Impact of Resistance Based Exercises on Cancer-Associated Bone Health Changes.

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Overview

- **What**: Define bone health
- **So What?** Cancer-Specific Changes in Bone Health
- **What?** Resistance Exercise
- **So What?** Resistance Exercise & Cancer
- **Now What?**
What?

- Bones are continuously re-modeling (breaking and building)
The Sun, Vitamin D, Calcium

Vitamin D Metabolism

Sunlight → Skin → 7-dehydrocholesterol → D3 → Liver

Liver → 25 hydroxy D3 → Kidneys

Kidneys: Increases absorption of calcium → 1.25 hydroxy D3 → Increases bone mineralization and maintains calcium balance in the body

Dietary and supplement sources of vitamin D3, D2

Thyroid: Senses low calcium levels and increases PTH secretion
What is Osteoporosis?
Please answer the questions below to calculate the ten year probability of fracture with BMD.

**Questionnaire:**

1. Age (between 40 and 90 years) or Date of Birth
   - Age: 58
   - Date of Birth: Y: [ ] M: [ ] D: [ ]

2. Sex
   - Male □ Female □

3. Weight (kg)
   - 70

4. Height (cm)
   - 168

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 or more units/day
    - No □ Yes □

12. Femoral neck BMD (g/cm²)
    - Select BMD □

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**Results:**

**BMI: 24.8**

The ten year probability of fracture (%)

**without BMD**

- Major osteoporotic: 5.7
- Hip Fracture: 0.9

[View NOGG Guidance]
Risk Factors

- Age over 50 years
- Female
- Low body weight
- Smoking
- 3 or more alcoholic drinks in a day
So What?

- Decreased Bone Mass
- Decreased Lean Body Mass
- Increased body fat

= Increased fracture risk
Breast Cancer & Bone Health Changes

*Decreased Bone Mineral Density & Increased Risk of Fractures*

Chemotherapy  
Early Menopause
## Breast Cancer & Bone Health Changes

<table>
<thead>
<tr>
<th>Decreased BMD</th>
<th>Fracture Risk</th>
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<tbody>
<tr>
<td>5% loss</td>
<td>May increase by 55%</td>
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<tr>
<td>Decrease T-Score by 0.04 to 0.06</td>
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</tbody>
</table>
Prostate Cancer & Bone Health Changes

- **Androgen Deprivation Therapy**

<table>
<thead>
<tr>
<th>Decreased BMD</th>
<th>Decreased Lean Body mass</th>
<th>Osteoporosis Risk</th>
<th>Fracture Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 10 fold</td>
<td>2 to 3.6% (Owen)</td>
<td>Increased by 30-40% (Lomax 20, Gardner)</td>
<td>19% compared to 12%</td>
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<tr>
<td>Hip: 0.6 to 4%</td>
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<tr>
<td>Spine: 2 to 4.8%</td>
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</table>

- **Greatest Loss is seen in the first 6-12 Months (Owen)**
What? Resistance Exercise

Biceps brachii muscle
Weights used as resistance
Skeletal muscle pulls against the bone, causing it to retain calcium and become stronger

<table>
<thead>
<tr>
<th>Osteopenia</th>
<th>Osteoporosis</th>
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</thead>
<tbody>
<tr>
<td>Jumping/hopping</td>
<td>Free Weights</td>
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<tr>
<td>Plyometrics</td>
<td>Machines</td>
</tr>
<tr>
<td>Free weights, kettle bells, resistance bands</td>
<td>Resistance bands</td>
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<td>Sports that involve jumping</td>
<td>Stairclimbing</td>
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<td>(basketball, volleyball)</td>
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<tr>
<td>Weight bearing aerobic activities</td>
<td>Walking</td>
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<tr>
<td>(jogging, tennis, stairclimbing)</td>
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</table>
Benefits of Resistance Exercise?

- In Non-Cancer Individuals, Normal Aging
  - Lose 5-10% of muscle mass every 10 years after age 50 (Strasser)
- Training 2 times/week ➔ Increased 1-2 kg of muscle mass every 6 months (Strasser)
- Takes 8-12 weeks to see a difference (Strasser)

Muscle strength  
Bone Mineral Density  
Fatigue  
Physical Function
## So what? Resistance Exercise & Breast cancer

<table>
<thead>
<tr>
<th>Exercise Group</th>
<th>No Resistance Exercise group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintained bone mineral density (Dobek)</td>
<td>Greater loss of bone mineral density (3%) (Dobek)</td>
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<tr>
<td>Increased lower body strength (Dobek)</td>
<td>Increased lower body strength (Dobek)</td>
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<tr>
<td>Less of a delay in starting chemotherapy (Courneya)</td>
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</tbody>
</table>
So What? Resistance Exercise & Prostate Cancer

- Fewer Studies (10-15)

