NATIONAL GUIDELINE CLEARINGHOUSE™ (NGC) GUIDELINE SYNTHESIS

OSTEOPOROSIS PART 1. SCREENING AND RISK ASSESSMENT

Guidelines

1. **American College of Obstetricians and Gynecologists (ACOG)**. Osteoporosis. Washington (DC): American College of Obstetricians and Gynecologists (ACOG); 2004 Jan. 14 p. (ACOG practice bulletin; no. 50). [78 references]
2. **The North American Menopause Society (NAMS)**. Management of osteoporosis in postmenopausal women: 2006 position statement of The North American Menopause Society. Menopause 2006 May-Jun;13(3):340-67. [234 references]
3. **University of Michigan Health System (UMHS)**. Osteoporosis: prevention and treatment. Ann Arbor (MI): University of Michigan Health System; 2005 Jul. 13 p. [Various references].

INTRODUCTION

A direct comparison of American College of Obstetricians and Gynecologists (ACOG), The North American Menopause Society (NAMS), and University of Michigan Health System (UMHS) recommendations for osteoporosis screening and risk assessment is provided in the tables, below.

The guidelines are similar in scope. In addition to addressing screening, all three guidelines also address the prevention and treatment of osteoporosis. These topics, however, are beyond the scope of this synthesis. Recommendations concerning prevention of osteoporosis are compared in Part II of this synthesis (under development). Recommendations for diagnosis and treatment of are addressed in Part III of this synthesis (under development). The NAMS and UMHS guidelines are updates of earlier guidelines.

- Table 1 provides a quick-view glance at the primary interventions considered by each group.
- Table 2 provides a comparison of the overall scope of both guidelines.
- Table 3 provides a comparison of the methodology employed and documented by both groups in developing their guidelines.
- Table 4 provides a comparison of the availability of the full-text guidelines and the implementation tools provided by the guideline groups.
- Table 5 provides a more detailed comparison of the specific recommendations offered by each group for the topics under consideration in this synthesis, including:
    - Definition of Osteoporosis
    - Whom to Screen
    - Risk Assessment Components

    - Measurement of BMD: Modality and Frequency
    - Supporting References
- Table 6 lists the potential benefits and harms associated with the implementation of each guideline as stated in the original guidelines.
- Table 7 presents the rating schemes used by ACOG and UMHS to rate the level of evidence and/or the strength of the recommendations.

A summary discussion of the areas of agreement and areas of differences among the guidelines is presented following the content comparison tables.

Abbreviations used in the text and tables follow:

- ACOG, American College of Obstetricians and Gynecologists
- BMD, bone mineral density
- BMI, body mass index
- DEXA/DXA, dual-energy x-ray absorptiometry
- NAMS, The North American Menopause Society
- UMHS, University of Michigan Health System
- WHO, World Health Organization

TABLE 1: COMPARISON OF INTERVENTIONS AND PRACTICES CONSIDERED
("✓" indicates topic is addressed)

	ACOG (2004)	NAMS (2006)	UMHS (2005)
Definition of osteoporosis	✓	✓	✓
Whom to screen	✓	✓	✓
Risk Assessment			
• Assessment of risk factors	✓	✓	✓
• Medical history		✓	✓
• Physical examination		✓	
• BMD measurement	✓	✓	✓
Measurement of BMD: Modality and Frequency			

• DXA/DEXA	✓	✓	✓
• Quantitative ultrasound	✓		✓
• Biochemical markers	✓	✓	✓

TABLE 2: COMPARISON OF GUIDELINE SCOPE	
Objective and Scope	
ACOG (2004)	• To aid practitioners in making decisions about appropriate obstetric and gynecologic care • To discuss appropriate screening strategies and significant pharmacologic interventions available to prevent and treat osteoporosis
NAMS (2006)	• To update the evidence-based position statement published by NAMS in 2002 regarding the management of osteoporosis in postmenopausal women • To provide guidance on the diagnosis, prevention, and treatment of osteoporosis in postmenopausal women
UMHS (2005)	• To decrease osteoporotic fractures and their associated morbidity and mortality
Target Population	
ACOG (2004)	• United States • Adult women (counseling, screening)
NAMS (2006)	• North America • Postmenopausal women
UMHS (2005)	• United States • Postmenopausal women and persons at risk for secondary osteoporosis related to long-term glucocorticoid use, organ

	transplant, or other medical conditions
Intended Users	
ACOG (2004)	Physicians
NAMS (2006)	Advanced Practice Nurses Allied Health Personnel Health Care Providers Health Plans Managed Care Organizations Nurses Pharmacists Physician Assistants Physicians
UMHS (2005)	Physicians

