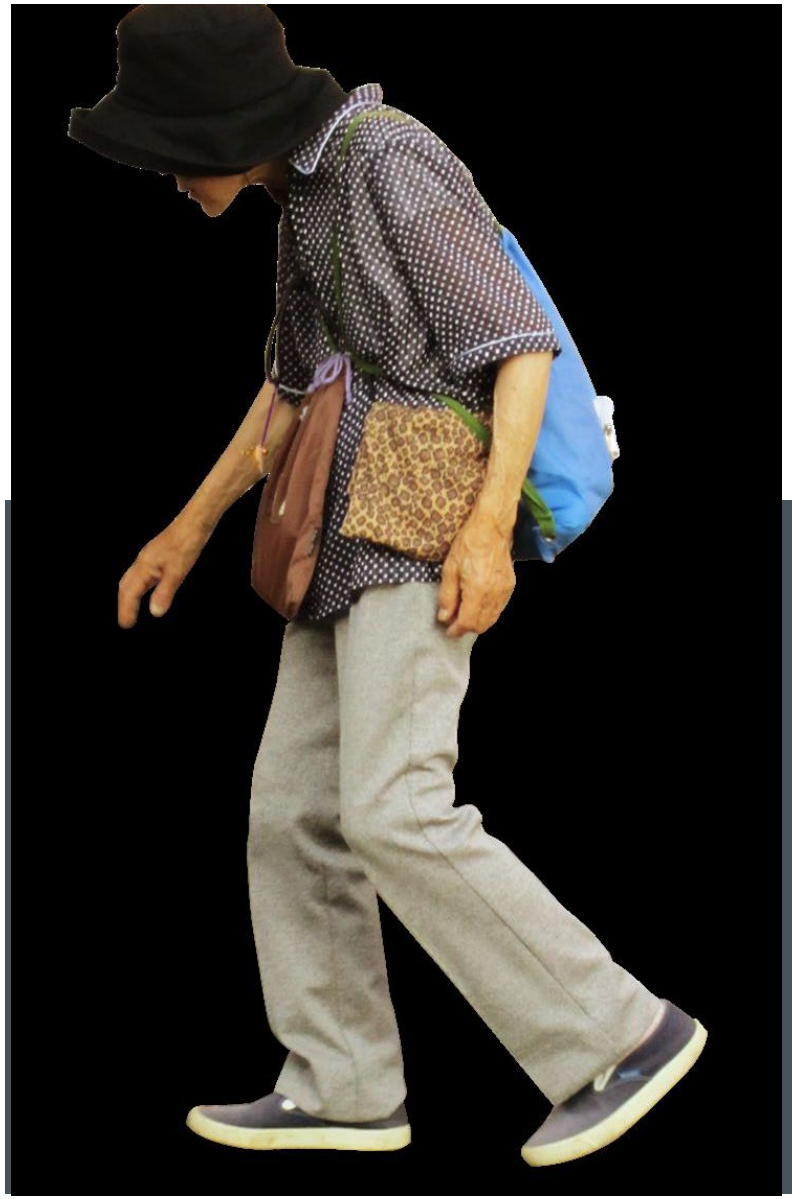


OSTEOPOROSIS: UPDATE

JANEL JOHNSON, DO, MPH

ASSISTANT CLINICAL PROFESSOR OF MEDICAL EDUCATION

OSU-COM AT THE CHEROKEE NATION

DISCLOSURES

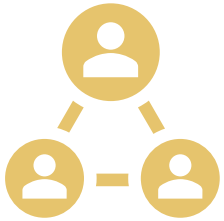
I HAVE NO FINANCIAL DISCLOSURES TO MAKE.

LEARNING OBJECTIVES

- By the end of this lecture the learner will:
  - Be able to define osteoporosis
  - Identify the diagnostic criteria for osteoporosis
  - Discuss the epidemiology of osteoporosis including healthcare associated costs
  - Identify the signs and symptoms of osteoporosis
  - Identify multiple risk factors for osteoporosis
  - Identify the multiple pathogenetic pathways for osteoporosis
  - Identify the diagnostics used in diagnosing osteoporosis
  - Describe the treatment and management of osteoporosis
  - Describe "The Osteoporosis Treatment Gap."
  - Describe the morbidity and mortality associated with hip fracture
  - Describe the National Institute of Health (NIH) Fall Triangle
  - Describe the osteopathic considerations in osteoporosis

OSTEOPATHIC TENETS

The body is capable of self-regulation, self-healing, and health maintenance.



