



AMERICAN ACADEMY OF
ORTHOPAEDIC SURGEONS

Prevention of Secondary Fractures

Appropriate Use Criteria

Adapted by:

The American Academy of Orthopaedic Surgeons Board of Directors

December 1, 2023

Endorsed by:



Please cite this Appropriate Use Criteria as:

American Academy of Orthopaedic Surgeons Prevention of Secondary Hip Fractures Appropriate Use Criteria.
Published December 1, 2023

Disclaimer

Volunteer physicians from multiple medical specialties created and categorized these Appropriate Use Criteria. These Appropriate Use Criteria are not intended to be comprehensive or a fixed protocol, as some patients may require more or less treatment or different means of diagnosis. These Appropriate Use Criteria represent patients and situations that clinicians treating or diagnosing musculoskeletal conditions are most likely to encounter. The clinician's independent medical judgment, given the individual patient's clinical circumstances, should always determine patient care and treatment.

Disclosure Requirement

In accordance with American Academy of Orthopaedic Surgeons (AAOS) policy, all individuals whose names appear as authors or contributors to this document filed a disclosure statement as part of the submission process. All authors provided full disclosure of potential conflicts of interest prior to participation in the development of these Appropriate Use Criteria. Disclosure information for all panel members can be found in Appendix B.

Funding Source

The American Academy of Orthopaedic Surgeons exclusively funded development of these Appropriate Use Criteria. The American Academy of Orthopaedic Surgeons received no funding from outside commercial sources to support the development of these Appropriate Use Criteria.

FDA Clearance

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Published 2023 by the American Academy of Orthopaedic Surgeons (AAOS)

9400 West Higgins Road

Rosemont, IL 60018

First Edition

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To view the clinical practice guideline for this topic, please visit
<https://www.aaos.org/quality/quality-programs>

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WRITING PANEL

Liron Sinvani, MD

American Geriatrics Society

Robin Kamal, MD, FAAOS

American Academy of Orthopaedic Surgeons

Jason Strelzow, MD, FAAOS

Orthopaedic Trauma Association

Paras Goel, DPT, Med, PT

American Physical Therapy Association

Christopher Carpenter, MD, MS

American College of Emergency Physicians

Lauren Shapiro, MD

American Academy of Orthopaedic Surgeons

Flutura Hasa, MD

3M

RATING PANEL

Hari P. Bezwada, MD, FAAOS

American Association of Hip and Knee Surgeons

Ajay Srivastava, MD, FAAOS

American Association of Hip and Knee Surgeons

Daniel Mendelson, MD

American Geriatrics Society

Ryan Harrison, MD, FAAOS

Orthopaedic Trauma Association

James Dunleavy, PT, DPT

American Physical Therapy Association

Gregory Della Rocca, MD, PhD, MBA, FAAOS

American Academy of Orthopaedic Surgeons

Kristine Ensrud, MD, MPH

American Society for Bone and Mineral Research

Ryan L. Meyer, MD

American Academy of Physical Medicine and Rehabilitation

Paul A. Manner, MD, FAAOS

American Academy of Orthopaedic Surgeons

Bruce Ziran, MD, FAAOS, FACS

American Academy of Orthopaedic Surgeons

RATING PANEL MODERATOR

Aaron Chamberlain, MD, FAAOS

AAOS Committee on Evidence Based Quality and Value

AAOS STAFF

Jayson Murray, MA, EMBA

Director, Clinical Quality and Value

Kaitlyn Sevarino, MBA, CAE

Director, Clinical Quality and Value

Danielle Schulte, MS, EMBA

Manager, Clinical Quality and Value

Tyler Verity, MS/LIS

Medical Librarian, Clinical Quality and Value

Jennifer Rodriguez, MBA

Administrative Assistant, Clinical Quality and Value

INTRODUCTION

OVERVIEW

AAOS has developed this Appropriate Use Criteria (AUC) to determine appropriateness of various treatments for the prevention of secondary fracture after hip fracture in an older adult.

An “appropriate” healthcare service is one for which the expected health benefits exceed the expected negative consequences by a sufficiently wide margin.¹ Evidence-based information, in conjunction with the clinical expertise of physicians from multiple medical specialties, was used to develop the criteria in order to improve patient care and obtain the best outcomes while considering the subtleties and distinctions necessary in making clinical decisions. To provide the evidence foundation for this AUC, the AAOS Department of Clinical Quality and Value provided the writing panel and rating panel with the AAOS Clinical Practice Guideline on the Management of Hip Fracture in Older Adults, which can be accessed via the following link:

<https://www.orthoguidelines.org/topic?id=1038>

The purpose of this AUC is to help determine the appropriateness of clinical practice guideline recommendations for the heterogeneous patient population routinely seen in practice. The best available scientific evidence is synthesized with collective expert opinion on topics where gold standard randomized clinical trials are not available or are inadequately detailed for identifying distinct patient types. When there is evidence corroborated by consensus that expected benefits substantially outweigh potential risks, exclusive of cost, a procedure is determined to be appropriate. The AAOS uses the RAND/UCLA Appropriateness Method (RAM)¹ to assess the appropriateness of a particular treatment. This process includes reviewing the results of the evidence analysis, compiling a list of clinical vignettes, and having an expert panel

comprised of representatives from multiple medical specialties to determine the appropriateness of each of the clinical indications for treatment as “Appropriate,” “May be Appropriate,” or “Rarely Appropriate.” To access a more user-friendly version of the appropriate use criteria for this topic online, please visit our AUC web-based application at www.orthoguidelines.org/auc or download the OrthoGuidelines app from Google Play or Apple Store.

These criteria should not be construed as including all indications or excluding indications reasonably directed to obtaining the same results. The criteria intend to address the most common clinical scenarios facing qualified physicians managing patients to prevent secondary fracture. The ultimate judgment regarding any specific criteria should address all circumstances presented by the patient and the needs and resources particular to the locality or institution. It is also important to state that these criteria are not meant to supersede clinician expertise and experience or patient preference.

ETIOLOGY

Hip fractures in older adults are most often the result of low energy trauma. These fractures are usually associated with osteoporosis or impaired bone strength. Other conditions, such as history of falls or frailty, may also predispose to hip fracture risk.

INCIDENCE AND PREVALENCE

With increasing life expectancy, the number of older individuals at risk for hip fracture will increase over time.

RISK FACTORS

Risk factors for an older adult sustaining a hip fracture include, but are not limited to, increasing age, low bone density, impaired balance, gait disturbance, poor vision, and hazardous living environments (such as cluttered spaces, throw rugs, or a lack of grab bars where appropriate). Race and ethnicity are

also non-modifiable risk factors that can play an important role in patient outcomes.