TABLE 3: COMPARISON OF METHODOLOGY	
Methods Used to Collect/Select the Evidence	
ACOG (2004)	*Hand-searches of Published Literature (Primary Sources)* *Hand-searches of Published Literature (Secondary Sources)* *Searches of Electronic Databases* *Described Process*: The MEDLINE database, the Cochrane Library, and American College of Obstetricians and Gynecologists' own internal resources and documents were used to conduct a literature search to locate relevant articles published between January 1985 and October 2003. The search was restricted to articles published in the English language. Priority was given to articles reporting results

	of original research, although review articles and commentaries also were consulted. Abstracts of research presented at symposia and scientific conferences were not considered adequate for inclusion in this document. Guidelines published by organizations or institutions such as the National Institutes of Health and the American College of Obstetricians and Gynecologists were reviewed, and additional studies were located by reviewing bibliographies of identified articles. When reliable research was not available, expert opinions from obstetrician-gynecologists were used. *Number of source documents:* Not stated *Number of references:* 78
NAMS (2006)	*Hand-searches of Published Literature (Primary Sources)* *Hand-searches of Published Literature (Secondary Sources)* *Searches of Electronic Databases* *Described Process:* The North American Menopause Society conducted a search of the medical literature published since the previous position statement was submitted for publication in November 2001. A search was made for clinical trials, meta-analyses, and clinical practice guidelines published in English and related to osteoporosis in postmenopausal women using the database MEDLINE. The Medical Subject Headings (MeSH) used for the search were postmenopausal osteoporosis and bone loss with subheadings for epidemiology, etiology, diagnosis, prevention and control, and therapy. The National Guideline Clearinghouse was searched for relevant clinical practice guidelines and the Cochrane Library was searched for relevant systematic reviews. Priority was given to evidence from randomized controlled clinical trials and meta-analyses of such trials, followed by evidence from controlled observational studies, using criteria described elsewhere. Conclusions from other evidence-based guidelines also were reviewed. *Number of Source Documents:* Not stated *Number of References:* 234
UMHS (2005)	*Hand-searches of Published Literature (Primary Sources)* *Hand-searches of Published Literature (Secondary Sources)* *Searches of Electronic Databases* *Described Process:* The literature search for this project started with the results of a literature search performed by the National

	Osteoporosis Foundation (Osteoporosis: review of the evidence for prevention, diagnosis and treatment and cost-effectiveness analysis), published in 1998 and including literature through 1996. The guideline developers searched subsequent literature. The search was conducted prospectively using the major key words of: *osteoporosis* (or *osteoporosis, postmenopausal*); *osteopenia*; either *hip fractures* or *spinal fractures* with either *osteoporosis or osteopenia*; English language; *cost savings, cost and cost analysis; sensitivity and specificity, false negative reactions, false positive reactions, likelihood functions, sensitivity, diagnosis; clinical protocols, physician's practice patterns, algorithms, outcome and process assessment (health care), consensus development conferences, practice guidelines, guideline; clinical trials, clinical trials phase IV, controlled clinical trials, multicenter studies, randomized controlled trials, cohort studies.* Specific searches were performed for (1) *postmenopausal osteoporosis* (1996-99), for (2) *steroids* (1994-99), and for *organ transplantation, transplantation* (1990-99) with each of the following: *densitometry x-ray, bone density, absorptiometry photon; calcium, calcium carbonate, calcium citrate; Vitamin D; estrogens, progestational hormones, androgens, estrogen replacement therapy; diphosphonates; tamoxifen; piperidines; calcitonin; exercise; accident prevention.* Searches were also performed for *men, male; alternative medicine, isoflavones; alkaline phosphatase, hydroxyproline, osteocalcin, bone marker, bone and bones; osteopenia* (1990-99). The search was conducted in components each keyed to a specific causal link in a formal problem structure (available upon request). The search was supplemented with very recent clinical trials known to expert members of the panel. Negative trials were specifically sought. The search was a single cycle. *Number of source documents:* Not stated *Number of references:* 5
Methods Used to Assess the Quality and Strength of the Evidence	
ACOG (2004)	Weighting According to a Rating Scheme (Scheme Given - Refer to Table 7)
NAMS (2006)	Expert Consensus
UMHS (2005)	Weighting According to a Rating Scheme (Scheme Given - Refer to Table 7)
Methods Used to Analyze the Evidence	
ACOG	*Review of Published Meta-Analyses*

(2004)	*Systematic Review* *(Process not described)*
NAMS (2006)	*Review of Published Meta-Analyses* *Systematic Review* *(Process not described)*
UMHS (2005)	*Review of Published Meta-Analyses* *Systematic Review* *Described Process:* Conclusions were based on prospective randomized clinical trials if available, to the exclusion of other data. If randomized controlled trials were not available, observational studies were admitted to consideration. If no such data were available for a given link in the problem formulation, expert opinion was used to estimate effect size.
Methods Used to Formulate the Recommendations	
ACOG (2004)	*Expert Consensus* *Described Process:* Analysis of available evidence was given priority in formulating recommendations. When reliable research was not available, expert opinions from obstetrician-gynecologists were used. See also the "Rating Scheme for the Strength of Recommendations" field regarding Grade C recommendations.
NAMS (2006)	*Expert Consensus* *Described Process:* NAMS enlisted a five-person Editorial Board composed of endocrinologists and gynecologists from both clinical practice and research, with expertise in metabolic bone diseases and/or women's health. The Editorial Board reviewed the previous position statement and incorporated data published since that statement, compiled supporting statements, and made recommendations. Where the evidence was contradictory or inadequate to form a conclusion, a consensus-based opinion was established.
UMHS (2005)	*Expert Consensus* *Described Process:* Consideration of benefits, harms, costs, and patient preferences
Outcomes	