Structure and function are reciprocally interrelated.

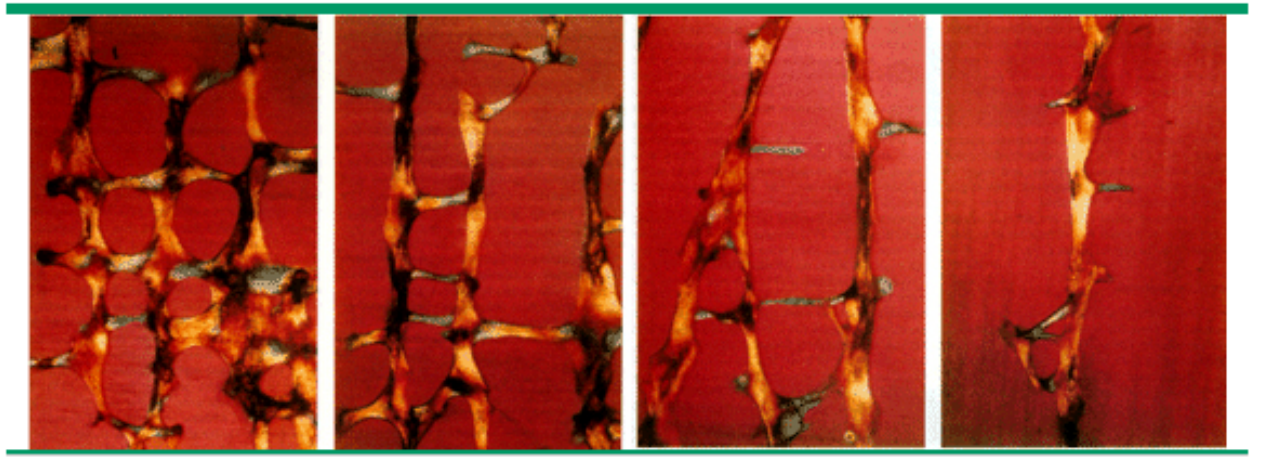
Rational treatment is based upon an understanding of the basic principles of body unity, self-regulation, and the interrelationship of structure and function.

CONTENTS

DEFINITIONS/DIAGNOSIS

- Osteoporosis literally translates to "porous bone."
  - Low bone mass, microarchitectural disruption, and increased skeletal fragility.
  - Clinical Diagnosis:
    - Fragility fracture, particularly at the spine, hip, wrist, humerus, rib, and pelvis
    - T-score less than or equal to -2.5 standard deviations at any site based upon bone mineral density (BMD) measurement by dual energy x-ray absorptiometry
    - National Bone Health alliance notes clinical diagnosis can be made if there is clear elevated risk of fracture such as a Fracture Risk Assessment tool (FRAX) shows a greater or equal to 20% of major osteopathic fracture or greater than or equal to 3% chance of hip fracture.
    - Z-score is a comparison of the patient's BMD to an age-matched population. A score of less than -2 is considered abnormal. Should be used in premenopausal women and men <50 years of age as well as children.

Age-related loss of trabecular bone



Sequential trabecular loss as shown by histologic examination of bone specimens; the vertical trabeculae are shown in yellow, the horizontal in blue-green.
(A) Normal 50-year-old man with an almost perfect continuous trabecular network
(B) 58-year-old man with thinning of the horizontal trabeculae and some loss of continuity.
(C) 76-year-old man with continued thinning of the horizontal trabeculae and wider separation of the vertical structures.
(D) 87-year-old woman with advanced breakdown of the entire network showing unsupported vertical trabeculae.
Panels C and D represent the degree of loss of bone mass and microarchitectural deterioration that is generally defined as osteoporosis.

From: Mosekilde LI. Age-related changes in vertebral trabecular bone architecture—assessed by a new method. Bone 1988; 9:247. Reprinted with permission from Pergamon Press.

