Findings from the WHI Objective Physical Activity and Cardiovascular Health (OPACH) Study in Older Women

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University of California, San Diego
GSA and AHA Talks
November 2015 and March 2016

1. OPACH Overview - Andrea LaCroix, UC San Diego

2. Associations of PA/SB with CVD Risk Factors - Andrea LaCroix

3. Associations of PA/SB with SPPB - David Buchner/Michael LaMonte, University at Buffalo, SUNY

4. Falls associated with physical activity - Steve Marshall, UNC

5. SB and Fall History - Dori Rosenberg, Group Health Research Institute

6. PA, SB and Predicted CVD Risk (Reynolds Score) – Mike LaMonte, University of Buffalo, SUNY
Overview of the OPACH Study
WHI LLS and OPACH

- **Long Life Study (LLS): 2012-2013**
  - 7875 women from the WHI Extension II Medical Records Cohort
  - In-home visit with blood draw, clinical assessment, functional status

- **Objective Physical Activity and Cardiovascular Health (OPACH)**
  - Ancillary study of LLS: R01 HL105065 (PI: Andrea LaCroix)
  - Aims to determine associations of PA and SB with cardiovascular events, total mortality, and incident falls
  - Adding accelerometry, self-reported PA (PAQ and CHAMPS) and Falls calendar for a year
  - N=7048 participated, 6489 completed 7-day accelerometer and sleep log
Physical Activity (PA)

• Intensity by METs
  – Sedentary behavior (SB): <1.5 METs
  – Light activity: 1.5—3.0 METs
  – MVPA: >3.0 METs

• 2008 PA Guidelines for Americans
  – 150 min/week moderate, or 75 min vigorous
  – Bouts of at least 10 minutes, throughout the week
  – Double the amount for additional benefits
Accelerometers

- Wearable device to measure movement
- 1-axis (vertical) vs. 3-axis


- Unit of raw data: “g”
- Actigraph GT3X+: worn on hip/wrist
OPACH calibration study

- Cutpoints are population and device specific
- Previous cutpoints were derived using 1-axis device, and for young adults
- No consensus on cutpoints for older adults, to determine intensity thresholds (SB/light/MVPA)
- Calibration study
  - N=200
  - Standardized tasks (DVD, doing dishes, puzzle, mop, walk, treadmill)
  - Accelerometer and METs (oxygen consumption by portable calorimeter)
OPACH calibration study
OPACH calibration study

- Derived cut points using vector magnitude counts (vs. vertical axis):
  - Sedentary: 0–18
  - Light low: 19–225
  - Light high: 226–518
  - MVPA: 519+

OPACH PA summary variables

- Total PA volume (counts)
- Intensity-specific time and volume
  - SB, light low, light high, MVPA
- Two versions of summary data
  - 24-hour data
  - Awake time data (exclude sleep)
Strobe Flow Chart for OPACH Study

Total Eligible Sample (Consented to LLS) N = 9252

Original OPACH Consented Sample N = 8818

Alive at Recruitment: n = 8560
Met Eligibility Criteria*: n = 8419
Able to Contact: n = 7654
Agreed to Participate = 7058

Enrolled OPACH Sample N = 7058
(LLS visit: Yes=8590, No=468)

Alive to Participate = 7048

OPACH Sample N = 7048
(LLS visit: Yes=8580, No=468)

Accelerometer Returned: n = 6721
Downloadable Data: n = 6512
Processed for Analysis: n=6489

Final OPACH Accelerometer Sample N = 8489
N=5100 had phlebotomy
N=6278 have PAQ data

Had ≥24 days of wear with ≥10 hours/day: n = 6181

Final Non-Imputed, Adherent OPACH Accelerometer Sample N = 6181
N=4870 had phlebotomy
N=6046 have PAQ data

* No health problems that prevent participation (e.g. dementia), able to walk, does not reside in nursing home.
## OPACH sample by age groups

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>63 – 69</th>
<th>70 – 79</th>
<th>80 – 89</th>
<th>≥90</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (%)</td>
<td>6489</td>
<td>666 (10.3)</td>
<td>2600 (40.1)</td>
<td>2953 (45.5)</td>
<td>270 (4.2)</td>
</tr>
<tr>
<td>% White</td>
<td>49.4</td>
<td>14.1</td>
<td>26.8</td>
<td>74.2</td>
<td>82.2</td>
</tr>
<tr>
<td>% College Grad</td>
<td>40.9</td>
<td>44.0</td>
<td>40.6</td>
<td>39.8</td>
<td>41.1</td>
</tr>
<tr>
<td>% Non-Smoker</td>
<td>97.5</td>
<td>94.7</td>
<td>96.9</td>
<td>98.4</td>
<td>99.6</td>
</tr>
<tr>
<td>% Obese</td>
<td>31.6</td>
<td>38.9</td>
<td>36.1</td>
<td>22.9</td>
<td>15.9</td>
</tr>
</tbody>
</table>
## OPACH sample by age group