ACOG (2004)	• Bone mineral density • Fracture rates
NAMS (2006)	• Incidence of postmenopausal osteoporosis and osteoporotic fracture • Changes in bone mineral density • Risk of postmenopausal osteoporosis and osteoporotic fracture • Morbidity and mortality associated with osteoporotic fracture • Effect of osteoporosis therapy on bone loss and risk for fracture
UMHS (2005)	• Risk for osteoporosis or osteoporotic fractures • Incidence of osteoporosis or osteoporotic fractures • Bone mineral density, bone turnover and loss • Predictive value of diagnostic tests • Mortality related to osteoporotic hip fractures • Morbidity (chronic pain, disability, deformity, depression) related to osteoporotic fractures • Pain relief • Medication side effects
Financial Disclosures/Conflicts of Interest	
ACOG (2004)	Not stated
NAMS (2006)	The North American Menopause Society (NAMS) is committed to ensuring balance, independence, and objectivity in all its educational activities. All those involved in the development of a continuing medical education (CME) activity are required to disclose financial relationships they or their spouse/partner have had during the past 12 months with a commercial interest whose products or services are discussed in the CME activity content, or with any commercial supporters of the activity over which they have control. For the Editorial Board, Dr. Ettinger reports Berlex, GlaxoSmithKline, Novartis, Merck, Procter & Gamble, Roche (consultant); Dr. Harris reports Amgen, Eli Lilly, GlaxoSmith-Kline, Merck, Novartis, Procter & Gamble, Roche, Sanofi-Aventis, Wyeth (consultant), Eli Lilly, GlaxoSmithKline, Merck, Procter & Gamble, Roche, Sanofi-Aventis, Wyeth (sponsored lectures); Dr. Kendler reports Amgen, Eli Lilly, Merck, Novartis, Pfizer, Servier, Wyeth (consultant, research support, speakers' bureau); Dr. Kessel reports Procter & Gamble, Wyeth (research support), Berlex, Procter & Gamble, Merck, Wyeth (speakers' bureau); Dr. McClung reports Wyeth (consultant), Amgen, Eli Lilly, Merck, Novartis, Pfizer, Sanofi-Aventis (consultant, research support).

	For the NAMS Board of Trustees who are not serving on the Editorial Board, Dr. Freedman reports Alexza, Duramed, GlaxoSmithKline, Novartis, Organon, Pfizer, Vela, Wyeth (consultant), GlaxoSmithKline, National Institutes of Health, Organon (research support); Dr. Gallagher reports GlaxoSmithKline, Organon, Pfizer, Wyeth (consultant), Organon, Pfizer, Wyeth (research support): Dr. Goldstein reports Eli Lilly, Merck, Pfizer, Procter & Gamble, TAP (advisory boards); Dr. Gorodeski reports Molecular Diagnostics (advisory board); Dr. Henderson reports Council on Hormone Education (consultant); Dr. Pinkerton reports Duramed, Eli Lilly, Merck, Procter & Gamble, Roche, Solvay (consultant), Berlex, Eli Lilly, Pfizer/Alta, Procter & Gamble, Wyeth (speakers' bureau), Eli Lilly, Merck, Pfizer, Procter & Gamble, Solvay, Wyeth (research support), Council on Hormone Education (executive committee); Dr. Reame reports Procter & Gamble (consultant), Novo Nordisk, Procter & Gamble (research support); Dr. Rothert reports no significant financial relationships; Dr. Richardson reports Procter & Gamble (consultant); Dr. Schiff reports Alliance for Better Bone Health, Medco, *Pause*, the consumer magazine of the American College of Obstetricians and Gynecologists (advisory board), *Menopause*, the official journal of The North American Menopause Society (editor-in-chief); Dr. Speroff reports Barr (consultant), Berlex, Organon, Wyeth (research support); Dr. Stuenkel reports no significant financial relationships; Dr. Utian reports Barr/Duramed, Berlex, Johnson & Johnson Pharmaceutical Research and Development, Merck, Merrion, Novartis, Organon, Pfizer, Roche/GlaxoSmithKline (consultant, advisory board), Amylin, 3M, Barr, Berlex, Bristol- Myers Squibb, Duramed, Eli Lilly, Forest, Glen, GlaxoSmithKline, Johnson & Johnson, Neurocrine Biosciences, Novartis, Novo Nordisk, Organon, Pharmacia, Procter & Gamble, Pfizer, Roche, Sepracor, Solvay, Wyeth, Yamanouchi (research support). For additional contributors, Ms. Boggs, Dr. Graham, and Mr. Lammers all report no significant financial relationships.
UMHS (2005)	The University of Michigan Health System endorses the Guidelines of the Association of American Medical Colleges and the Standards of the Accreditation Council for Continuing Medical Education that the individuals who present educational activities disclose significant relationships with commercial companies whose products or services are discussed. Disclosure of a relationship is not intended to suggest bias in the information presented, but is made to provide readers with information that might be of potential importance to their evaluation of the information. Team Member: Yolanda Smith, MD Company: Lilly, Forest, Abbott, Wyeth, Glaxo-Smith-Kline Relationship: Speaker's Bureau Company: Pfizer Relationship: Consultant

