Disclosures

• Financial relationships with industry
  • None

• Discussion of off-label use of devices or drugs
  • None planned
Learning Objectives

Participants should be able to…

• Describe recent trends in the evaluation and management of osteoporosis with a focus on secondary fracture prevention

• Apply strategies to reduce the risk of recurrent osteoporotic fractures

• Engage patients in discussions regarding the benefits and risk of osteoporosis medications
Osteoporosis
Time to rethink our strategy?

Overdiagnosis of bone fragility in the quest to prevent fracture

Despite widespread endorsement, Teppo Järvinen and colleagues argue that evidence for identifying risk of fracture and subsequent drug therapy to prevent hip fracture is insufficient to warrant our current approach.

Teppo LN Järvinen professor¹, Karl Michaëlsson professor², Jarkko Jokihaara registrar³, Gagnon associate professor⁴, Thomas L Perry clinical assistant professor⁵, Barbara Mintzes senior registrar⁶, Vijaya Musini assistant professor⁷, Juan Erviti head⁷, Javier Gorricho senior evaluator⁸, James M Wright professor⁵, Harri Sievänen research director⁹

¹Department of Orthopaedics and Traumatology, University of Helsinki and Helsinki University Central Hospital, Helsinki, Finland; ²Departments of Epidemiology and Public Health, School of Public Health, Uppsala University, Uppsala, Sweden; ³Department of Hand Surgery, Tampere University Hospital, Tampere, Finland; ⁴Centre for Statistics in Medicine, Botnar Research Centre, University of Oxford, Oxford, UK; ⁵Departments of Anesthesiology and Critical Care Medicine and Therapeutics and Medicine, University of British Columbia, Vancouver, British Columbia, Canada; ⁶Faculty of Pharmacy and Chemistry, Mladá Boleslav, Czech Republic; ⁷Department of General Practice, University of Oulu, Oulu, Finland; ⁸Department of Medical Oncology, University of California, San Francisco, San Francisco, USA; ⁹Department of Endocrinology and Metabolism, Helsinki University Central Hospital, Helsinki, Finland.
FRAX™ WHO Fracture Risk Assessment Tool

Calculation Tool

Please answer the questions below to calculate the ten year probability of fracture with BMD.

Country: US (Caucasian) Name / ID:

Questionnaire:

1. Age (between 40-90 years) or Date of birth
   Age: 65
   Y: M: D:

2. Sex
   Male Female

3. Weight (kg) 65

4. Height (cm) 165

5. Previous fracture
   No Yes

6. Parent fractured hip
   No Yes

7. Current smoking
   No Yes

8. Glucocorticoids
   No Yes

9. Rheumatoid arthritis
   No Yes

10. Secondary osteoporosis
    No Yes

11. Alcohol 3 more units per day
    No Yes

12. Femoral neck BMD
    T-score: -2.2

BMI 23.8
The ten year probability of fracture (%) with BMD

- Major osteoporotic: 31
- Hip fracture: 2.1

Weight Conversion:
pound: convert

Height Conversion:
inches: convert
Ten Year Absolute Risk of Fracture
Justifying Intervention with Drugs

10 Year Risk (%)

Major Osteoporotic Fracture
- Doctors
- Patients

Hip Fracture
- Doctors
- Patients

Relative Reduction in Fracture Risk Required to Accept Taking a Drug

Welcome to the Bone Health Choice Decision Aid.

This tool will help you and your doctor discuss how you might want to reduce your risk for bone fractures.

Let's get started

Caution: This application is for use exclusively during the clinical encounter with your clinician.
Current Risk

What is my risk of breaking a bone?

Select type of risk
- Osteo
- Hip

Age: 74
Gender: M
Population Group: Caucasian
Calculation using: BMD
Femoral neck BMD: -2.7

Previous fracture: Y
Parents fracture hip: Y
Secondary osteoporosis: Y
Glucocorticoids: Y
Current Smoking: Y
Alcohol 3 or more units/day: Y
**Intervention**

Select Intervention

- **Bisphosphonates**

*Bisphosphonates* work to reduce bone loss. This decision aid will walk you through the benefits and downsides of bisphosphonates, so that we can make an informed choice about whether or not they are right for you.