EPIDEMIOLOGY

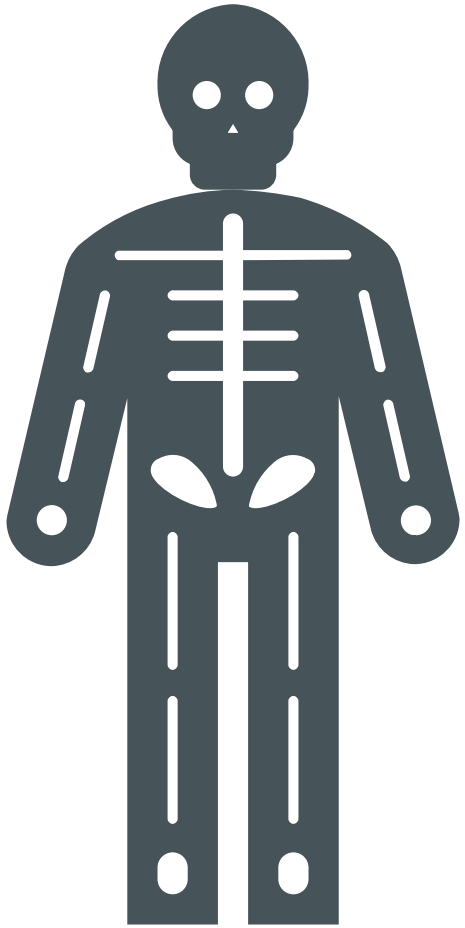
- A WOMAN WITH HISTORY OF A PREMENOPAUSAL FRACTURE HAS A 35% INCREASE OF HAVING A POSTMENOPAUSAL FRACTURE.
- USING BONE MINERAL DENSITY (BMD) DATA FROM THE NATIONAL HEALTH AND NUTRITION EXAMINATION SURVEY (NHANES), APPROXIMATELY 10.2 MILLION OLDER ADULTS IN THE UNITED STATES HAD OSTEOPOROSIS AND 43 MILLION HAD LOW BONE MASS IN 2010
- HIGHEST RATES OF HIP FRACTURE IN SCANDINAVIAN COUNTRIES
- HIGHEST RATES OF VERTEBRAL FRACTURES IN SOUTH KOREA AND UNITED STATES
- OSTEOPOROSIS RELATED FRACTURE COST BURDEN IN THE US IS $17.9 BILLION
- 1.5 MILLION FRAGILITY FRACTURES A YEAR IN THE US

"ETHNIC VARIATION"

- The true common denominator for osteoporosis across ethnicities is body size. When controlling for all other factors, this was the one that had the strongest correlation.

SIGNS AND SYMPTOMS

- VERTEBRAL FRACTURES
  - 2/3 ARE ASYMPTOMATIC
  - KYPHOSIS
- HIP FRACTURES
- COLLES FRACTURES
- HEIGHT LOSS



(Source: 1, 2)

RISK FACTORS

From the International Osteoporosis Foundation

- Non-Modifiable
  - Age 65 and over
  - Biological Female
  - Family history of osteoporosis
  - Previous fracture from minor fall
  - Menopause/hysterectomy
  - Other diseases – e.g. **rheumatoid arthritis,** lactose intolerance, Turner/Klinefelter syndrome, diabetes, chronic kidney disease, etc.

RISK FACTORS: MODIFIABLE

- More than 2 alcoholic drinks a day
- Commercial tobacco use
- Underweight
- Poor nutrition
- Eating Disorders
- Inactivity
- Frequent Falls

RISK FACTORS: MAY BE MODIFIABLE

- Medications
  - glucocorticoids
  - medroxyprogesterone acetate
  - luteinizing hormone releasing hormone antagonists, androgen deprivation therapy
  - Proton pump inhibitors
  - aromatase inhibitors, etc.

PATHOGENESIS

Peak bone mass is believed to be achieved on average in the mid third decade of life.

So far, there have been 80 genetic loci known to influence BMD.