BURDEN OF DISEASE

Although the age-standardized incidence of hip fracture is falling in many developed countries, the aging of the world population results in an increased overall number of hip fractures globally. Thus, the number of hip fractures in older adults that occur globally is expected to increase from 1.26 million in 1990 to 4.5 million by the year 2050². Between 1986 and 2005, the annual mean number of hip fractures in the US was 957.3 per 100 000 (95% confidence interval [CI], 921.7-992.9) for women and 414.4 per 100 000 (95% CI, 401.6-427.3) for men. The majority of fractures in both men and women occurred among those aged 75-84 years. The overall mortality for hip fracture is 24% at one year. However, for some of the most vulnerable hip fracture patients (i.e., nursing home residents), the 6-month mortality is as high as 36% for all, and 46% for men³.

Older patients who sustain hip fractures are at risk for:

1. Increased rates of mortality⁴.
2. Increased rates of morbidity².
3. Decreased quality of life⁵.
4. Increased rates of depression^{2,5}.
5. Decreased levels of mobility and ambulation⁶.
6. Increased rates of subsequent fractures⁷.
7. Increased need for enhanced level of care and supervision⁸.

A typical older adult patient who has sustained a hip fracture will incur over \$50,000/year in medical costs⁹.

POTENTIAL BENEFITS, HARMS, AND CONTRAINDICATIONS

Hip fracture in an older adult patient is typically a life-altering event requiring surgical treatment, with the associated risks. Recovery to pre-fracture level of function is often unsuccessful and may occur in less than 50% of patients, regardless of their previous level of function¹⁰. The aim of treatment of hip fracture in older adults is to provide pain relief and

restoration of function. For the vast majority of fractures, surgical treatment is indicated and carries greater potential benefit than harm. While there are more hip fractures in women than men, there may be important sex and gender differences in hip fracture and this CPG does not explore or address such potential differences. Future research may result in a better understanding of how a patient's sex and gender alter treatment benefits and harms.

INTERPRETING THE APPROPRIATENESS RATING

To prevent misuse of these criteria, it is extremely important that the user of this document understands how to interpret the appropriateness ratings. The appropriateness rating scale ranges from one to nine and there are three main range categories that determine how the median rating is defined (i.e., 1-3 = "Rarely Appropriate", 4-6 = "May Be Appropriate", and 7-9 = "Appropriate"). Before these AUCs are consulted, the user should read through and understand all contents of this document.

METHODS

This AUC for Prevention of Secondary Fracture is based on a review of the available literature and a list of clinical scenarios (i.e., criteria) constructed and rated by experts in orthopaedic surgery and other relevant medical fields. This section describes the methods adapted from RAM¹. This section also includes the activities and compositions of the various panels that developed, defined, reviewed, and rated the criteria.

Two panels participated in the development of the Prevention of Secondary Fracture AUC, a writing panel and a rating panel. Members of the writing panel developed a list of patient scenarios and relevant treatment options. Additional detail on how the writing panel developed the patient scenarios and treatments

is below. The rating panel participated in two rounds of rating. During the first round, the rating panel was given approximately one month to independently rate the appropriateness of each the provided treatments for each of the relevant patient scenarios as ‘Appropriate’, ‘May Be Appropriate’, or ‘Rarely Appropriate’ via an electronic ballot. How the rating panel rates for appropriateness is described in more detailed below. After the first round of appropriateness ratings were submitted, AAOS staff calculated the median ratings for each patient scenario and specific treatment. A virtual rating panel meeting was held on Sunday, August 27, 2023. During this meeting rating panel members addressed the scenarios/treatments which resulted in disagreement from round one rating. The rating panel members discussed the list of assumptions, patient indications, and treatments to identify areas that needed to be clarified/edited. After the discussion and subsequent changes, the group was asked to rerate their first-round ratings during the rating panel meeting, only if they were persuaded to do so by the discussion and available evidence. There was no attempt to obtain consensus about appropriateness.

The AAOS Committee on Evidence Based Quality and Value, the AAOS Research and Quality Council, and the AAOS Board of Directors sequentially approve all AAOS AUC.

DEVELOPING CRITERIA

Panel members of the Prevention of Secondary Fracture AUC developed patient scenarios using the following guiding principles:

1. **Comprehensive** – Covers a wide range of patients.
2. **Mutually Exclusive** - There should be no overlap between patient

scenarios/indications.

3. **Homogenous** –The final ratings should result in equal application within each of the patient scenarios.
4. **Manageable** – Number of total rating items (i.e., # of patient scenarios x # of treatments) should be practical for the rating panel. Target number of total rating items should be >1500. This means that not all patient indications and treatments can be assessed within one AUC.

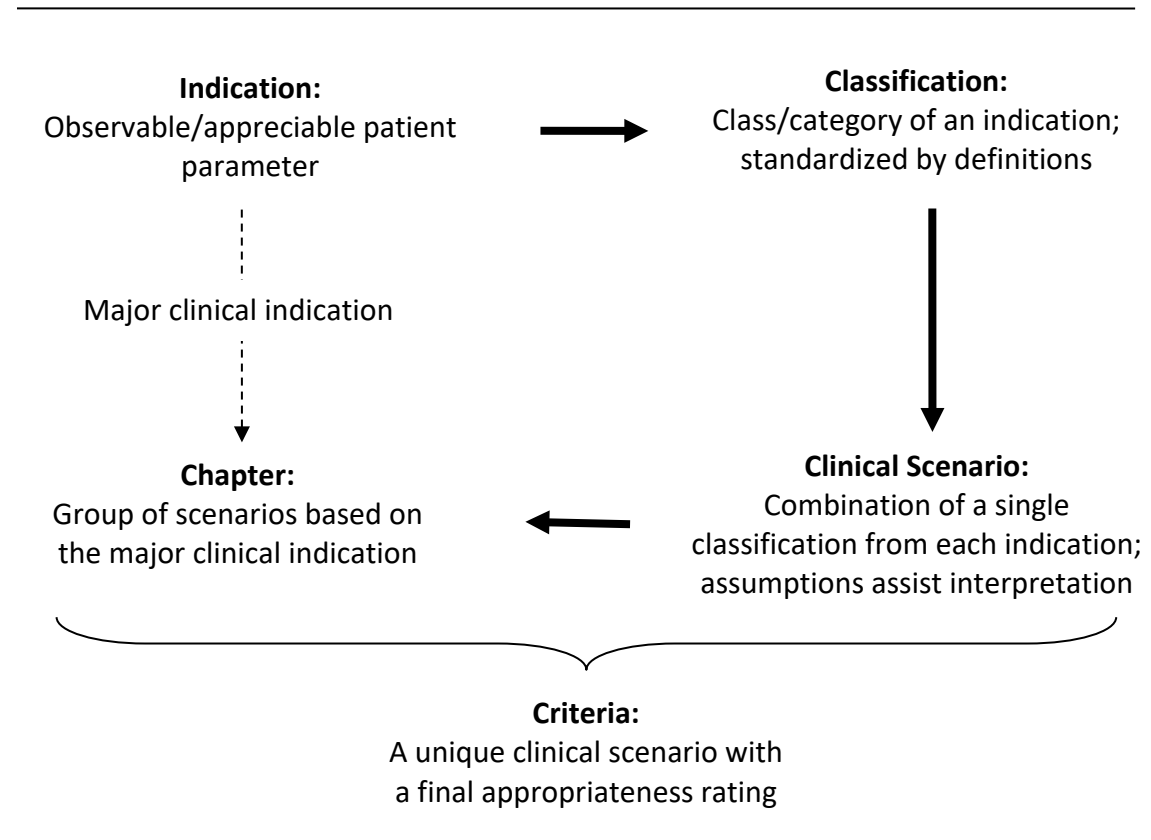
The writing panel developed the scenarios by categorizing patients in terms of indications evident during the clinical decision-making process. These scenarios relied upon definitions and general assumptions, mutually agreed upon by the writing panel during the development of the scenarios. These definitions and assumptions were necessary to provide consistency in the interpretation of the clinical scenarios among experts rating on the scenarios, and readers using the final criteria.