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<thead>
<tr>
<th></th>
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<th>80 – 89</th>
<th>≥90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Physical Function Score</td>
<td>67.9</td>
<td>78.9</td>
<td>73.0</td>
<td>62.5</td>
<td>48.3</td>
</tr>
<tr>
<td>Mean (EPESE) SPPB Score</td>
<td>8.2</td>
<td>9.2</td>
<td>8.6</td>
<td>7.7</td>
<td>6.5</td>
</tr>
<tr>
<td>Mean (self-reported) Total MET-hours/wk</td>
<td>11.9</td>
<td>15.0</td>
<td>13.3</td>
<td>10.4</td>
<td>6.6</td>
</tr>
<tr>
<td>% Self-report sitting ≥10 hours/day</td>
<td>19.2</td>
<td>17.8</td>
<td>17.0</td>
<td>20.3</td>
<td>31.4</td>
</tr>
<tr>
<td>% Fell ≥2 in Past Year</td>
<td>11.2</td>
<td>9.2</td>
<td>9.5</td>
<td>12.8</td>
<td>16.3</td>
</tr>
</tbody>
</table>
Physical Activity and Falls
Hypothetical “U”-shaped Relationship Between Physical Activity & Fall Risk

Too Little
- ↓ Muscle Function
- ↓ Cardio-Respiratory Function
- ↑ Fear of Falling
- ↑ Gait Dysfunction
- ↓ Neuromuscular Coordination
- ↓ Social Integration

Optimal
- ↑ Muscle Function
- ↑ Balance & Postural Stability
- ↓ Fear of Falling

Too Much
- ↑ Exposure to Environmental Hazards
- ↑ Fatigue
- ↑ Overuse Injury

Level of Physical Activity

Risk of Fall & Fall-Related Injury
Falls and PA-related Falls

• Approx. ⅓ Reported a Fall in the past 12 months
• Approx. ⅔ of Falls were PA-related (1294/2078=62%)

<table>
<thead>
<tr>
<th>All subjects</th>
<th>Most recent fall was physical activity related</th>
<th>Most recent fall was unrelated to physical activity</th>
<th>Did not Fall</th>
<th>Falls Data Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td>6437</td>
<td>1294 (20.1)</td>
<td>784 (12.2)</td>
<td>4165 (64.7)</td>
<td>194 (3.0)</td>
</tr>
</tbody>
</table>

• 63% of fallers reported one fall in the past 12 months
• 32% of fallers reported 1-3 falls in the past 12 months
• 5% of fallers reported 4 or more falls in the past 12 months
Self-Reported Fall Injuries

- **Injury Falls**: 43.2% of Falls
  - similar for PA and non-PA falls
- **Physician Treatment Falls**: 22.7% of Falls
  - similar for PA and non-PA falls
- **Overnight Inpatient Stay Falls**: 5.6% of Falls
  - PA falls ~2x more likely to result in Inpatient Stay

<table>
<thead>
<tr>
<th></th>
<th>Most recent fall was physical activity related</th>
<th>Most recent fall was unrelated to physical activity</th>
<th>Physical Activity-Related Fall (reference) compared to Non-Physical Activity-Related Fall</th>
<th>Age-Adjusted OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Had Any Injury from a fall in past 12 months</td>
<td>573 (45.4)</td>
<td>324 (42.0)</td>
<td>0.87 (0.72-1.04)</td>
<td></td>
</tr>
<tr>
<td>Received Medical Treatment for Injury</td>
<td>292 (22.6)</td>
<td>180 (23.0)</td>
<td>1.08 (0.85-1.38)</td>
<td></td>
</tr>
<tr>
<td>Required Overnight Stay in Hospital for Injury</td>
<td>56 (7.7)</td>
<td>60 (4.3)</td>
<td>2.02 (1.33-3.06)</td>
<td></td>
</tr>
</tbody>
</table>
CHAMPS Physical Activity
Small ↑ in PA Falls ; Major ↓ in non-PA Falls

<table>
<thead>
<tr>
<th>Fell one or more times in past 12 months</th>
<th>Did not Fall (past 12 months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most recent fall was physical activity related</td>
<td>Most recent fall was unrelated to physical activity</td>
</tr>
</tbody>
</table>