Environmental factors

- Physical activity in childhood
- Malnutrition

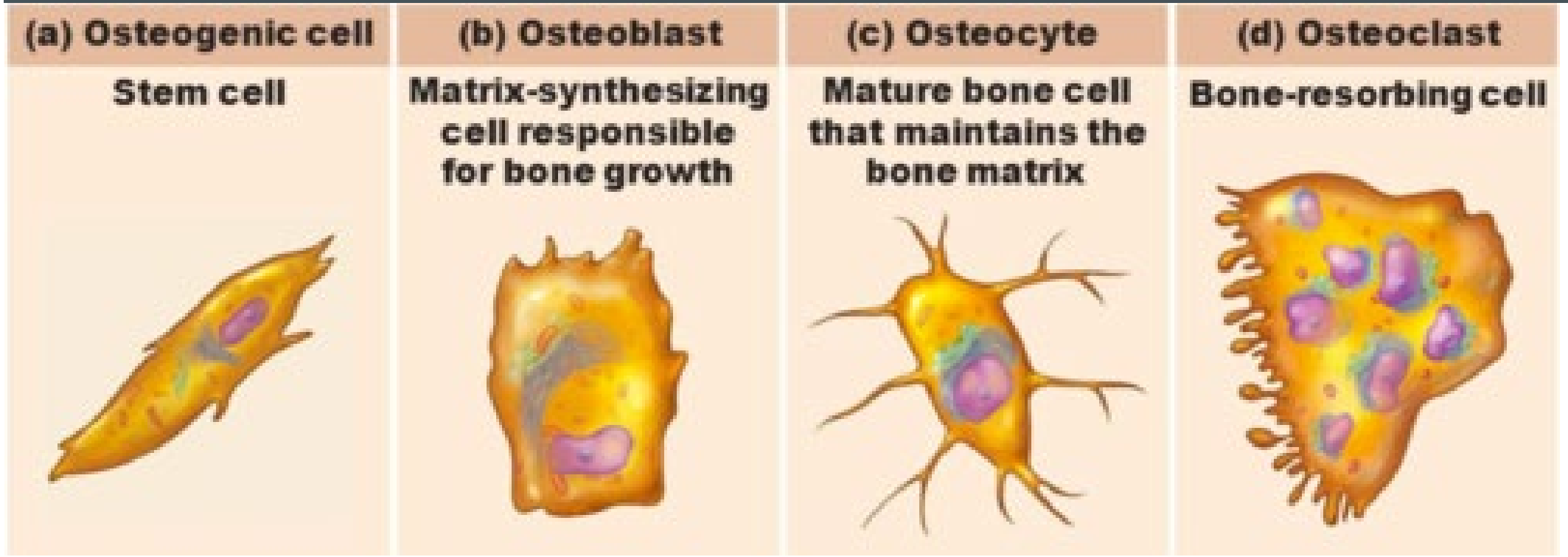
Oxidative Stress

Osteoblast and osteocyte senescence

Autophagy

Sex Steroid Deficiency

- Estrogen and Androgens



OSTEOBLASTS, OSTEOCYTES, OSTEOCLAST

OXIDATIVE STRESS

- Reactive oxygen species trigger apoptosis in osteoblasts and this decreases bone formation. Hydrogen peroxide is known to induce osteoclast generation, activation, and survival and so this increases bone breakdown.

OSTEOBLAST AND OSTEOCYTE SENESCENCE

- Increased production of SASP cytokines by senescent, apoptotic, or dysfunctional osteocytes and probably their affected neighbors (paracrine senescence), stimulate osteoclastogenesis, matrix degradation, focal bone resorption, and cortical porosity.