FORMULATING INDICATIONS AND SCENARIOS

The AUC writing panel began the development of the scenarios by identifying clinical indications typical of older patients who have had a hip fracture in clinical practice. Indications are most often parameters observable by the clinician, including symptoms or results of diagnostic tests.

Additionally, “human factor” (e.g., activity level) or demographic variables can be considered.

FIGURE 1. DEVELOPING CRITERIA



Indications identified in clinical trials, derived from patient selection criteria, included in AAOS Clinical Practice Guidelines (<https://www.orthoguidelines.org/topic?id=1038>) served as a starting point for the writing panel, as well as ensured that these AUCs referenced the evidence base for this topic. The writing panel considered this initial list and other indications based on their clinical expertise and selected the most clinically relevant indications. The writing panel then defined distinct classes for each indication to stratify/categorize the indication (Figure 1).

The writing panel organized these indications into a matrix of clinical scenarios that addressed all combinations of the classifications. The writing panel was given the opportunity to remove any scenarios that rarely occur in clinical practice but agreed that all scenarios were clinically relevant. The major clinical decision-making indications chosen by the writing panel divided the matrix of clinical scenarios into chapters, as follows: Previous Fracture History, Previous Bisphosphonate Treatment, Functional Status, and Prognosis

CREATING DEFINITIONS AND ASSUMPTIONS

The Prevention of Secondary Fracture AUC writing panel constructed concise and explicit definitions for the indications and classifications. This standardization helps ensure that the way the writing panel defined the patient indications is consistent among those reading the clinical scenario matrix or the final criteria. Definitions create explicit boundaries when possible and are based on standard medical practice or existing literature.

Additionally, the writing panel formulated a list of general assumptions in order to provide more consistent interpretations of a scenario. These assumptions differed from definitions in that they identified circumstances that exist outside of the control of the clinical decision-making process. Assumptions also address the use of existing published literature regarding the effectiveness of treatment and/or the procedural skill level of physicians. Assumptions also highlight intrinsic methods described in this document such as the role

of cost considerations in rating appropriateness, or the validity of the definition of appropriateness. The main goal of assumptions is to focus scenarios so that they apply to the average patient presenting to an average physician at an average facility.

The definitions and assumptions should provide all readers with a common starting point in interpreting the clinical scenarios. The list of definitions and assumptions accompanied the matrix of clinical scenarios in all stages of AUC development and appears in the Writing Panel section of this document.

LITERATURE REVIEW

The Clinical Practice Guideline on the Management of Hip Fracture in Older Adults, was used as the evidence base for this AUC (see here: <https://www.orthoguidelines.org/topic?id=1038>). This guideline helped to inform the decisions of the writing panel and rating panel where available and necessary.

RATING PANEL MODIFICATIONS TO WRITING PANEL DOCUMENT

At the start of the rating panel meeting, the rating panel was reminded that they could amend the original writing panel materials if the amendments resulted in more clinically relevant and practical criteria. To amend the original materials, a rating panel member must make a motion to amend and another member must “second” that motion, after which a vote is conducted. If the majority of rating panel members voted “yes” to amend the original materials, the amendments were accepted. After group discussion and voting to amend the indications, the clinical scenarios were updated to include the following indications: Bisphosphonate Treatment, Pre-Hip Fracture Functional Status, and Prognosis.

DETERMINING APPROPRIATENESS

RATING PANEL

As mentioned above, a multidisciplinary panel of clinicians was assembled to determine the appropriateness of treatments for the Prevention of Secondary Fracture AUC. A non-rating moderator, who is an orthopaedic surgeon, but is not a specialist in the management of secondary fracture, moderated the rating panel. The moderator

was familiar with the methods and procedures of AAOS Appropriate Use Criteria and led the panel (as a non-rater) in discussions. Additionally, no member of the rating panel was involved in the development, i.e., writing panel, of the scenarios.

The rating panel used a modified Delphi procedure to determine appropriateness ratings. The rating panel participated in two rounds of rating while considering evidence-based information provided in the literature review.

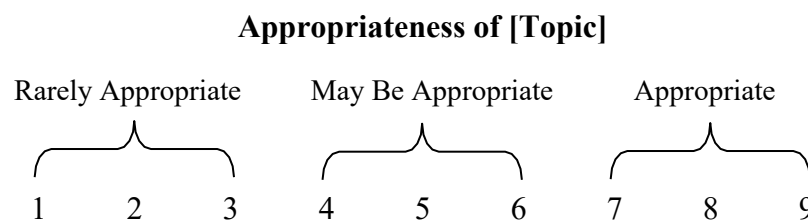
RATING APPROPRIATENESS

When rating the appropriateness of a scenario, the rating panel considered the following definition: “An appropriate procedural step for preventing a secondary fracture in an older adult who has had a hip fracture, is one for which the procedure **is** generally acceptable, **is** a reasonable approach for the indication, and **is** likely to improve the patient’s health outcomes or survival.” The rating panel rated each scenario using their best clinical judgment, taking into consideration the available evidence, for an average patient presenting to an average physician at an average facility as follows:

FIGURE 2. INTERPRETING THE 9-POINT APPROPRIATENESS SCALE

Rating	Explanation
7-9	Appropriate: Appropriate for the indication provided, meaning treatment is generally acceptable and is a reasonable approach for the indication and is likely to improve the patient’s health outcomes or survival.
4-6	May Be Appropriate: Uncertain for the indication provided, meaning treatment may be acceptable and may be a reasonable approach for the indication, but with uncertainty implying that more research and/or patient information is needed to further classify the indication.
1-3	Rarely Appropriate: Rarely an appropriate option for management of patients in this population due to the lack of a clear benefit/risk advantage; rarely an effective option for individual care plans; exceptions should have documentation of the clinical reasons for proceeding with this care option (i.e., procedure is not generally acceptable and is not generally reasonable for the indication).