<table>
<thead>
<tr>
<th>Exercise Group</th>
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<tbody>
<tr>
<td>No change in bone mineral density (Gardner)</td>
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<tr>
<td>Increased upper body strength (Gardner)</td>
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<tr>
<td>Increased lower body strength (Gardner)</td>
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<tr>
<td>Increased lean body mass (Gardner)</td>
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</tbody>
</table>
General Conclusions

- These studies were done in very structured, supervised, almost “lab-like” settings
- Resistance exercise increased upper body muscle strength by 7 kg (Strasser)
- Resistance exercise increased lower body muscle strength by 15 kg (Strasser)
- Higher intensity does not necessarily mean greater gain in strength (Strasser)
- Bone Mineral Density: Less is known but it appears to maintain or slow bone loss of density
- See improvements with resistance exercise during and after cancer treatment
- Resistance Exercise is SAFE in Cancer Survivors
To consider

- Length of program

- Sustainability
  - Bone Mineral Density Changes may be maintained with less frequency and intensity
  - Muscle Strength maintenance requires regular frequency, maintained intensity

- Zero training over a 6 month period \(\rightarrow\) reverses bone and muscle improvements
Questions to be answered

- Are the effects of resistance exercise long-lasting?
- How much is needed to enhance bone health?
- How does the effect vary across different cancers?
- Optimal timing during treatment course?
NCCN Guidelines: Bone Health Screening

1. Cancer patients at increased risk for bone loss and fracture because of therapy or age
2. History & physical examination, BMD screening, FRAX analysis
3. Lifestyle modifications, calcium and vitamin D supplementation

- T score > -1.0
- T score between -1.0 and -1.5
- T score between -1.5 and -2.0
- T score < -2.0 or FRAX 10-year fracture risk >20% for major fracture or >3% for hip fracture

4. Check 25(OH) D level
5. Consider pharmacologic therapy
6. Strongly consider treatment with pharmacologic therapy

7. Repeat DXA every 2 years
ACSM Guidelines for Cancer Survivors: Resistance Exercise

Survivors = time of diagnosis

2 days a week. Moderate intensity

Post-Menopausal:
- 60-70% of RM
- 8-12 repetitions per set
- 1-3 sets
Exercise is Medicine
Exercise Prescription

- 2 Times per Week
  - Upper and Lower Body

- Intensity: 50-80% of Maximum Resistance

- 2-3 Sets of 8-12 Repetitions
Now What?

Talk to your Oncologist or Primary Care Physician
  ◦ Restrictions or Precautions

To think about
  ◦ Are you interested in it?
  ◦ Do you feel ready to incorporate into your life?
  ◦ Which barriers or factors prevent you from exercising?
    ◦ Time
    ◦ Knowledge
    ◦ Comfort Level
    ◦ Fatigue
    ◦ Weakness
    ◦ Pain

Physiatrist or PM&R Doctor
Cancer Certified Exercise Physiologist
Physical Therapist
Fitness Center
Resources

National Cancer Institute
American Cancer Society
National Institute on Aging: Exercise & Physical Activity

Local Resources in Chicago
Gilda’s Club
RIC Fitness Center
## Strength Daily Record

You can use this form to keep track of the strength exercises you do each day. Try to do strength exercises for all of your major muscle groups on 2 or more days a week for 30-minute sessions each, but don't exercise the same muscle group on any 2 days in a row. Record the number of repetitions and the amount of weight you use.

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<th></th>
<th>Sunday</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
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<tbody>
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<td><strong>Upper-Body</strong></td>
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<td>Hand Grip</td>
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<td>Wrist Curl</td>
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<td>Overhead Arm Raise</td>
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<td>Front Arm Raise</td>
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<td>Side Arm Raise</td>
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<td>Arm Curl</td>
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<td>Seated Row</td>
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<td>Wall Push-Up</td>
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<td>Elbow Extension</td>
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<td>Chair Dip</td>
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<td>Back Leg Raise</td>
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<td>Side Leg Raise</td>
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<td>Knee Curl</td>
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<td>Leg Straightening</td>
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<td>Chair Stand</td>
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<td>Toe Stand</td>
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Monthly Progress Test
Take the tests on page 92 monthly, record your scores, and watch your progress.

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<td><strong>Endurance</strong></td>
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<td>— Pick a fixed course, such as the distance from your house to the corner, and see how long it takes you to walk that far.</td>
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<td><strong>Upper-Body Strength</strong></td>
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<td>— Count the number of arm curls you can safely do in 2 minutes.</td>
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<td>— Count the number of chair stands you can safely do in 2 minutes.</td>
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<td><strong>Balance</strong></td>
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<td>— Time yourself as you stand on one foot, without support, for as long as possible. Repeat with the other foot.</td>
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<td><strong>Flexibility</strong></td>
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<td>— Note how far you can reach until you feel a stretch.</td>
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References