TABLE 4: AVAILABILITY AND IMPLEMENTATION TOOLS PROVIDED	
COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE	
ACOG (2004)	*Not stated*
NAMS (2006)	*Members identified; Affiliations provided; Multidisciplinary; No patient representation*
UMHS (2005)	*Members identified; Multidisciplinary; No patient representation*
Source(s) of Funding	
ACOG (2004)	American College of Obstetricians and Gynecologists (ACOG)
NAMS (2006)	The development of this position statement was supported by unrestricted educational grants from the Novartis Pharmaceuticals Corporation.
UMHS (2005)	University of Michigan Health System (UMHS)
Guideline Availability	
ACOG (2004)	*Print distribution* Print copies: Available for purchase from the American College of Obstetricians and Gynecologists (ACOG) Distribution Center, PO Box 4500, Kearneysville, WV 25430-4500; telephone, 800-762-2264, ext. 192; e-mail: sales@acog.org. The ACOG Bookstore is available online at the ACOG Web site.
NAMS (2006)	*Electronic and print distribution; Open access* Electronic copies: Available in Portable Document Format (PDF) from The North American Menopause Society (NAMS) Web site. Print copies: Available from NAMS, P.O. Box 94527, Cleveland, OH 44101, USA. Order forms are available in Portable Document Format (PDF) from The North American Menopause Society (NAMS) Web site, www.menopause.org.
UMHS (2005)	*Electronic distribution; Open access* Electronic copies: Available in Portable Document Format (PDF) from the University of Michigan Health System Web site.

Implementation Tools	
ACOG (2004)	Foreign Language Translations Patient Resources
NAMS (2006)	Staff Training/Competency Material
UMHS (2005)	Foreign Language Translations Patient Resources Staff Training/Competency Material

TABLE 5: COMPARISON OF RECOMMENDATIONS FOR SCREENING AND RISK ASSESSMENT	
Definitions of Osteoporosis and Osteopenia	
ACOG (2004)	The WHO has defined low bone mass (osteopenia) and osteoporosis on the basis of axial skeleton measurements of bone density to facilitate screening and identification of individuals at risk (see below). These definitions apply specifically to T scores derived from the use of DXA of the lumbar spine or hip. • Normal: A T-score greater than or equal to -1 • Osteopenia: A T-score between -1 and -2.5 • Osteoporosis: A T-score less than or equal to -2.5 For older women who have experienced an osteoporotic vertebral fracture, treatment may be given without bone mineral density measurement, although baseline bone mineral density testing may be useful to follow the effects of therapy.
NAMS (2006)	NAMS supports the WHO definition of osteoporosis in a postmenopausal woman as a BMD T-score less than or equal to -2.5 at the total hip, femoral neck, or lumbar spine (posterior-anterior, not lateral). In addition to diagnosis through densitometry, osteoporosis can be diagnosed clinically, regardless of the T-score. Presence of a fragility fracture constitutes the clinical diagnosis of osteoporosis.
UMHS (2005)	*Osteoporosis* is defined as a DEXA T-score $\leq$ -2.5, osteopenia as > -

	2.5 but < -1.0 *Note:* DEXA not required for diagnosis in patients with prior osteoporotic fracture (fracture in absence of significant trauma). Order only if it will help follow response to treatment or guide treatment changes.
Whom to Screen	

ACOG (2004)	**The following recommendations are based on limited or inconsistent scientific evidence (Level B):**
	
	• Bone mineral density testing should be recommended to all postmenopausal women aged 65 years or older.
	• Bone mineral density testing may be recommended for postmenopausal women younger than 65 years who have 1 or more risk factors for osteoporosis (see below).
	• Bone mineral density testing should be performed on all postmenopausal women with fractures to confirm the diagnosis of osteoporosis and determine disease severity.
	
	Risk Factors for Osteoporotic Fracture in Postmenopausal Women
	
	• History of prior fracture
	• Family history of osteoporosis
	• Caucasian race
	• Dementia
	• Poor nutrition
	• Smoking
	• Low weight and BMI
	• Estrogen deficiency*
	  • Early menopause (age younger than 45 years) or bilateral oophorectomy
	  • Prolonged premenopausal amenorrhea (>1 year)
	• Long-term low calcium intake
	• Alcoholism
	• Impaired eyesight despite adequate correction
	• History of falls
	• Inadequate physical activity
	
	*A patient's current use of hormone therapy does not preclude estrogen deficiency.

NAMS (2006)	**Evaluation** All postmenopausal women should be assessed for risk factors associated with osteoporosis and fracture.