AUTOPHAGY

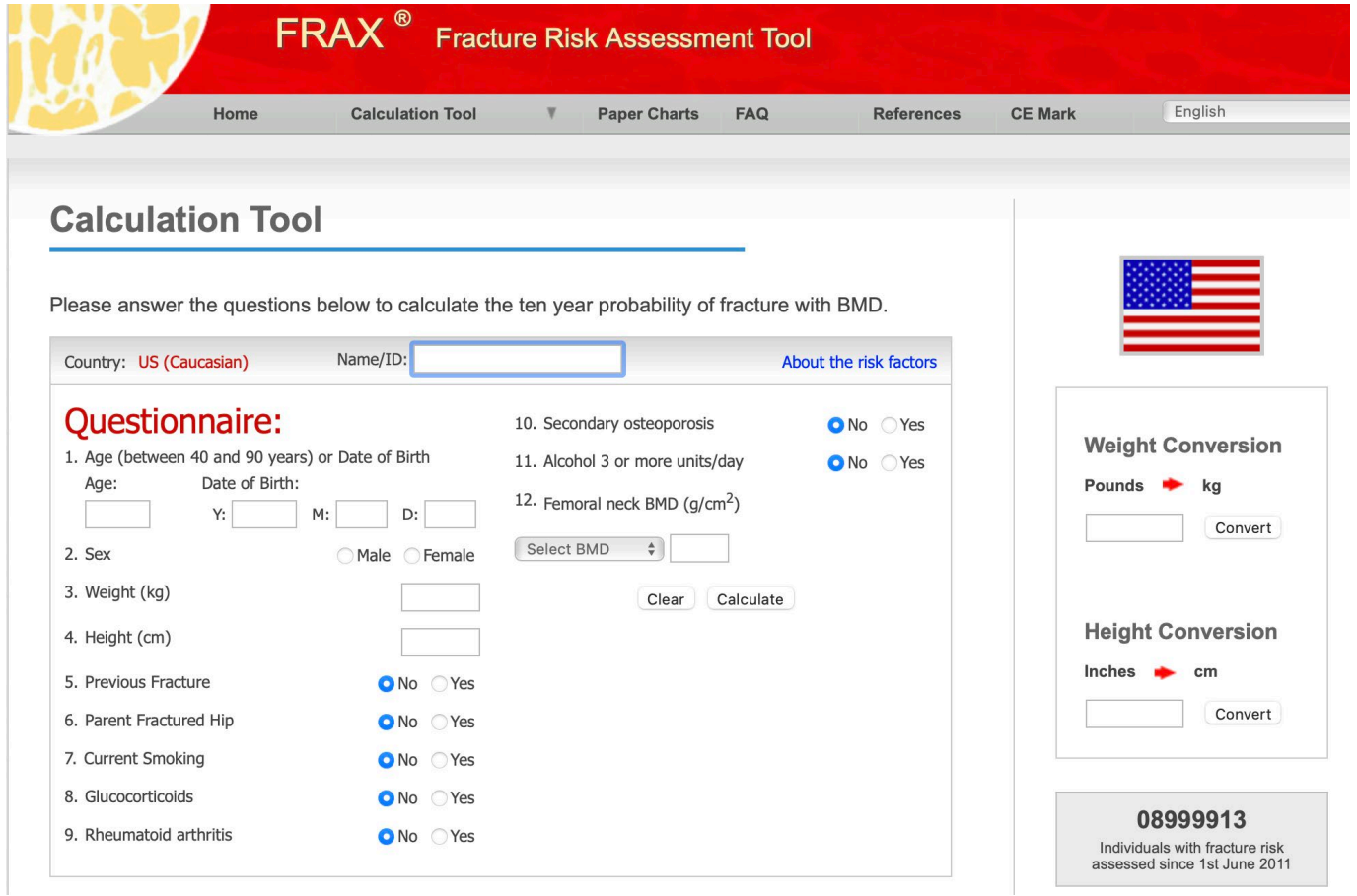
- The autophagy of osteocytes declines with age leading to increased, exaggerated bone remodeling. This in turn creates a weaker bone matrix.

ESTROGEN AND ANDROGENS

TARGET OSTEOCYTES AND OSTEOBLASTS AND DECREASE THEIR APOPTOSIS RATES.

DIAGNOSTICS

- Gold Standard is dual-energy x-ray absorptiometry (DXA) for a multitude of reasons (FRAX and WHO criteria require it, literature is securely confident in its predictability).
  - Hip, Spine, and Femoral Neck
- FRAX



TREATMENT /MANAGEMENT

- Lifestyle
  - Calcium intake of 1200mg daily and Vitamin D 800IU daily
  - If the patient has celiac disease, a gluten free diet has been shown to increase BMD
  - Prudent weight bearing exercise of 30 minutes at least three times a week
    - Avoid high intensity exercise in premenopausal women as this can lead to amenorrhea and weight loss which contributes to osteoporosis.
  - Smoking Cessation
  - Emerging therapy: whole body vibration

Guidelines for pharmacologic intervention in postmenopausal women and men ≥50 years of age

History of hip or vertebral fracture.
T-score ≤-2.5 (DXA) at the femoral neck or spine, after appropriate evaluation to exclude secondary causes.
T-score between -1 and -2.5 at the femoral neck or spine, and a 10-year probability of hip fracture ≥3 percent or a 10-year probability of any major osteoporosis-related fracture ≥20 percent based upon the United States-adapted WHO algorithm.