Each panelist uses the scale below to record their response for each scenario:



ROUND ONE RATING

The first round of rating occurred after approval of the final indications, scenarios, and assumptions by the writing panel. The rating panel rated the scenarios electronically using the AAOS AUC Electronic Ballot Tool, a personalized ballot created by AAOS staff. There was no interaction between rating panel members while completing the first round of rating. Panelists considered the following materials:

- The instructions for rating appropriateness
- The completed literature review, that is appropriately referenced when evidence is available for a scenario
- The list of indications, definitions, and assumptions, to ensure consistency in the interpretation of the clinical scenarios

ROUND TWO RATING

The second round of rating occurred during the virtual rating panel meeting on August 27, 2023. Prior to the meeting, each rating panelist received a personalized document that included his/her first-round ratings along with summarized results of the first-round ratings that resulted in disagreement. These results indicated the frequency of ratings for a scenario for all panelists. The document contained no identifying information for other panelists' ratings. The moderator also used a document that summarized the results of the panelists' first round rating. These personalized documents served as the basis for discussions of scenarios which resulted in disagreement.

During the discussion, the rating panel members were allowed to add or edit the assumptions list, patient indications, and/or treatments if clarification was needed. Rating panel members were also able to record a new rating for any scenarios/treatments, if they were persuaded to do so by the discussion and/or the evidence. There was no attempt to obtain consensus among the panel members. After the final ratings were submitted, AAOS staff used the AAOS AUC Electronic Ballot Tool to export the median values and level of agreement for all rating items.

FINAL RATINGS

Using the median value of the second-round ratings, AAOS staff determined the final levels of appropriateness. Disagreement among raters can affect the final rating. Agreement and disagreement were determined using the BIOMED definitions of Agreement and Disagreement, as reported in the RAND/UCLA Appropriate Method User's Manual¹, for a panel of 8-10 rating members (see Figure 3 below). The 8-10 panel member disagreement cutoff was used for this rating panel. For this panel size, disagreement is defined as when ≥ 3 members' appropriateness ratings fell within the appropriate (7-9) and rarely appropriate (1-3) ranges for any scenario (i.e., ≥ 3 members' ratings fell between 1-3 and ≥ 3 members' ratings fell between 7-9 on any given scenario and its treatment). If there is still disagreement in the rating panel ratings after the last round of rating, that rating item is labeled as "5" regardless of median score. Agreement is defined as ≤ 2 panelists rated outside of the 3-point range containing the median.

FIGURE 3. DEFINING AGREEMENT AND DISAGREEMENT FOR APPROPRIATENESS RATINGS

Panel Size	<u>Disagreement</u>	<u>Agreement</u>
	Number of panelists rating in each extreme (1-3 and 7-9)	Number of panelists rating outside the 3-point region containing the median (1-3, 4-6, 7-9)
8,9,10	≥ 3	≤ 2
11,12,13	≥ 4	≤ 3
14,15,16	≥ 5	≤ 4
17,18,19	≥ 6	≤ 5

Adapted from RAM ¹

The classifications in the table below determined final levels of appropriateness.

Table 1. INTERPRETING FINAL RATINGS OF CRITERIA

Level of Appropriateness	Description
Appropriate	<ul style="list-style-type: none"> • Median panel rating between 7-9 and no disagreement
May Be Appropriate	<ul style="list-style-type: none"> • Median panel rating between 4-6 or • Median panel rating 1-9 with disagreement
Rarely Appropriate	<ul style="list-style-type: none"> • Median panel rating between 1-3 and no disagreement

REVISION PLANS

These criteria represent a cross-sectional view of current methods for prevention of secondary fracture in older adults who have had a hip fracture, and may become outdated as new evidence becomes available or clinical decision-making indicators are improved. In accordance with guideline and appropriate use criteria standards, AAOS will update or withdraw these criteria in five years. AAOS will issue updates in accordance with new evidence, changing practice, rapidly emerging treatment options, and new technology.

DISSEMINATING APPROPRIATE USE CRITERIA



All AAOS AUCs can be accessed via a user-friendly app that is available via the OrthoGuidelines website (www.orthoguidelines.org/auc) or as a native app via the Apple and Google Play stores.

Publication of the AUC document is on the AAOS website at <https://www.aaos.org/quality/quality-programs/>. This document provides interested readers with full documentation about the development of Appropriate Use Criteria and further details of the criteria ratings.

AUCs are first announced by an Academy press release and then published on the AAOS website. AUC summaries are published in *AAOS Now* and the *Journal of the American Academy of Orthopaedic Surgeons (JAAOS)*. AUCs may also be promoted via JAAOS' Unplugged podcast. In addition, most appropriate use criteria are promoted at the AAOS Annual Meeting in the Resource Center.

The dissemination efforts of AUCs may include the AAOS Learning Management Systems (LMS), AAOS' Education by Specialty Area pages, webinars, and media briefings. In addition, AUCs are also promoted in relevant Continuing Medical Education (CME) courses. Specialty Societies that participated in the development of the AUC are invited to endorse the AUC and share the links to the online tool and full AUC pdf to their membership via their websites.

Other dissemination efforts outside of the AAOS include submitting AUCs to the Guidelines International Network and to other medical specialty societies' meetings.

PATIENT INDICATIONS AND TREATMENTS

Assumptions

Before these appropriate use criteria are consulted, it is assumed that:

1. The focus of this AUC is on prevention of secondary hip or fragility fracture in patients who have had a previous frailty hip fracture and have received surgical intervention.
2. The physician who is prescribing assessments or treatments for a patient is aware of indications and contraindications.
3. The physician has an informed discussion with the patient about the treatment options and that the optimum treatment options may change over time for the patient.
4. Patient values and preferences are taken into account.
5. The patient has given adequate and informed consent.
6. The physician would initiate any necessary assessments/treatments as soon as is reasonably possible post-operatively and ideally within 6 months.

Definitions:

Fragility Fracture: low energy hip, proximal humerus, wrist, or spine compression fracture

Disclaimer:

Volunteer physicians from multiple medical specialties created and categorized these Appropriate Use Criteria. These Appropriate Use Criteria are not intended to be comprehensive or a fixed protocol, as some patients may require more or less treatment or different means of diagnosis. These Appropriate Use Criteria represent patients and situations that clinicians treating or diagnosing musculoskeletal conditions are most likely to encounter. The clinician's independent medical judgment, given the individual patient's clinical circumstances, should always determine patient care and treatment.