	Bone mineral density measurement NAMS recommends that BMD be measured in the following populations: • Postmenopausal women with medical causes of bone loss, regardless of age • Postmenopausal women at least 65 years of age, regardless of additional risk factors Testing should be considered for healthy postmenopausal women younger than age 65 when one or more of the following risk factors for fracture have been identified (the greater the number of risk factors, the greater is the need for testing): • Fracture (other than skull, facial bone, ankle, finger, and toe) after menopause • Thinness [body weight less than 127 lb. (57.7 kg) or BMI less than 21 kg/m^2 • History of hip fracture in a parent • Current smoker

UMHS (2005)	Assess all adults for clinical risk factors for osteoporotic fracture (see Table 2 in the original guideline document for detailed clinical risk categories) *[C]*:
	
	• Postmenopausal woman with one or more of the following:
	  • Age $\geq$ 65 years
	  • Current smoking
	  • Low body weight
	  • Frailty
	  • Personal history of fracture without substantial trauma age $\geq$ 40
	  • Hip, wrist, or spine fracture without substantial trauma in first-degree relative $\geq$50
	• Chronic glucocorticoid use (prednisone $\geq$7.5mg daily, or equivalent, for $\geq$6 months)
	• Organ transplant or pending transplant
	• Other associated medical conditions and medications

Risk Assessment	
ACOG (2004)	*When should screening for osteoporosis be initiated?* Testing of bone mineral density should be performed on the basis of an individual woman's risk profile and is not indicated unless the results will influence a treatment or management decision.

	NGC Note: See boxes "Risk Factors for Osteoporotic Fracture in Postmenopausal Women", "Medical Conditions That May Be Associated With an Increased Risk of Osteoporosis in Adults", and "Drugs Associated with an Increased Risk of Generalized Osteoporosis in Adults" in the original guideline document for information regarding risk factors.
NAMS (2006)	**Evaluation** All postmenopausal women should be assessed for risk factors associated with osteoporosis. This assessment requires a medical history, physical examination, and necessary diagnostic tests. The goals of this evaluation are to identify risk factors for fractures, including whether osteoporosis is present, and, if so, assessing its severity, ruling out secondary causes for osteoporosis, and identifying modifiable risk factors for falls and injuries. *History and Physical Examination* The medical history and physical examination should focus on the detection of clinical risk factors for osteoporosis and fractures. This includes a personal history of fracture as well as a history of hip fracture. Most of these risks can be uncovered with a simple questionnaire. Although most risk factors may help identify contributing causes of osteoporosis or help guide therapeutic recommendations, they cannot be used to diagnose osteoporosis. Loss of height may be a sign of vertebral fracture. After achieving maximal height, women (and men) can lose up to 1.0 to 1.5 inches (2 to 3 cm) of height as part of the normal aging process, primarily as a result of shrinkage of intervertebral disks. Height loss greater than 1.5 inches (3 cm) increases the likelihood that a vertebral fracture is present. Height should be measured annually with an accurate method, such as a wall-mounted ruler or a stadiometer. Loss of 1.5 inches (3 cm) or more calls for evaluation by a lateral thoracolumbar radiograph to identify silent vertebral fractures. Weight also should be recorded to identify those with a body weight of 127 lb (57.7 kg) or lower and to calculate BMI. The examination should include an assessment for acute or chronic back pain, especially in the middle back, which may indicate the presence of vertebral fractures. The mid-back vertebrae T11-12 and L1 are the most common fracture sites, followed by T6 through T9. Multiple, severe vertebral compression fractures ultimately result in kyphosis (abnormal curvature of the thoracic spine), the most obvious sign of osteoporosis. Because back pain, height loss, and kyphosis may occur without osteoporosis, and two thirds of vertebral fractures are asymptomatic, vertebral fracture must be confirmed, usually by lateral spine radiographs. In addition, some DXA techniques (e.g.,

	instant vertebral assessment, morphometric x-ray absorptiometry) allow vertebral fracture assessment, and, hence, can be used to visualize a fracture at the same time that BMD is being measured. Height loss of more than 20% (or 4mm) of the anterior, mid, or posterior dimension of a vertebra on spinal radiograph is also indicative of vertebral fracture. **Recommendation** • The physical examination should include an annual measurement of height and weight, along with an assessment for kyphosis and back pain.
UMHS (2005)	**Risk Assessment and Diagnosis** • Assess all adults for clinical risk factors for osteoporotic fracture (refer to Table 2 in the original guideline document) *[C]* • Order DEXA based on clinical risk factors and potential impact of results on management (refer to Table 3 in the original guideline document). • Evaluate appropriately and refer, when indicated, for secondary causes of osteoporosis (see Table 4 in the original guideline document) *[D]*.
Measurement of Bone Mineral Density: Modality and Frequency	
ACOG (2004)	**Screening Methods** Several tests to measure bone mineral density are available, either radiation-based or radiation-free. DXA is the technical standard for measuring bone mineral density. Most of the recent large, randomized, controlled clinical trials have used DXA of the hip and spine to determine therapeutic efficacy. DXA is preferred because it measures bone mineral density at the important sites of osteoporotic fractures (especially the hip), is relatively inexpensive, has high precision and accuracy, and has modest radiation exposure. Although tests at peripheral sites (e.g., wrist, calcaneus) can identify women with low bone mass, they may not be as useful as central-site tests (e.g., hip, spine) because the results may not be as precise. Peripheral site measurements should be limited to the assessment of fracture risk when DXA is not available and lower-risk populations are being screened. These devices have been shown to predict fracture and are less costly than axial devices. They should not be used for definitive diagnosis of osteoporosis or to monitor response to therapy. *Under what circumstances are screening tests other than DXA*