DXA: dual-energy x-ray absorptiometry; WHO: World Health Organization.

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TREATMENT/MANAGEMENT

PHARMACOLOGICAL MANAGEMENT

FIRST: MUST HAVE NORMAL SERUM CALCIUM AND 25-HYDROXYVITAMIN D

- IF NOT, SUPPLEMENT.
- INITIAL THERAPY – ORAL BISPHOSPHONATES
  - ALENDRONATE OR RISEDRONATE, ONCE A WEEK
  - WATCH OUT FOR ESOPHAGEAL DISORDERS OR CHRONIC KIDNEY DISEASE
- IF PATIENT HAS INABILITY TO TAKE ORAL BISPHOSPHONATES, THEN USE IV
  - ZOLEDRONIC ACID OR IBANDRONATE
- DENOSUMAB IM IS ALSO AVAILABLE BUT MEANS INDEFINITE TREATMENT
  - IF STOPPED RUN THE RISK OF HIGHER VERTEBRAL FRACTURE RISK
- FOR SEVERE OSTEOPOROSIS (T SCORE LESS THAN OR EQUAL TO 3.5 OR T SCORE LESS THAN OR EQUAL TO 2.5 WITH FRAGILITY FRACTURE) ANABOLIC AGENTS ARE INDICATED
  - TERIPARATIDE, ABALOPARATIDE, ROMOSOZUMAB
- LAST LINE – RALOXIFENE (SELECTIVE ESTROGEN RECEPTOR MODULATORS)

PROGNOSIS: THE OSTEOPOROSIS TREATMENT GAP

- "A recent report issued by the US National Osteoporosis Foundation estimated that 2 million Americans had 2.3 million osteoporotic fractures in 2015 with only 9% undergoing bone mineral density testing within 6 months of the fracture. In the first 2–3 years post fracture, a second fracture occurred in 307,000 of these individuals incurring a cost of in excess of $6.3 billion."

HIP FRACTURE: MORBIDITY AND MORTALITY

After a hip fracture, approximately 50% of patients will lose the ability to live independently.

In hospital mortality ranges from 1-10% and are higher in men.

One year mortality rates increase to 12-37%.

In a meta-analysis of prospective studies, the mortality risk in older patients (≥ age 80 years) was elevated during the first three months following a hip fracture, with a higher risk in men compared with women (hazard ratio [HR] 7.95, 95% CI 6.13-10.30 and HR 5.75, 95% CI 4.94-6.67, respectively).

NIH "FALL TRIANGLE"

- The Fall itself
- The Force and Direction of the Fall
- The Fragility of the bones that take the fall