---

**Future Risk of having a fracture**

Risk of 100 people like you who do take Bisphosphonates.

- **Over 10 years**
  - **76** will not break a bone
  - **24** will break a bone

- **Over 10 years**
  - **76** will not break a bone
  - **10** will avoid breaking a bone
  - **14** will break a bone
Call to Action to Address the Crisis in the Treatment of Osteoporosis

American Society for Bone and Mineral Research
American Academy of Orthopaedic Surgeons
American Academy of Physician Assistants
American Association of Clinical Endocrinologists
American Bone Health
American College of Rheumatology
American Medical Society for Sports Medicine
American Orthopaedic Association
American Osteopathic Academy of Orthopedics
American Society for Surgery of the Hand
Australia New Zealand Bone and Mineral Society
Bulgarian Society of Osteoporosis and Osteoarthritis
Czech Society for Metabolic Bone Diseases
Dutch Society of Cancer and Bone Metabolism
European Calcified Tissue Society
European Union Geriatric Medicine Society
Finnish Osteoporosis Association
Hellenic Osteoporosis Foundation
International Geriatric Fracture Society
International Osteoporosis Foundation
International Society for Clinical Densitometry
Michigan Consortium for Osteoporosis
National Bone Health Alliance
National Osteoporosis Foundation
Northern California Institute for Bone Health, Inc.
Orthopaedic Research and Education Foundation
Orthopedic Research Society
Osteoporosis Australia
Osteoporosis New Zealand
Syrian National Osteoporosis Society
University of Rochester Department of Orthopaedics and Rehabilitation
U.S. Bone and Joint Initiative
4BoneHealth

Difference Between Office-based Practices Initiating and Discontinuing DXA Services

Annual Probability of Osteoporosis Medication Use Within 12 months After Hip Fx Discharge

Osteoporosis Drugs Shunned by Patients
Medication Related Osteonecrosis of the Jaw
(1 in 10,000 and 1/100,000)
Incidence of Atypical Femur Fracture by Duration of Bisphosphonate Use


# per 100,000 person-years

- Unadjusted
- Age adjusted

Years of Treatment

## Fracture Risk by Duration of Bisphosphonate Therapy

### Table 2. Risk of Subtrochanteric or Femoral Shaft Fractures Among Women Taking Bisphosphonate Therapy

<table>
<thead>
<tr>
<th>Duration of Bisphosphonate Therapy</th>
<th>Transient, &lt;100 days</th>
<th>Short-term Use, 100 days to 3 years</th>
<th>Intermediate Use, 3 to 5 Years</th>
<th>Long-Term Use, ≥5 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. (%) of Cases</td>
<td>42 (5.9)</td>
<td>349 (48.7)</td>
<td>204 (28.5)</td>
<td>121 (16.9)</td>
</tr>
<tr>
<td>Control (n = 3380)</td>
<td>218 (6.1)</td>
<td>1832 (51.2)</td>
<td>1070 (29.9)</td>
<td>460 (12.9)</td>
</tr>
<tr>
<td>Odds Ratio (95% CI)</td>
<td>1.0 [Reference]</td>
<td>1.00 (0.70-1.43)</td>
<td>1.08 (0.73-1.59)</td>
<td>1.74 (1.11-2.72)</td>
</tr>
<tr>
<td>Crude</td>
<td>1.0 [Reference]</td>
<td>0.90 (0.48-1.68)</td>
<td>1.59 (0.80-3.15)</td>
<td>2.74 (1.25-6.02)</td>
</tr>
</tbody>
</table>

Abbreviation: CI, confidence interval.  
*The full list of covariates for the adjusted model are given in eAppendix 2 (available at http://www.jama.com).

