AGING AND PHYSICAL ACTIVITY: INSIGHTS ON AVOIDING AND SURVIVING CANCER

Wendy M Kohrt, PhD
University of Colorado – Anschutz Medical Campus
Department of Medicine, Division of Geriatric Medicine
Outline

- Successful vs usual aging
- Physical Activity Guidelines for Americans
- Prescribing physical activity for older adults
- Self-reported vs measured physical function
- Sex hormone deficiency and physical activity
biological function

high

usual aging + disease

+ obesity

+ physical inactivity

+ environmental toxins

successful aging

functional independence

functional dependence

low

young adult

elderly

ideal aging
Outline

- Successful vs usual aging
- Physical Activity Guidelines for Americans
The 2008 Physical Activity Guidelines for Americans provides science-based guidance to help Americans aged 6 and older improve their health through appropriate physical activity.
Key Guidelines for Adults

All adults should avoid inactivity. Some physical activity is better than none, and adults who participate in any amount of physical activity gain some health benefits.
Key Guidelines for Adults

For substantial health benefits:

- >150 min/week of moderate-intensity aerobic physical activity, or
- >75 min/week of vigorous-intensity aerobic physical activity, or
- an equivalent combination of moderate- and vigorous-intensity aerobic activity
- perform in episodes of at least 10 min
- preferably, spread throughout the week
Adults should also do moderate or high-intensity muscle-strengthening activities that involve all major muscle groups on 2 or more days a week, because these activities provide additional health benefits.
Key Guidelines for Older Adults

When older adults cannot do 150 minutes of moderate-intensity aerobic activity a week because of chronic conditions, they should be as physically active as their abilities and conditions allow.

Older adults should do exercises that maintain or improve balance if they are at risk of falling.
Health Benefits of Regular Physical Activity for Adults and Older Adults

**Strong evidence** for lower risk of:

- Early death
- Coronary heart disease
- Stroke
- High blood pressure
- Adverse lipid profile
- Type 2 diabetes
- Metabolic syndrome
- Colon cancer
- Breast cancer
- Weight gain
- Falls
- Depression
- Cognitive dysfunction (older adults)
Health Benefits of Regular Physical Activity for Adults and Older Adults

Moderate to strong evidence for:

- Better functional health (older adults)
- Reduced abdominal obesity
Health Benefits of Regular Physical Activity for Adults and Older Adults

Moderate evidence for:

- Lower risk of hip fracture
- Lower risk of lung cancer
- Lower risk of endometrial cancer
- Prevention of weight re-gain
- Increased bone mineral density
- Improved sleep quality
Bottom line on risks of physical activity:

The health benefits of physical activity far outweigh the risks of adverse events for almost everyone

But ....

The recommended level of physical activity may not be sufficient to achieve the stated health benefits
Currently, it appears that 210 to 420 minutes per week of moderate-intensity physical activity is needed to significantly reduce the risk of colon and breast cancer.
Outline

- Physical Activity Guidelines for Americans
- Prescribing physical activity for older adults
Prescribing Physical Activity

- Frequency – days per week
- Duration – minutes per day
- Intensity – moderate vs vigorous

\[ \% \text{VO}_{2\text{max}} = \text{target intensity} \times \text{VO}_{2\text{max}} \]
\[ \% \text{HR}_{\text{maximal}} = \text{target intensity} \times \text{HR}_{\text{max}} \]
\[ \% \text{HR}_{\text{reserve}} = \text{target intensity} \times (\text{HR}_{\text{max}} - \text{HR}_{\text{rest}}) + \text{HR}_{\text{rest}} \]