INDICATIONS

PATIENT INDICATIONS AND CLASSIFICATIONS

Bisphosphonate Treatment:

1. No (never)
2. Yes (previous)
3. Yes (current)

Pre-hip Fracture Functional Status:

1. Non-Mobile/Bedbound
2. Ambulator (with or without assistance)

Prognosis:

1. ≤ 1 year prognosis
2. >1 year prognosis

TREATMENTS

1. Fall Risk Assessment
2. Maintaining Physical Activity (eg appropriate weightbearing exercises, resistance training)
3. Serology Screening (vitamin D(25-OH), iPTH, TSH, Calcium, Albumin)
4. Fall Prevention Program (as dictated by level of functioning)
5. Bone Density Assessment
6. Calcium and Vitamin D Supplementation
7. Bisphosphonate Treatment
8. Consideration for Additional Pharmacological Agents (e.g., Synthetic Parathyroid Hormone, Biologics, Selective Estrogen Receptor Modulators)
9. Smoking Cessation and Excessive Alcohol Counseling

RESULTS OF APPROPRIATENESS RATINGS

For a user-friendly version of these appropriate use criteria, please access our AUC web-based application at www.orthoguidelines.org/auc. The OrthoGuidelines native app can also be downloaded via the Apple or Google Play stores.

Web-Based AUC Application Screenshot

INDICATION PROFILE	PROCEDURE RECOMMENDATIONS																																																						
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		8																																																					
	Smoking Cessation and Excessive Alcohol Counseling	+																																																					
		9																																																					
	Bisphosphonate Treatment	-																																																					
		5																																																					
<p>Submit </p>																																																							

RESULTS

The following Appropriate Use Criteria tables contain the final appropriateness ratings assigned by the members of the rating panel. Patient characteristics are found under the column titled “Scenario”. The Appropriate Use Criteria for each patient scenario can be found within each of the treatment rows. These criteria are formatted by appropriateness, median rating, and + or - indicating agreement or disagreement amongst the rating panel, respectively.

Out of 108 total rating items, 61 (56%) rating items were rated as “Appropriate”, 46 (43%) rating items were rated as “May Be Appropriate”, and 1 (1%) rating item was rated as “Rarely Appropriate” (Figure 4). Additionally, the rating panel members were in statistical agreement on 28 (26%) rating items and statistical disagreement on 15 (14%) rating items (Figure 5).

FIGURE 4. BREAKDOWN OF APPROPRIATENESS RATINGS

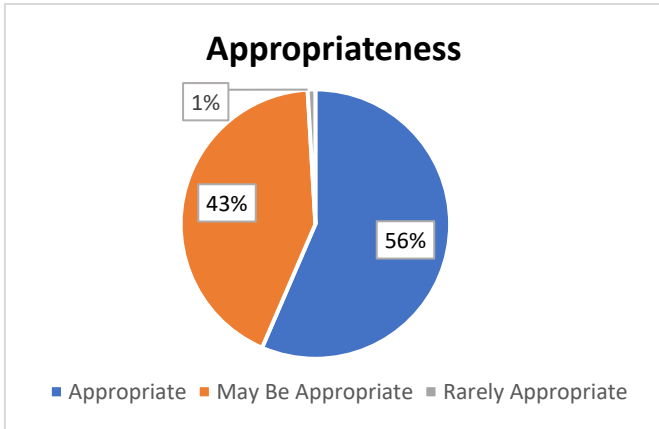


FIGURE 5. BREAKDOWN OF AGREEMENT AMONGST RATING PANEL

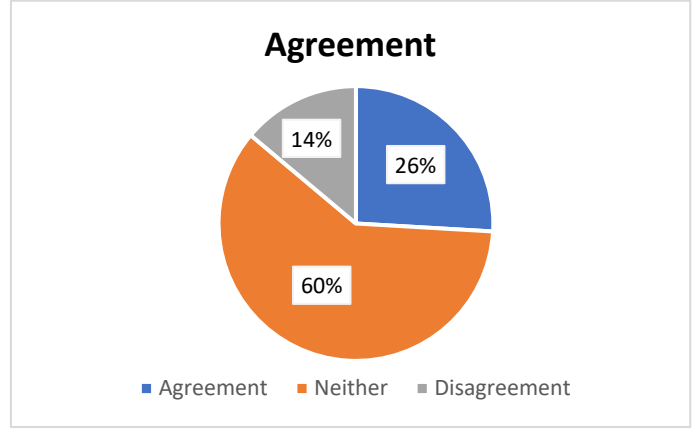
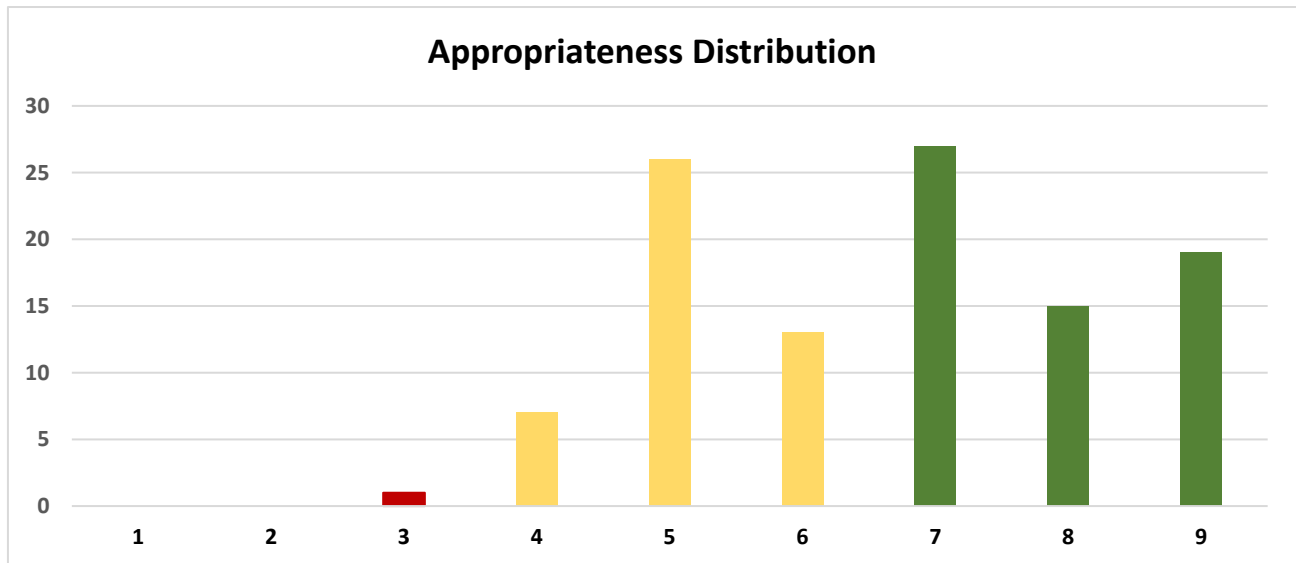


FIGURE 6. DISTRIBUTION OF APPROPRIATENESS ON 9-POINT RATING SCALE



APPROPRIATENESS RATINGS BY PATIENT SCENARIO

Interpreting the AUC tables:

- Each procedure contains the appropriateness (i.e., appropriate, may be appropriate, or rarely appropriate) for each patient scenario, followed by the median panel rating, and the panel's agreement in parentheses.

