Osteoporosis and Soft Tissue (Muscle/Fat) Disorders
Management and Medical Decision-Making
Exercise

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Disclosures

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• NIH (R33 AG056540, P30AG028740, U24AR071113, U01AG050499, U01AG061389, R01AG055529, P30 AG059297)
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Distribution of Self-Reported Volume of Moderate-to-Vigorous Physical Activity, U.S. Adults, 2015

Percentage Adults within or above Target Range for Moderate-to-Vigorous Physical Activity, by Population Subgroup, 2015

Legend: W=White, B=Black, H=Hispanic, A=Asian.

Proportion of Time-awake at Different Categories of Accelerometer Counts for U.S. Adults

Relationship among moderate-to-vigorous physical activity, sitting time, and risk of all-cause mortality

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Moderate-to-vigorous aerobic physical activity, and risk of all-cause mortality, diabetes, and cardiovascular disease

3.5 Year Risk of Fracture in Older Men by Quintile of Moderate-Intensity Physical Activity: The Osteoporotic Fractures in Men Study (N=2,731)

Source: Adapted from data found in Cauley et al., 2013.9
Odds of Maintaining a Healthy Weight by Level of Physical Activity

Source: Adapted from data found in Brown et al., 2016.20

Fat accumulation within skeletal muscle is associated with muscle weakness and the loss of function in older adults.

The effects of physical activity on fat within muscle in older adults are not clear.

CT scan of the thigh

Subcutaneous adipose

Intermuscular Adipose

Subfascial Adipose

Goodpaster et al.
J Appl Physiol 2008; 105:1498
LIFE-Pilot Muscle study

**Muscle size**

- N=20
- N=22

**Intermuscular adipose tissue**

- N=20
- P<0.05
- N=22

**Subcutaneous adipose tissue**

- N=20
- N=22

**Muscle quality**

- N=20
- N=22
- P<0.05
Events
Physical Activity: 30.1% (n=246/818)
Health Education: 35.5% (n=290/817)

HR=0.82, 95%CI=0.69-0.98
P=0.03

Pahor et al JAMA 2014
LIFE n=1635 - GEE MODELS PREDICTING FRAILTY OVER 24 MONTHS ACCORDING TO RANDOMIZATION GROUP

<table>
<thead>
<tr>
<th></th>
<th>Unadjusted odds ratio (95% CI)</th>
<th>P Value</th>
<th>Adjusted odds ratio* (95% CI)</th>
<th>P Value</th>
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</thead>
<tbody>
<tr>
<td>Fried frailty index</td>
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<tr>
<td>Physical activity (n=818)</td>
<td>0.83 [0.69-0.99]</td>
<td>0.040</td>
<td>0.81 [0.68-0.98]</td>
<td>0.028</td>
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<tr>
<td>Health education (n=817)</td>
<td>(Reference)</td>
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<tr>
<td>SOF frailty index</td>
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<tr>
<td>Physical activity (n=818)</td>
<td>0.81 [0.67-0.98]</td>
<td>0.034</td>
<td>0.86 [0.71-1.04]</td>
<td>0.125</td>
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<tr>
<td>Health education (n=817)</td>
<td>(Reference)</td>
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* Baseline value of the outcome, gender and field center (both used to stratify randomization), age, intervention, clinic visit, and intervention-by-visit interaction included in the models.

Adapted from Trombetti et al. Ann. Intern. Med. 2018
Data Science and wearable technologies

- Develop interactive mobile device monitoring
- Warehouse and integrate multi-modal data
- Use machine learning and data mining

The diagram illustrates the implementation of wearable technologies using accelerometers, heart rate monitors, temperature and GPS sensors. The data collected is filtered and sent to a secure server through a privacy firewall. The data is then analyzed and reported, leading to improved patient outcomes and mobility. Samsung Gear S: Tizen app is used for remote pseudo-real time data collection.
Knowledge gaps and research opportunities

- Physical activity implementation studies in the community
- Identifying molecular transducers of physical activity in older persons
- Impact of averting sedentariness
- Effects of physical activity on frailty and sarcopenia
- Implementation of wearable technologies