	useful? Peripheral bone densitometry devices use a variety of techniques, which include quantitative ultrasonography, single-energy x-ray absorptiometry, peripheral DXA, and peripheral quantitative computed tomography. These devices have the advantages of less expense, portable equipment, reasonable precision, and low radiation exposure. Their use is limited to the evaluation of the peripheral skeleton. These peripheral devices are used as screening tools in the evaluation of bone loss, but presently cannot replace DXA scans for the prediction of hip fractures and the diagnosis of osteoporosis or osteopenia. The T scores from these devices to do not always correlate with the T scores of DXA. **The following recommendations are based on limited or inconsistent scientific evidence (Level B):** • In the absence of new risk factors, screening should not be performed more frequently than every 2 years. **NGC Note**: Refer to the original guideline document for additional discussion of quantitative ultrasonography, peripheral quantitative computed tomography, and biochemical markers of bone turnover.
NAMS (2006)	**Recommendations** • When BMD testing is indicated, DXA is the preferred technique. The total hip, femoral neck, and posterior-anterior lumbar spine should be measured, using the lowest of the three BMD scores. • The routine use of biochemical markers of bone turnover in clinical practice is not generally recommended. *BMD Testing Options* Several tests to measure BMD are available. DXA is the preferred technique for measuring central (e.g., spine, hip) BMD and for diagnosing osteoporosis because it measures BMD at the important sites of osteoporotic fractures. When BMD testing is indicated, NAMS recommends measuring the total hip, femoral neck, and posterior-anterior lumbar spine, and using the lowest of the three BMD scores. In some older patients (older than 60 years), there can be artifacts of the spine that make spinal measurements unreliable. The spine, however, is a useful site for BMD measurement in early postmenopausal women because they tend to lose bone faster in the spine than in the hip. Although tests at peripheral sites (e.g., wrist, calcaneus) can identify women with low bone mass, they are not be as useful as central-site tests because the prediction of risk with the results is not well determined. WHO diagnostic criteria cannot be applied to peripheral

	sites with the exception of the distal radius, although BMD measurement has been predictive of fracture risk. Peripheral site measurements should be limited to the assessment of fracture risk when DXA is not available. They cannot be used to diagnose osteoporosis or to follow response to therapy. *Follow-up BMD Testing* In most cases, repeat DXA testing in untreated postmenopausal women is not useful until 3 to 5 years have passed, given the rate of bone loss of 1% to 1.5% per year. Postmenopausal women, after substantial BMD losses in early menopause, generally lose about 0.5 T-score units every 5 years. For women receiving osteoporosis therapy, BMD monitoring may not provide clinically useful information until after 2 years of treatment. The lack of an increase in BMD is not evidence of treatment failure. *Bone Turnover Markers* Biochemical markers of bone turnover cannot diagnose osteoporosis and have varying ability to predict fracture risk. Nevertheless, these tests have been studied as a means to assess therapeutic response earlier than through BMD changes, sometimes within a few months as opposed to the 1 to 3 years required with BMD. However, bone turnover markers vary from day to day, are affected by food intake and time of day, and lack assay standardization, limiting their clinical utility. The value of bone turnover markers in routine clinical practice has not been established.
UMHS (2005)	**DEXA** DEXA is currently the test of choice for measuring BMD. Although various skeletal sites can be assessed by DEXA, BMD of the nondominant hip is the best predictor of hip fracture and is an excellent predictor of vertebral or wrist fracture. There is accelerated loss of vertebral bone early in menopause and early in glucocorticoid use, thus spine BMD measurements may be helpful in these settings. BMD measurement by DEXA may be spuriously elevated by a number of factors. Vertebral compression fractures typically result in a "smaller" vertebral body with no change in the total amount of calcium, and thus produce an apparent increase in BMD. Vertebral osteophytes, degenerative joint disease, and aortic calcifications can also falsely raise BMD measurements. Hip measurements tend to have fewer artifacts.

	Other Diagnostic and Monitoring Modalities Quantitative ultrasound, usually of the calcaneus, is less expensive and more portable than DEXA, and is being used in large osteoporosis screening programs. Prospective data suggest that it can predict fracture risk at the hip. T-scores provided by ultrasound, however, are not equivalent to DEXA T-scores, and patients with abnormally low ultrasound T-scores should be evaluated by DEXA for more definitive diagnosis. Biochemical markers of bone resorption are used in research settings to assess the effect of antiresorptive therapy, with benefit usually resulting in decreased marker levels over two to three months *[A]*. They are not, however, predictive of BMD or fracture risk, and their use in general practice is not recommended. **Follow-up** • Follow-up osteoporosis or osteopenia with a repeat DEXA based on a patient's situation (refer to Tables 3 & 5 in the original guideline document). • For most persons an interval of $\geq$ 2 years between DEXAs provides the most meaningful information. • Early in glucocorticoid use and/or after transplantation consider repeating DEXA in 6-12 months. **Follow Up and When to Repeat DEXA** When deciding if and when to repeat a DEXA scan, consider: • The patient's clinical risk factors for progression of bone loss for fracture • The results from prior scans • Whether a repeat DEXA will change management • Whether a repeat DEXA result may improve compliance with therapy even if it will not change management