Table 2: AUC Rating Results

Scenario 1:	Treatment	Appropriateness Rating
No (never), Non-Mobile/Bedbound, Less than or equal to 1 year prognosis	Fall Risk Assessment	Appropriate (7)
	Maintaining Physical Activity (eg appropriate weightbearing exercises, resistance training)	May Be Appropriate (5 -)
	Serology Screening (vitamin D(25-OH), iPTH, TSH, Calcium, Albumin)	May Be Appropriate (5)
	Fall Prevention Program (as dictated by level of functioning)	Appropriate (7)
	Bone Density Assessment	May Be Appropriate (4)
	Calcium and Vitamin D Supplementation	May Be Appropriate (6)
	Bisphosphonate Treatment	May Be Appropriate (6)
	Consideration for Additional Pharmacological Agents (e.g., Synthetic Parathyroid Hormone, Biologics, Selective Estrogen Receptor Modulators)	Rarely Appropriate (3)
	Smoking Cessation and Excessive Alcohol Counseling	May Be Appropriate (5)
Scenario 2:	Treatment	Appropriateness Rating
No (never), Non-Mobile/Bedbound, Greater than 1 year prognosis	Fall Risk Assessment	Appropriate (8)
	Maintaining Physical Activity (eg appropriate weightbearing exercises, resistance training)	Appropriate (7)
	Serology Screening (vitamin D(25-OH), iPTH, TSH, Calcium, Albumin)	May Be Appropriate (6)
	Fall Prevention Program (as dictated by level of functioning)	Appropriate (8)
	Bone Density Assessment	May Be Appropriate (5)
	Calcium and Vitamin D Supplementation	Appropriate (7)
	Bisphosphonate Treatment	May Be Appropriate (6)

	Consideration for Additional Pharmacological Agents (e.g., Synthetic Parathyroid Hormone, Biologics, Selective Estrogen Receptor Modulators)	May Be Appropriate (4)
	Smoking Cessation and Excessive Alcohol Counseling	Appropriate (7)
Scenario 3:	Treatment	Appropriateness Rating
No (never), Ambulator (with or without assistance), Less than or equal to 1 year prognosis	Fall Risk Assessment	Appropriate (9 +)
	Maintaining Physical Activity (eg appropriate weightbearing exercises, resistance training)	Appropriate (9 +)
	Serology Screening (vitamin D(25-OH), iPTH, TSH, Calcium, Albumin)	May Be Appropriate (6)
	Fall Prevention Program (as dictated by level of functioning)	Appropriate (9 +)
	Bone Density Assessment	May Be Appropriate (5)
	Calcium and Vitamin D Supplementation	Appropriate (7)
	Bisphosphonate Treatment	Appropriate (7)
	Consideration for Additional Pharmacological Agents (e.g., Synthetic Parathyroid Hormone, Biologics, Selective Estrogen Receptor Modulators)	May Be Appropriate (5)
	Smoking Cessation and Excessive Alcohol Counseling	Appropriate (7)
Scenario 4:	Treatment	Appropriateness Rating
No (never), Ambulator (with or without assistance), Greater than 1 year prognosis	Fall Risk Assessment	Appropriate (9 +)
	Maintaining Physical Activity (eg appropriate weightbearing exercises, resistance training)	Appropriate (9 +)
	Serology Screening (vitamin D(25-OH), iPTH, TSH, Calcium, Albumin)	Appropriate (7 +)
	Fall Prevention Program (as dictated by level of functioning)	Appropriate (9 +)
	Bone Density Assessment	Appropriate (7)
	Calcium and Vitamin D Supplementation	Appropriate (8 +)
	Bisphosphonate Treatment	Appropriate (8 +)
	Consideration for Additional Pharmacological Agents (e.g., Synthetic Parathyroid Hormone, Biologics, Selective Estrogen Receptor Modulators)	May Be Appropriate (6)
	Smoking Cessation and Excessive Alcohol Counseling	Appropriate (8)
Scenario 5:	Treatment	Appropriateness Rating

Yes (previous), Non-Mobile/Bedbound, Less than or equal to 1 year prognosis	Fall Risk Assessment	Appropriate (7)
	Maintaining Physical Activity (eg appropriate weightbearing exercises, resistance training)	May Be Appropriate (5 -)
	Serology Screening (vitamin D(25-OH), iPTH, TSH, Calcium, Albumin)	May Be Appropriate (4)
	Fall Prevention Program (as dictated by level of functioning)	Appropriate (7)
	Bone Density Assessment	May Be Appropriate (5)
	Calcium and Vitamin D Supplementation	May Be Appropriate (5 -)
	Bisphosphonate Treatment	May Be Appropriate (4)
	Consideration for Additional Pharmacological Agents (e.g., Synthetic Parathyroid Hormone, Biologics, Selective Estrogen Receptor Modulators)	May Be Appropriate (4)
	Smoking Cessation and Excessive Alcohol Counseling	May Be Appropriate (5 -)
Scenario 6:	Treatment	Appropriateness Rating
Yes (previous), Non-Mobile/Bedbound, Greater than 1 year prognosis	Fall Risk Assessment	Appropriate (9)
	Maintaining Physical Activity (eg appropriate weightbearing exercises, resistance training)	May Be Appropriate (5 -)
	Serology Screening (vitamin D(25-OH), iPTH, TSH, Calcium, Albumin)	Appropriate (7)
	Fall Prevention Program (as dictated by level of functioning)	Appropriate (8)
	Bone Density Assessment	May Be Appropriate (6)
	Calcium and Vitamin D Supplementation	Appropriate (7)
	Bisphosphonate Treatment	May Be Appropriate (5)
	Consideration for Additional Pharmacological Agents (e.g., Synthetic Parathyroid Hormone, Biologics, Selective Estrogen Receptor Modulators)	May Be Appropriate (6)
	Smoking Cessation and Excessive Alcohol Counseling	May Be Appropriate (5 -)
Scenario 7:	Treatment	Appropriateness Rating
Yes (previous), Ambulator (with or without assistance), Less than or equal to 1 year prognosis	Fall Risk Assessment	Appropriate (9 +)
	Maintaining Physical Activity (eg appropriate weightbearing exercises, resistance training)	Appropriate (9 +)
	Serology Screening (vitamin D(25-OH), iPTH, TSH, Calcium, Albumin)	May Be Appropriate (6)