### Table 3. Risk of Femoral Neck or Intertrochanteric Hip Fractures Among Women Taking Bisphosphonate Therapy

<table>
<thead>
<tr>
<th>Duration of Bisphosphonate Therapy</th>
<th>Transient, &lt;100 days</th>
<th>Short-term Use, 100 days to 3 years</th>
<th>Intermediate Use, 3 to 5 Years</th>
<th>Long-Term Use, ≥5 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. (%) of Patients</td>
<td>817 (8.4)</td>
<td>5587 (57.5)</td>
<td>2438 (25.1)</td>
<td>881 (9.1)</td>
</tr>
<tr>
<td>Case (n = 9723)</td>
<td>3434 (7.1)</td>
<td>27086 (55.8)</td>
<td>13148 (27.1)</td>
<td>4896 (10.1)</td>
</tr>
<tr>
<td>Odds Ratio (95% CI)</td>
<td>1.0 [Reference]</td>
<td>0.87 (0.80-0.94)</td>
<td>0.72 (0.65-0.79)</td>
<td>0.65 (0.58-0.74)</td>
</tr>
<tr>
<td>Crude</td>
<td>1.0 [Reference]</td>
<td>0.93 (0.81-1.07)</td>
<td>0.86 (0.73-1.00)</td>
<td>0.76 (0.63-0.93)</td>
</tr>
</tbody>
</table>

Abbreviation: CI, confidence interval.
Please answer the questions below to calculate the ten year probability of fracture with BMD.

**Questionnaire:**

1. Age (between 40-90 years) or Date of birth
   - Age: 65
   - Date of birth: Y: __ M: __ D: __

2. Sex
   - Male
   - Female

3. Weight (kg) 65

4. Height (cm) 165

5. Previous fracture
   - No
   - Yes

6. Parent fractured hip
   - No
   - Yes

7. Current smoking
   - No
   - Yes

8. Glucocorticoids
   - No
   - Yes

9. Rheumatoid arthritis
   - No
   - Yes

10. Secondary osteoporosis
    - No
    - Yes

11. Alcohol 3 more units per day
    - No
    - Yes

12. Femoral neck BMD
    - T-score: -2.2

**BMI:** 23.8

**The ten year probability of fracture (%):**

- Major osteoporotic: 31
- Hip fracture: 2.1
- Atypical fracture: 0.0016
Current Risk of having a fracture
Risk for 100 people like you who do not medicate for bone problems.

Cost
- With insurance: $30/year
- Without insurance: $70-90/year

Daily Routine
This medication must be taken:
- Once a week
- On an empty stomach in the morning
- With 8 oz of water
- While upright (sitting or standing for 30 min)

Over 10 years
76 will not break a bone
24 will break a bone

Side Effects
Abdominal Problems
About 1 in 4 people will have heartburn, nausea, or belly pain. However, it may not be from the medication. If the medication is the cause, the problem will go away if you stop taking it.

Osteonecrosis of the Jaw
Fewer than 1 in 10,000 (over the next 10 years) will have bone sores of the jaw that may need surgery.

Future Risk of having a fracture
Risk for 100 people like you who do take Bisphosphonates.

Over 10 years
76 will not break a bone
10 will avoid breaking a bone
14 will break a bone
Use of Osteoporosis Medications Following Hip Fracture: Impact of FDA Statements