Rating of Perceived Exertion

75-150 min/wk
Prescribing Physical Activity

<table>
<thead>
<tr>
<th>Relative Intensity</th>
<th>HR_{max}</th>
<th>HR_{res} or VO_{2max}</th>
<th>Rating of Perceived Exertion</th>
</tr>
</thead>
<tbody>
<tr>
<td>35 - 59%</td>
<td>30 - 49%</td>
<td></td>
<td>10 - 11 LT</td>
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<tr>
<td>60 - 79%</td>
<td>50 - 74%</td>
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<td>12 - 13 MOD</td>
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<td>80 - 89%</td>
<td>75 - 84%</td>
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<td>14 - 16 VIG</td>
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<tr>
<td>90+%</td>
<td>85+%</td>
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<td>17 - 20</td>
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</table>
Prescribing Intensity of Physical Activity for Older Adults (60 – 80 y)

Prescribing Intensity of Physical Activity for Older Adults (60 – 80 y)

Vigorous exercise was high risk for older adults (60+ years)

There was little, if any, benefit of exercise training for older adults

Based on observations that older adults did not adapt to exercise training
State of Knowledge of Exercise Physiology and Aging

circa 1990

Lactate Responses of Young and Older Adults to 15 Minutes of Treadmill Exercise at 78% of VO$_2$max

Adapted from: Kohrt WM et al. *J Appl Physiol* 75:1828, 1993
Outline

- Prescribing physical activity for older adults
- Self-reported vs measured physical function
Measured Function After TKA

Outline

- Self-reported vs measured physical function
- Sex hormone deficiency and physical activity
Body Weight in Mice and Rats
OVX vs Sham

Adapted from: Witte MM et al. General Compar Endocrinol 166:520, 2010
Locomotor Activity in Mice and Rats
OVX vs Sham

Adapted from: Witte MM et al. General Compar Endocrinol 166:520, 2010
Effects of OVX in Mice on Metabolic Rate and Spontaneous Physical Activity

From: Rogers NH et al. *Endocrinol* 150:2161, 2009
ESTRADIOL AND TAMOXIFEN REVERSE OVARIECTOMY-INDUCED PHYSICAL INACTIVITY IN MICE

Gorzek FJ, Hendrickson KC, Forstner JP, Rixen JL, Moran AL, Lowe DA

Wheel-running Distance in Sham and OVX Mice

IMPACT OF OVARIOHYSSTERECTOMY AND FOOD INTAKE ON BODY COMPOSITION, PHYSICAL ACTIVITY, AND ADIPOSE GENE EXPRESSION IN CATS

Belsito KR, Vester BM, Keel T, Graves TK, Swanson KS

J Anim Sci 87:594, 2009
Body Weight in OVX Cats

Physical Activity in OVX Cats

Exercise and E₂ Prevent Weight Gain and Visceral Fat Gain in OVX Mice

Effects of the Menopausal Status and HT on Fat Distribution

Adapted from: Genazzani AR, Gambacciani M Gynecol Endocrinol 22:145, 2006
Effects of 6 months GnRH Agonist Therapy on Body Composition

Adapted from: Revilla R et al *Maturitas* 31:63, 1998
INCREASED VISCERAL FAT AND DECREASED ENERGY EXPENDITURE DURING THE MENOPAUSAL TRANSITION

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ADIPOKINES, INFLAMMATION, AND VISCERAL ADIPOSITY ACROSS THE MENOPAUSAL TRANSITION

Lee CG et al. J Clin Endocrinol Metab 94:1104 2009
Figure 3. REE (kcal/d) in premenopausal women during the mid-luteal and early follicular phases of the menstrual cycle and in response to 6 days of GnRH<sub>ANT</sub> therapy. The inset bars (■) depict the serum E<sub>2</sub> levels.

Adapted from: Day DS et al. J Clin Endocrinol Metab 90:3312, 2005
Estrogens
↓
Physical activity
↓
Energy intake ↑
↓ Energy expenditure

Weight gain
Fat gain
Abdominal fat gain
↑ Disease risk
Aging and Physical Activity

What type?   How much?   When?

Anything is better than nothing

The more you do, the greater the benefits

It is never too late to start