	Fall Prevention Program (as dictated by level of functioning)	Appropriate (9 +)
	Bone Density Assessment	May Be Appropriate (5)
	Calcium and Vitamin D Supplementation	Appropriate (7)
	Bisphosphonate Treatment	May Be Appropriate (5)
	Consideration for Additional Pharmacological Agents (e.g., Synthetic Parathyroid Hormone, Biologics, Selective Estrogen Receptor Modulators)	May Be Appropriate (6)
	Smoking Cessation and Excessive Alcohol Counseling	Appropriate (7)
Scenario 8:	Treatment	Appropriateness Rating
Yes (previous), Ambulator (with or without assistance), Greater than 1 year prognosis	Fall Risk Assessment	Appropriate (9 +)
	Maintaining Physical Activity (eg appropriate weightbearing exercises, resistance training)	Appropriate (9 +)
	Serology Screening (vitamin D(25-OH), iPTH, TSH, Calcium, Albumin)	Appropriate (7)
	Fall Prevention Program (as dictated by level of functioning)	Appropriate (9 +)
	Bone Density Assessment	Appropriate (7)
	Calcium and Vitamin D Supplementation	Appropriate (8 +)
	Bisphosphonate Treatment	May Be Appropriate (6)
	Consideration for Additional Pharmacological Agents (e.g., Synthetic Parathyroid Hormone, Biologics, Selective Estrogen Receptor Modulators)	Appropriate (7 +)
	Smoking Cessation and Excessive Alcohol Counseling	Appropriate (8)
Scenario 9:	Treatment	Appropriateness Rating
Yes (current), Non-Mobile/Bedbound, Less than or equal to 1 year prognosis	Fall Risk Assessment	Appropriate (8)
	Maintaining Physical Activity (eg appropriate weightbearing exercises, resistance training)	May Be Appropriate (5 -)
	Serology Screening (vitamin D(25-OH), iPTH, TSH, Calcium, Albumin)	May Be Appropriate (4)
	Fall Prevention Program (as dictated by level of functioning)	Appropriate (7)
	Bone Density Assessment	May Be Appropriate (5)
	Calcium and Vitamin D Supplementation	May Be Appropriate (5 -)
	Bisphosphonate Treatment	May Be Appropriate (4)

	Consideration for Additional Pharmacological Agents (e.g., Synthetic Parathyroid Hormone, Biologics, Selective Estrogen Receptor Modulators)	May Be Appropriate (5 -)
	Smoking Cessation and Excessive Alcohol Counseling	May Be Appropriate (5 -)
Scenario 10:	Treatment	Appropriateness Rating
Yes (current), Non-Mobile/Bedbound, Greater than 1 year prognosis	Fall Risk Assessment	Appropriate (8)
	Maintaining Physical Activity (eg appropriate weightbearing exercises, resistance training)	May Be Appropriate (5 -)
	Serology Screening (vitamin D(25-OH), iPTH, TSH, Calcium, Albumin)	Appropriate (7)
	Fall Prevention Program (as dictated by level of functioning)	Appropriate (8)
	Bone Density Assessment	May Be Appropriate (5)
	Calcium and Vitamin D Supplementation	Appropriate (7)
	Bisphosphonate Treatment	May Be Appropriate (5 -)
	Consideration for Additional Pharmacological Agents (e.g., Synthetic Parathyroid Hormone, Biologics, Selective Estrogen Receptor Modulators)	May Be Appropriate (6)
	Smoking Cessation and Excessive Alcohol Counseling	May Be Appropriate (5 -)
Scenario 11:	Treatment	Appropriateness Rating
Yes (current), Ambulator (with or without assistance), Less than or equal to 1 year prognosis	Fall Risk Assessment	Appropriate (9 +)
	Maintaining Physical Activity (eg appropriate weightbearing exercises, resistance training)	Appropriate (8 +)
	Serology Screening (vitamin D(25-OH), iPTH, TSH, Calcium, Albumin)	Appropriate (7)
	Fall Prevention Program (as dictated by level of functioning)	Appropriate (9 +)
	Bone Density Assessment	May Be Appropriate (6)
	Calcium and Vitamin D Supplementation	Appropriate (7 +)
	Bisphosphonate Treatment	May Be Appropriate (5 -)
	Consideration for Additional Pharmacological Agents (e.g., Synthetic Parathyroid Hormone, Biologics, Selective Estrogen Receptor Modulators)	Appropriate (7)
	Smoking Cessation and Excessive Alcohol Counseling	Appropriate (8)

Scenario 12:	Treatment	Appropriateness Rating
Yes (current), Ambulator (with or without assistance), Greater than 1 year prognosis	Fall Risk Assessment	Appropriate (9 +)
	Maintaining Physical Activity (eg appropriate weightbearing exercises, resistance training)	Appropriate (9 +)
	Serology Screening (vitamin D(25-OH), iPTH, TSH, Calcium, Albumin)	Appropriate (7 +)
	Fall Prevention Program (as dictated by level of functioning)	Appropriate (9 +)
	Bone Density Assessment	Appropriate (7)
	Calcium and Vitamin D Supplementation	Appropriate (8 +)
	Bisphosphonate Treatment	May Be Appropriate (5 -)
	Consideration for Additional Pharmacological Agents (e.g., Synthetic Parathyroid Hormone, Biologics, Selective Estrogen Receptor Modulators)	Appropriate (8 +)
	Smoking Cessation and Excessive Alcohol Counseling	Appropriate (9 +)

APPENDICES

APPENDIX A. DOCUMENTATION OF APPROVAL

AAOS BODIES THAT APPROVED THIS APPROPRIATE USE CRITERIA

Evidence-Based Quality and Value Committee: Approved on September 16, 2023

The AAOS Committee on Evidence Based Quality and Value consists of 19 AAOS members. The overall purpose of this committee is to plan, organize, direct, and evaluate initiatives related to Clinical Practice Guidelines, Appropriate Use Criteria, and Quality Measures.

Research and Quality Council: Approved on October 21, 2023

To enhance the mission of the AAOS, the Research and Quality Council promotes the most ethically and scientifically sound basic, clinical, and translational research possible to ensure the future care for patients with musculoskeletal disorders. The Council also serves as the primary resource to educate its members, the public, and public policy makers regarding evidenced-based medical practice, orthopaedic devices and biologics regulatory pathways and standards development, patient safety, and other related areas of importance.