SELECTED SUPPORTING REFERENCES **Note from NGC**: Bolded references are cited in more than one guideline. Refer to the original guideline documents for a complete listing of supporting references	
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TABLE 6: BENEFITS AND HARMS	
Benefits	
ACOG (2004)	Appropriate screening, prevention, and treatment of osteoporosis
NAMS (2006)	Appropriate management of postmenopausal osteoporosis may help prevent fractures by slowing or preventing bone loss, maintaining bone strength, and minimizing or eliminating factors that may contribute to falls.
UMHS (2005)	• Improved identification of patients at high risk for osteoporosis • Decreased incidence of osteoporotic fractures and associated morbidity and mortality

Harms	
ACOG (2004)	No harms related to screening/risk assessment are provided.
NAMS (2006)	No harms related to screening/risk assessment are provided.
UMHS (2005)	No harms related to screening/risk assessment are provided.

TABLE 7: EVIDENCE RATING SCHEMES AND REFERENCES	
ACOG (2004)	Studies were reviewed and evaluated for quality according to the method outlined by the U.S. Preventive Services Task Force: **I**: Evidence obtained from at least 1 properly designed randomized controlled trial **II-1**: Evidence obtained from well-designed controlled trials without randomization **II-2**: Evidence obtained from well-designed cohort or case-control analytic studies, preferably from more than 1 center or research group **II-3**: Evidence obtained from multiple time series with or without the intervention. Dramatic results in uncontrolled experiments also could be regarded as this type of evidence **III**: Opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees Based on the highest level of evidence found in the data, recommendations are provided and graded according to the following categories: **Level A** - Recommendations are based on good and consistent scientific evidence **Level B** - Recommendations are based on limited or inconsistent scientific evidence **Level C** - Recommendations are based primarily on consensus and expert opinion

NAMS (2006)	The position statement was supported by evidence from randomized, controlled clinical trials and meta-analyses of such trials, followed by evidence from controlled observational studies and conclusions from other evidence-based guidelines. If the evidence was contradictory or inadequate to form a conclusion, a consensus-based opinion was established.
UMHS (2005)	**Levels of Evidence** Levels of evidence reflect the best available literature in support of an intervention or test. A. Randomized controlled trials B. Controlled trials, no randomization C. Observational trials D. Opinion of expert panel

GUIDELINE CONTENT COMPARISON

The American College of Obstetricians and Gynecologists (ACOG), The North American Menopause Society (NAMS), and University of Michigan Health System (UMHS) present recommendations for risk assessment and screening for osteoporosis. All of the guidelines provide explicit reasoning behind their judgments. ACOG and UMHS rank the level of evidence for each major recommendation. NAMS provides the rationale for its recommendations in narrative form.

The guidelines are similar in scope. In addition to addressing screening, all of the guidelines also address prevention and treatment of osteoporosis. These topics, however, are beyond the scope of this synthesis. Recommendations concerning prevention of osteoporosis are compared in Part II of this synthesis (under development). Recommendations for diagnosis and treatment of are addressed in Part III of this synthesis (under development). The NAMS and UMHS guidelines addressed in this synthesis are updates of earlier guidelines.

Guideline Methodology

The guidelines were developed using similar methods. To collect and select the evidence, all three guideline groups performed hand-searches of published literature (both primary and secondary sources) as well as searches of electronic databases. All three groups provide certain relevant data about the strategy (date ranges searched, search strategy, and inclusion/exclusion criteria). ACOG and NAMS also provide the names of the specific databases that were searched.

In terms of methods used to assess the quality and strength of the evidence, ACOG and UMHS both weighted the evidence according to a rating scheme and provide the corresponding scheme. NAMS employed expert consensus to assess

the evidence. UMHS provides their guidance in the form of recommendation statements for which the quality of the supporting evidence is graded, followed by a rationale for the recommendations in narrative format. Evidence provided in the narrative portion is also graded. ACOG and NAMS both provide their guidance primarily in narrative format, followed by a bulleted summary of recommendations (ACOG's recommendations are graded). References are provided throughout the narrative discussions of both guidelines to identify the supporting evidence for a particular topic. ACOG indicates the strength of the evidence in the reference list for each supporting reference.

Methods to analyze the evidence were identical, with all three groups having performed a review of published meta-analyses as well as a systematic review. Expert consensus was employed by all three groups to formulate the recommendations, and each group provided a description of the processes used. ACOG is the only group to grade its recommendation statements. All three groups provide reference lists (78 for ACOG, 234 for NAMS, 5 for UMHS). NAMS and UMHS present potential conflicts of interest.