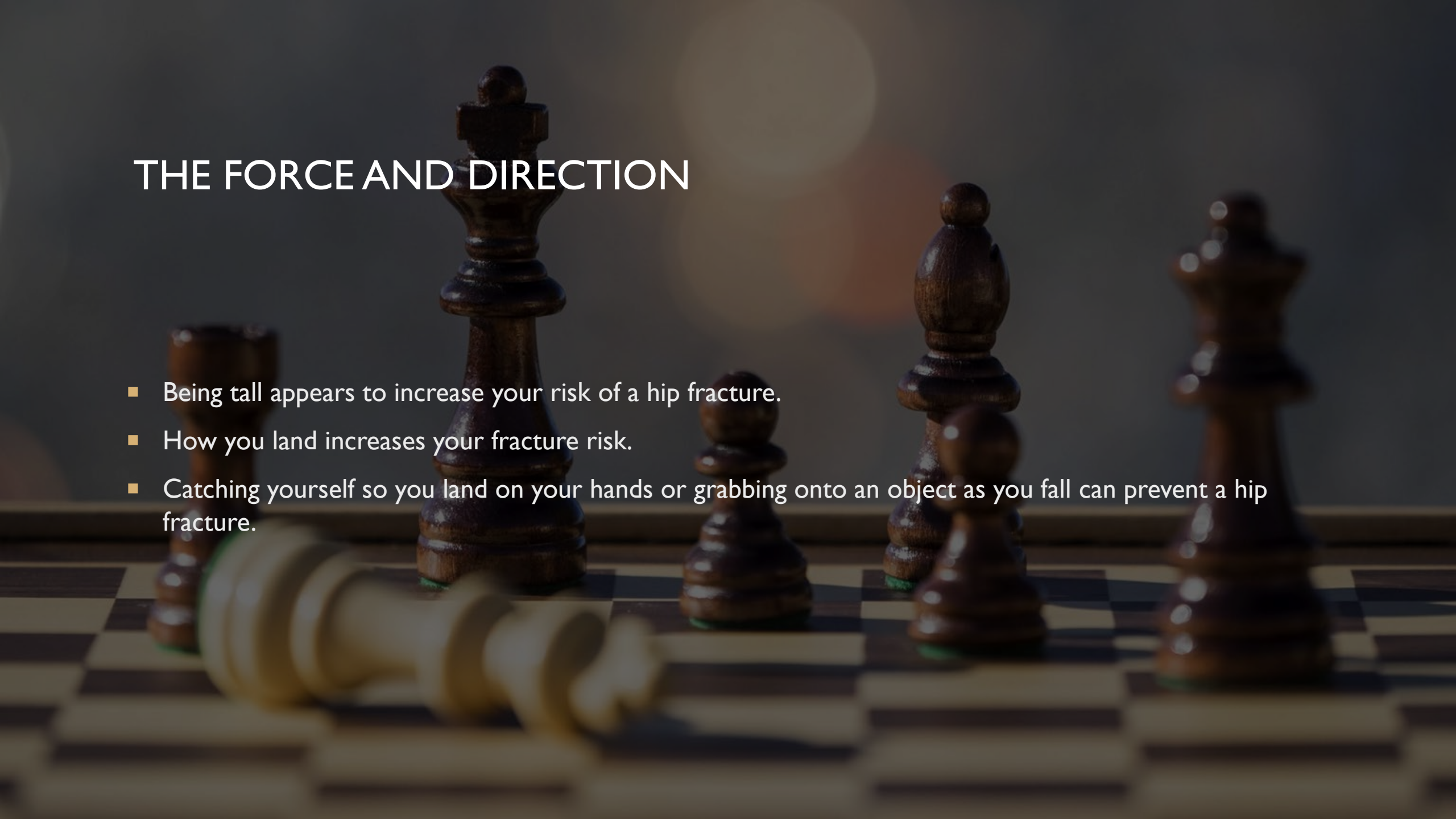
THE FALL

Improving balance

- Do muscle-strengthening exercises.
- Obtain maximum vision correction.
- Practice using bifocal or trifocal glasses.
- Practice balance exercises daily.

Medications that may increase the risk of falling

- Blood pressure pills.
- Heart medicines.
- Diuretics or water pills.
- Muscle relaxers or tranquilizers.



THE FORCE AND DIRECTION

- Being tall appears to increase your risk of a hip fracture.
- How you land increases your fracture risk.
- Catching yourself so you land on your hands or grabbing onto an object as you fall can prevent a hip fracture.

TROCHANTERIC PADDING

TOMSHOO Hip Protection Pads...

$24.99

Amazon.com

EASY PREVENTION ACTIONS

Refer	Refer for home health or other agency to do a comprehensive survey of the patient's home to look for fall risks and adjust as needed.
Provide	Provide resources on bad weather remedies and proper footwear.
Stay up	Stay up on eye exams
Use	Use bright light bulbs and overhead lights operated by switch or voice.
Make	Make daily contact with someone by phone
Consider	Consider a 24-hour monitoring service
Watch	Watch oneself in the mirror to detect sway

OSTEOPATHIC CONSIDERATIONS

- HVLA is Contraindicated
- "Effects of Comprehensive Osteopathic Manipulative Treatment on Balance in Elderly Patients: A Pilot Study." Daniel Lopez, DO; Hollis H. King, DO, PhD; Janice A. Knebl, DO; Victor Kosmopoulos, PhD; DeRaan Collins, BS; Rita M. Patterson, PhD. JAOA, June 2011.
  - N – 40, treatment arm of 20
  - muscle energy, myofascial, soft tissue, sacral rock, counterstrain, Occipitoatlantal and condylar decompression, venous sinus technique, V-spread, frontal and parietal lifts, or both, CV4 technique
  - Statistically significant improvements in sway values
  - Takeaway: keep patient's from falling and that will reduce fracture rates.

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