The Science Behind the 2018 PA Guidelines

Exercise is Medicine Across the Lifespan Colloquium

Durham, NC
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The STRRIDE Journey

2018 Physical Activity Guidelines

How Does it all Work? MoTrPAC
The STRRIDE Journey

2018 Physical Activity Guidelines

How Does it all Work? MoTrPAC
STRRIDE: Eligibility Criteria

Age: 40 - 65

Body Composition: $25 \leq \text{BMI} \leq 35$

Lipids: $130 \leq \text{LDL} \leq 190 \text{ or } \text{HDL} \leq 40 \text{ M and } \leq 45 \text{ W}$

Glucose: fasting $\leq 140 \text{ mg\%};$ fasting insulin $\geq 10 \text{ IU/ml}$

Blood pressure: $\leq 160/90 \text{ mmHg}$

Menstrual status: postmenopausal (FSH $\geq 40)$ $\pm$ HRT $\geq 6$ months

Demographics: equal genders, 30% minority

Activity: “sedentary”, peak VO$_2 \approx 29$ mL/kg/min (8.3 METS)

Medications: nothing that is known to influence skeletal muscle or exercise training responses (e.g. ACE inhibitors, $\beta$-blockers) and stable for 6 months
## STRRIDE - Training Protocols

<table>
<thead>
<tr>
<th>Intensity</th>
<th>Amount</th>
<th>Time/wk</th>
</tr>
</thead>
<tbody>
<tr>
<td>(peak VO₂)</td>
<td>(kcal/wk)</td>
<td>(min per wk)</td>
</tr>
<tr>
<td>Brisk Walking</td>
<td>13 miles/week</td>
<td>170</td>
</tr>
<tr>
<td>Jogging</td>
<td>13 miles/week</td>
<td>120</td>
</tr>
<tr>
<td>Jogging</td>
<td>22 miles/week</td>
<td>170</td>
</tr>
<tr>
<td>Inactive</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Intensity</td>
<td>Amount</td>
<td>Time/wk</td>
</tr>
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</table>
STRRIDE - Study Design

Months 0 3 6 9 10 12

Screening

Ramp up

Training

Detraining

Retraining (optional)
Percent Change Peak VO$_2$

Group

Inactive  Low Dose Moderate  Low Dose Vigorous  High Dose Vigorous

δ

*  *

DUKE MOLECULAR PHYSIOLOGY INSTITUTE
AUC Glucose by Group

Glucose AUC Chg (mg/dL * 120 min)

-2500 -2000 -1500 -1000 -500 0

High Moderate High Vigorous Low Moderate DPP-like Lifestyle

73.9% 23.5% 51.3% 100%

High Moderate

High Vigorous

Low Moderate

DPP-like

Lifestyle

**
Responses of HDL to Various Exercise Regimens

<table>
<thead>
<tr>
<th>Group</th>
<th>Intensity Effect</th>
<th>Amount Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inactive</td>
<td>-0.10</td>
<td>***</td>
</tr>
<tr>
<td>Low Dose</td>
<td>-0.05</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>Low Dose</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>Vigorous</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>High Dose</td>
<td></td>
<td>***</td>
</tr>
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</table>

HDL-C (mmol/L)
Reunion Results

- % ∆ Peak VO₂ (L/min)
- ∆ Mean Arterial BP (mmHg)
- ∆ Fasting Insulin (uU/mL)
- ∆ Minimal Waist (cm)
Change in Peak VO$_2$

![Graph showing change in peak VO$_2$ over time for different response levels.](image-url)
Reduction in coronary heart disease (CHD) risks per metabolic equivalent hours per day (METh/d) energy expended by walking or running at baseline.

US Physical Activity Guidelines for Americans 2018

Overview and Highlights from the Physical Activity Guidelines Committee
Defining the exposure targets

- 654, 827 Men & Women, 82,465 deaths
- Steep early slope
- No lower threshold for benefit
- About 70% of benefit reached by 8.25 MET-hr/wk
- No apparent upper threshold
- No evidence of increased risk at high end
- No obvious best amount

150-300 Min MPA @ 3.3 METs (3 miles per hour)

Moore, et al. PLOS Medicine, 2012
Attributed to WL Haskell
Relationship Among Moderate-to-Vigorous Physical Activity, Sitting Time, and Risk of All-Cause Mortality in Adults

It takes approximately 600 min/week of moderate intensity PA or 300 min/week of vigorous intensity PA to go from here …

… to here to overcome sedentary time the most sedentary of lifestyles (>8 h/day)

Not Just for Mortality and CVD
Risk of selected health events by hours/week of moderate to vigorous physical activity

- Breast cancer
- Depression, dementia
- Colon cancer
- All-cause mortality
- Diabetes
- Hip fracture
- CVD, CHD, stroke

Relative Risk

Hours per week
How best to describe the amount of PA recommended by these Guidelines

Is it the minimal amount of activity to obtain health benefit?
Is it the amount of activity that provides maximal benefit?
Is it the amount of activity that provides optimal benefit?
It is a “public health target” where many adults achieve substantial benefit – benefit for the most people

Defining the exposure targets

Attributed to WL Haskell
“The needs of the many outweigh the needs of the few, or the one.”
What about Measuring Steps?
• Steps are a basic unit of locomotion
  – Easy to understand metric of ambulation
• Measuring step counts shown to motivate diverse samples of individuals to increase physical activity levels
• Self-assessment of steps through objective, readily obtainable technology
• Step counts per day provides a comparable denominator to caloric intake per day
  – Tool for researchers and the public addressing a variety of health and physical activity issues
• Steps can be at light-, moderate-, and vigorous-intensity levels
  – Range of exertion choice for the promotion of walking
Yates (2014): steps per day were associated with a reduced risk for cardiovascular events—every 2,000 steps per day was associated with an 8% yearly reduction in cardiovascular event rate.

Quartile 1 to 4: least to most steps

Yates et al. Lancet, 2014
What about Steps?

- Background steps—those associated with activities of daily living are about 5,000 steps per day.
- Walking briskly for 10 minutes at 3.3 miles per hour requires about 1,000 steps.
- This equates to between \((5,000 + 2,000 =) \text{ 7,000 steps per day}\) and \((5,000 + 4,000 =) \text{ 9,000 steps per day}\) to meet weekly physical activity guidelines.
Do Bouts Matter?

Whence did this whole idea originate?
New Data

Saint-Maurice, JAHA, 2018

NHANES, 2003-2006 wave
>40 y
4840 individuals
700 deaths (31 Dec 2011)

100-759 cpm = light
≥ 760 cpm = MVPA