Prevalent Vertebral Fracture & Future Vertebral Fracture Risk

Fracture Risk Ratio

<table>
<thead>
<tr>
<th>Bone Mineral Density</th>
<th>One fracture</th>
<th>No fracture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowest 1/3</td>
<td>7.4</td>
<td>25.1</td>
</tr>
<tr>
<td>Middle 1/3</td>
<td>4.4</td>
<td>14.9</td>
</tr>
<tr>
<td>Highest 1/3</td>
<td>1.0</td>
<td>10.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Risk Factor for Fracture</th>
<th>Therapeutic option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Bone Strength</td>
<td>Bisphosphonates, anti-RANKL, SERMS, HRT, PTH, calcitonin, strontium</td>
</tr>
<tr>
<td></td>
<td>Vitamin D and/or Calcium</td>
</tr>
<tr>
<td></td>
<td>High-impact or intensity training</td>
</tr>
<tr>
<td>Falls</td>
<td>Resistance training, Balance training</td>
</tr>
<tr>
<td></td>
<td>Multifactorial risk factor interventions (polypharmacy, vision, lower extremity</td>
</tr>
<tr>
<td></td>
<td>dysfunction, footwear, assistive devices, home safety, hip protectors?, etc.)</td>
</tr>
<tr>
<td></td>
<td>Evaluate and treat postural hypotension</td>
</tr>
<tr>
<td>Under nutrition</td>
<td>Nutritional counseling</td>
</tr>
<tr>
<td>Polypharmacy</td>
<td>Drug review and modification</td>
</tr>
<tr>
<td>Smoking &amp; excess alcohol intake</td>
<td>Reduce or eliminate</td>
</tr>
<tr>
<td>Visual impairment</td>
<td>Ophthalmologic evaluation</td>
</tr>
</tbody>
</table>
Osteoporosis Pharmacotherapy and Fracture Healing

Osteoporosis Medications and Fracture Healing

- No negative effect of osteoporosis medications on fracture healing
  - It is safe to start osteoporosis medications as soon as possible after both vertebral and non-vertebral fracture
- Potential benefit of anabolic therapy on fracture healing

Osteoporosis Medication Adherence

Proportion Adherent

Years until nonadherence

Solomon, DH. Arch Int Med 165:2416, 2005
Adherence & Probability of Fracture in 24 Months in Bisphosphonate-Treated Patients

Prolonged Effects of Zoledronic Acid

Serum sCTx (ng/mL)

<table>
<thead>
<tr>
<th>Months</th>
<th>Zoledronic acid 2x5 mg</th>
<th>Zoledronic acid 1x5 mg</th>
<th>Placebo</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>189</td>
<td>164</td>
<td>193</td>
</tr>
<tr>
<td>1</td>
<td>175</td>
<td>159</td>
<td>186</td>
</tr>
<tr>
<td>3</td>
<td>188</td>
<td>165</td>
<td>191</td>
</tr>
<tr>
<td>6</td>
<td>187</td>
<td>166</td>
<td>192</td>
</tr>
<tr>
<td>9</td>
<td>166</td>
<td>146</td>
<td>174</td>
</tr>
<tr>
<td>12</td>
<td>139</td>
<td>124</td>
<td>156</td>
</tr>
<tr>
<td>15</td>
<td>161</td>
<td>141</td>
<td>169</td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

McClung M et al: Ob & Gyne 114(5):999, 2009
Incidence of Clinical Fractures After 1 vs. 3 Annual Infusions of Zoledronic Acid
HORIZON-PFT and HORIZON-RFT subgroup study

• Total hip BMD at 3 years differed from placebo by
  • 3.8% in those receiving 1 infusion
  • 6.2% in those receiving 3 infusions

• 32% reduction in clinical fractures vs. placebo over 3 years (95% CI 2–53%, p = .04)
  • vs. 34% (95% CI, 23–43%, p < .0001 in those receiving 3 or more annual infusions

• New morphometric vertebral fractures reduced by 68% in the single-infusion group (p = .004)
Use of Drugs That Affect Fracture Risk Before and After Fracture

Summary

Participants should be able to…

• Describe recent trends in the evaluation and management of osteoporosis with a focus on secondary fracture prevention

• Apply strategies to reduce the risk of recurrent osteoporotic fractures

• Engage patients in discussions regarding the benefits and risk of osteoporosis medications
Patient Education Resources

- http://shareddecisions.mayoclinic.org/decision-aid-information/decision-aids-for-chronic-disease/other-decision-aids/
- http://nof.org/resources-brochures
- http://www.healthinaging.org/