Screening and Risk Assessment for Osteoporosis: Comparison of Selected ACOG, NAMS, and UMHS Recommendations	
Whom to Screen	
ACOG (2004)	BMD testing should be: • Recommended to all postmenopausal women aged 65 years or older • Recommended for postmenopausal women younger than 65 years who have 1 or more risk factors for osteoporosis • Performed on all postmenopausal women with fractures to confirm the diagnosis of osteoporosis and determine disease severity

NAMS (2006)	• BMD should be measured in the following postmenopausal women:
	  • With medical causes of bone loss, regardless of age
	  • At least 65 years of age, regardless of additional risk factors
	• Testing should be considered for healthy postmenopausal women younger than age 65 when one or more of the risk factors have been identified (the greater the number of risk factors, the greater is the need for testing).

UMHS (2005)	Assess all adults for clinical risk factors for osteoporotic fracture: • Postmenopausal woman with one or more risk factors

	• Chronic glucocorticoid use (prednisone >7.5mg daily, or equivalent, for >6 months) • Organ transplant or pending transplant • Other associated medical conditions and medications
Risk Assessment	
ACOG (2004)	• Testing of BMD should be performed on the basis of an individual woman's risk profile and is not indicated unless the results will influence a treatment or management decision.
NAMS (2006)	• All postmenopausal women should be assessed for risk factors associated with osteoporosis and fracture. This assessment requires a medical history, physical examination, and necessary diagnostic tests. • The physical examination should include an annual measurement of height and weight, along with an assessment for kyphosis and back pain.
UMHS (2005)	• Assess all adults for clinical risk factors for osteoporotic fracture. • Order DEXA based on clinical risk factors and potential impact of results on management. • Evaluate appropriately and refer, when indicated, for secondary causes of osteoporosis.
Measurement of BMD: Modality and Frequency	
ACOG (2004)	• DXA is the technical standard for measuring bone mineral density. • In the absence of new risk factors, screening should not be performed more frequently than every 2 years.
NAMS (2006)	• In most cases, repeat DXA testing in untreated postmenopausal women is not useful until 3 to 5 years have passed. • For women receiving osteoporosis therapy, BMD monitoring may not provide clinically useful information until after 2 years of treatment.
UMHS (2005)	• For most persons an interval of = 2 years between DEXAs provides the most meaningful information. • Early in glucocorticoid use and/or after transplantation consider repeating DEXA in 6 to 12 months.

Areas of Agreement

Definition of Osteoporosis

All three guidelines support the classification of osteoporosis developed by the WHO, which is defined as a DXA T-score of $\leq$ -2.5. All three guidelines also agree that the presence of a "low impact" or "fragility" fracture constitutes a diagnosis of osteoporosis, regardless of BMD measurement score.

Whom to Screen

The guidelines agree that BMD testing should be recommended to all postmenopausal women aged 65 years or older. There is also agreement that BMD testing should be recommended for postmenopausal women younger than 65 when 1 or more risk factors (previous fracture, tobacco use, thinness, etc.) are present.

Risk Assessment Components

The guidelines are in agreement that the key components of a risk assessment are assessing the individual for osteoporotic risk factors and BMD testing based on the risk profile. All three guidelines provide risk factors for osteoporosis that should be assessed, including lifestyle risk factors (physical activity, cigarette smoking) and secondary risk factors (certain medications and/or medical conditions associated with increased risk). NAMS goes into the greatest detail, recommending a physical examination that includes an annual measurement of height and weight, along with an assessment for kyphosis and back pain.

Measurement of BMD: Modality and Frequency

The guidelines are in general agreement that when measurement of BMD is indicated, the technical standard is DXA. All three guidelines address the issue of peripheral site measurements (e.g., wrist, calcaneus) versus central site measurements (e.g., spine, hip), concluding that peripheral sites are not as reliable. ACOG and NAMS agree that peripheral site measurements should be limited to the assessment of fracture risk when DXA is not available, and that they should not be used to diagnose or to monitor response to therapy.

Concerning central site measurements, there is overall agreement that both hip and spine measurements are the most useful, although hip measurements may be the most reliable for predicting fracture risk. NAMS recommends measuring the total hip, femoral neck, and posterior-anterior lumbar spine, and using the lowest of the three BMD scores. UMHS notes that BMD of the nondominant hip is the best predictor of hip fracture and is an excellent predictor of vertebral or wrist fracture. They add, however, that there is accelerated loss of vertebral bone early in menopause and early in glucocorticoid use, thus spine BMD measurements may be helpful in these instances.

In terms of when to repeat BMD testing, there is overall agreement that an interval of at least two years is appropriate for most people. ACOG notes that in the absence of new risk factors, screening should not be performed more frequently than every 2 years; UMHS states that for most persons an interval of ≥ 2 years provides the most meaningful information. NAMS similarly recommends that for women receiving osteoporosis therapy, BMD monitoring may not provide clinically useful information until after 2 years of treatment. They also note, however, that repeat DXA testing in *untreated* postmenopausal women is not useful until 3 to 5 years have passed. UMHS provides repeat testing recommendations based on the T-score from the patient's first DXA and their level of clinical risk, with repeat testing intervals ranging from 6 to 12 months (in the case of glucocorticoid use and/or transplantation) to 3 to 5 years.

Areas of Differences

There are no significant areas of difference.

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