such as with warfarin)
Considering Disease and Syndrome Interactions (Table 3)	
Syncope – TCAs Amitriptyline Imipramine Clomipramine Doxepin	Clarified that the tertiary TCAs referenced by this criterion include those listed here.
Dementia Antipsychotics	Reflect data and enhance clarity
Delirium	Updated rationale to comment on opioids and enhance clarity
History of falls or fracture Antidepressants	Level of evidence lowered from “high” to “moderate” based on evidence
Parkinson disease	Rationale shortened for clarity.
Use with Caution (Table 4)	
Dextromethorphan-quinidine	Added heart failure concerns, supported by package insert.
Clinically Important Drug-Drug Interactions (Table 5)	
Opioid + benzodiazepine	Modified to include risk for adverse effects; supported by data.
Anticholinergic + anticholinergic	Modified to recognize specific adverse events.
Use of ≥3 CNS active agents	Clarified classes of medications of concern; level of evidence raised to “high.”
Warfarin	Consolidated interacting drugs into a list versus reporting as separate lines for each interaction.
Medications That Should be Avoided or Have Their Dosage Reduced with Reduced Kidney Function (Table 6)	
Rivaroxaban	Clarified CrCl cutoffs per available evidence and package insert.

CNS=central nervous system; CrCl=creatinine clearance

Table 11: Principles for How Patients, Clinicians, Health Systems, and Payors Should Use the AGS Beers Criteria®

Medications in the AGS Beers Criteria® are potentially inappropriate, not definitely inappropriate.
Read the rationale and recommendations statements for each criterion. The caveats and guidance listed there are important.
Understand why medications are included in the AGS Beers Criteria® and adjust your approach to those medications accordingly.
Optimal application of the AGS Beers Criteria® involves identifying PIMs and, when appropriate, offering safer nonpharmacologic and pharmacologic therapies.
The AGS Beers Criteria® should be a starting point for a comprehensive process of identifying and improving medication appropriateness and safety.
Access to medications included in the AGS Beers Criteria® should not be excessively restricted by prior authorization and/or health plan coverage policies.
The AGS Beers Criteria® are not equally applicable to all countries (because of cross-national differences in drug availability).

* Adapted from Steinman MA, Fick DM. Using Wisely: A reminder on the proper use of the American Geriatrics Society Beers Criteria®. *J Am Geriatr Soc.* 2019;67(4):644–646.