Board of Directors: Approved on December 1, 2023

The 17 member AAOS Board of Directors manages the affairs of the AAOS, sets policy, and determines and continually reassesses the Strategic Plan.

APPENDIX B. DISCLOSURE INFORMATION

PREVENTION OF SECONDARY FRACTURE WRITING PANEL MEMBER DISCLOSURES

Liron Sinvani, MD (This individual reported nothing to disclose); Submitted on: 03/28/2023

Robin Neil Kamal, MD, FAAOS Submitted on: 12/28/2022

AAOS: Board or committee member (\$0) EBQV(Self)

Acumed, LLC: Paid consultant (\$30,000) general consulting (Self)

American Society for Surgery of the Hand: Board or committee member (\$0) Quality Metrics Committee (Self)

Modum: Stock or stock Options Number of Shares: 5,500 Modum (Self)

Restor3d: Paid consultant (\$15,000) Restor3d (Self)

Jason Strelzow, MD, FAAOS Submitted on: 03/24/2023

Acumed, LLC: Paid presenter or speaker (\$2,000) Number of Presentations: 2 Acumed (Self)

Acumed, LLC: Paid consultant (\$9,000) Consulting Services (Self)

American Society for Surgery of the Hand: Board or committee member (\$0) N/A (Self)

BoneSupport: Paid presenter or speaker (\$2,500) Number of Presentations: 2 N/A (Self)

BoneSupport: Paid consultant (\$2,000) BoneSupport (Self)

Journal of Bone and Joint Surgery - American: Editorial or governing board (\$0) JBJS Reviews (Self)

Journal of Hand Surgery - American: Editorial or governing board (\$0) N/A (Self)

Orthopaedic Trauma Association: Board or committee member (\$0) N/A (Self)

OrthoXel: Paid consultant (\$6,000) Consultant (Self)

Stryker: Other financial or material support (\$300) N/A (Self)

Paras Goel, DPT, MEd, PT (This individual reported nothing to disclose); Submitted on: 03/27/2023

Christopher Robert Carpenter, MD, MS Submitted on: 04/02/2023

Academic Emergency Medicine: Editorial or governing board (\$0) N/A(Self)

Annals of Internal Medicine ACP Journal Club: Editorial or governing board (\$1,000) N/A(Self)

Journal of the American Medical Association: Editorial or governing board (\$1,000) N/A(Self)

ROM Technologies Incorporated: Stock or stock Options Number of Shares: 100 ROM Technologies Incorporated (Self)

Lauren Michelle Shapiro, MD, MS Submitted on: 03/24/2023

AAOS: Board or committee member (\$0) NA (Self)

American Society for Surgery of the Hand: Board or committee member (\$0) NA (Self)

Flutura Hasa, MD (This individual reported nothing to disclose)

PREVENTION OF SECONDARY FRACTURE RATING PANEL MEMBER DISCLOSURES

Hari Bezwada, MD, FAAOS Submitted on: 03/26/2023

American Association of Hip and Knee Surgeons: Board or committee member (\$0) Evidence Based Medicine Committee (Self)

Corentec: Paid consultant (\$0)

Encore Medical: Paid consultant (\$0)

Journal of Arthroplasty: Editorial or governing board (\$0)

Journal of the American Academy of Orthopaedic Surgeons: Editorial or governing board (\$0)

Ajay Kumar Srivastava, MD, FAAOS Submitted on: 03/24/2023

AAOS: Board or committee member (\$0) Committee on Healthcare Safety (Self)

American Association of Hip and Knee Surgeons: Board or committee member (\$0) EBM Committee (Self)

Daniel Ari Mendelson, MD, MS Submitted on: 03/24/2023

American Geriatrics Society: Board or committee member (\$0) Quality Performance and Measures Committee; Nominating Committee (Self)

Geriatric Orthopaedic Surgery and Rehabilitation/Sage: Editorial or governing board (\$0) (Self) Editorial Board Member

International Geriatric Fracture Society: Board or committee member (\$0) Past President, Board Member (Self)

Ryan Harrison, MD, FAAOS Submitted on: 03/24/2023

AAOS: Board or committee member (\$0)

American Orthopaedic Association: Board or committee member (\$0) Own the Bone Membership Subcommittee Member (Self)

Orthopaedic Trauma Association: Board or committee member (\$0)

James Dunleavy, DPT (This individual reported nothing to disclose); Submitted on: 03/27/2023

Gregory John Della Rocca, MD, PhD, MBA, FAAOS, FACS Submitted on: 03/22/2023

AAOS: Board or committee member (\$0)

American College of Surgeons: Board or committee member (\$0)

American Orthopaedic Association: Board or committee member (\$0) N/A (Self)

Association of Bone and Joint Surgeons: Board or committee member (\$0) Committee member (Self)

BioPoly: Unpaid consultant Unpaid consultant (Self)

Geriatric Orthopaedic Surgery and Rehabilitation: Editorial or governing board (\$0) N/A(Self)

Journal of Orthopaedic Trauma: Editorial or governing board (\$0) N/A(Self)

Mergenet: Stock or stock Options Number of Shares: 14,500 N/A (Self)

Orthopaedic Trauma Association: Board or committee member (\$0)

The Orthopaedic Implant Company: Stock or stock Options Number of Shares: 25,000 N/A (Self)

Wright Medical Technology, Inc.: IP royalties (\$4,500) N/A (Self)

Kristine E Ensrud, MD, MPH (This individual reported nothing to disclose); Submitted on: 03/30/2023

Ryan Meyer, MD (This individual reported nothing to disclose); Submitted on: 04/04/2023

Paul A Manner, MD, FAAOS Submitted on: 04/13/2023

Clinical Orthopaedics and Related Research: Editorial or governing board (\$60,000) Senior Editor (Self)

Bruce Ziran, MD, FAAOS, FACS (This individual reported nothing to disclose)

APPENDIX C. REFERENCES

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AAOS Management of Hip Fracture in Older Adults Clinical Practice Guideline

1. American Academy of Orthopaedic Surgeons. Systematic Literature Review on the Management of Hip Fracture in Older Adults. <https://www.aaos.org/>. Published 12/03/2021.

APPENDIX D. EXTERNAL ENDORSEMENTS

February 14, 2024

Kaitlyn S. Sevarino, MBA, CAE
Director
Department of Clinical Quality and Value

Dear Ms. Sevarino,

The American Association on Hip and Knee Surgeons has voted to endorse the AAOS Prevention of Secondary Fracture Appropriate Use Criteria. This endorsement implies permission for the AAOS to officially list our organization as an endorser of this clinical practice guideline and reprint our logo in the introductory section of the clinical practice guideline review document.

Sincerely,

Javad Parvizi, MD
AAHKS President