**All Physical Activity, MET-hours (CHAMPS)**

<table>
<thead>
<tr>
<th></th>
<th>Fell one or more times</th>
<th>Did not Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - &lt;10</td>
<td>251 (17.5)</td>
<td>267 (18.6)</td>
</tr>
<tr>
<td>10 - &lt;20</td>
<td>301 (20.2)</td>
<td>170 (11.4)</td>
</tr>
<tr>
<td>≥20</td>
<td>742 (21.1)</td>
<td>347 (9.9)</td>
</tr>
</tbody>
</table>

**Moderate and Vigorous Physical Activity, MET-hours (CHAMPS)**

<table>
<thead>
<tr>
<th></th>
<th>Fell one or more times</th>
<th>Did not Fall</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - &lt;10</td>
<td>690 (19.6)</td>
<td>529 (15.0)</td>
</tr>
<tr>
<td>10 - &lt;20</td>
<td>269 (20.5)</td>
<td>120 (9.1)</td>
</tr>
<tr>
<td>≥20</td>
<td>335 (20.9)</td>
<td>135 (8.4)</td>
</tr>
</tbody>
</table>
PAQ Physical Activity
Small ↓ in PA Falls ; Major ↓ in non-PA Falls

<table>
<thead>
<tr>
<th></th>
<th>Fell one or more times in past 12 months</th>
<th>Did not Fall (past 12 months)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Most recent fall was physical activity related</td>
<td>Most recent fall was unrelated to physical activity</td>
</tr>
<tr>
<td>All Physical Activity, MET-hours (CHAMPS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 - &lt;10</td>
<td>747 (20.4)</td>
<td>535 (14.6)</td>
</tr>
<tr>
<td>10 - &lt;20</td>
<td>282 (20.4)</td>
<td>138 (10.0)</td>
</tr>
<tr>
<td>≥20</td>
<td>263 (19.5)</td>
<td>110 (8.2)</td>
</tr>
<tr>
<td>Moderate and Vigorous Physical Activity, MET-hours (CHAMPS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 - &lt;10</td>
<td>962 (20.3)</td>
<td>630 (13.3)</td>
</tr>
<tr>
<td>10 - &lt;20</td>
<td>210 (20.4)</td>
<td>102 (9.9)</td>
</tr>
<tr>
<td>≥20</td>
<td>122 (18.1)</td>
<td>52 (7.7)</td>
</tr>
</tbody>
</table>
Summary

62% of Falls were related to Physical Activity (PA)
  - Predominantly walking outside the home

More Physical Activity was **NOT** associated with an Increased Risk of PA Falls

More Physical Activity **WAS** associated with Decreased Risk of non-PA Falls

Limitations
  - Self-report falls in past 12 months
  - Cross-sectional
Hypothetical “U”-shaped Relationship Between Physical Activity & Fall Risk

- Too Little Activity:
  - ↓ Muscle Function
  - ↓ Cardio-Respiratory Function
  - ↑ Fear of Falling
  - ↑ Gait Dysfunction
  - ↓ Neuromuscular Coordination
  - ↓ Social Integration

- Optimal Activity:
  - ↑ Muscle Function
  - ↑ Balance & Postural Stability
  - ↓ Fear of Falling

- Too Much Activity:
  - ↑ Exposure to Environmental Hazards
  - ↑ Fatigue
  - ↑ Overuse Injury

Level of Physical Activity:
- Too Little
- Optimal
- Too Much
**Observed Relationship Between Physical Activity & Fall Risk**

Older Adults may self-moderate Physical Activity that increases their Fall Risk.

- ↓ Muscle Function
- ↓ Cardio-Respiratory
- ↑ Fear of Falling
- ↑ Gait Dysfunction
- ↓ Neuromuscular Co-ordination
- ↓ Social Integration

- ↑ Muscle Function
- ↑ Balance & Postural Stability
- ↓ Fear of Falling

**Level of Physical Activity**

- **Too Little**
- **Optimal**
Next Steps
OPACH Presentations

1. GSA Nov. 2016 – PA and Incident Falls (Buchner)

2. Intl. Assn. of Gerontology and Geriatrics July 2017
   - MVPA and Falls (Buchner)
   - SB and Falls (Rosenberg)
   - Antihypertensive Medications and Falls (Margolis)
   - Self-efficacy and Falls (Hua)
   - Mortality and Falls (LaCroix/LaMonte)

3. ACSM June 2017 (Denver, CO)

4. ISBNPA June 2017 (Victoria, CA)

5. ICAMPAM June 2017 (Bethesda)
GSA Meeting
OPACH Papers in Progress

- 2 papers published so far
- 26+ manuscript proposals approved
- Primary paper on MVPA and incident falls to be submitted in summer 2016
- Primary paper on CVD and mortality outcomes to include events through 2016 and be submitted in 2017
NIH Grants using OPACH Data

1. WHISH U01 (Kooperberg, LaCroix, Stefanick)
2. WHISH-2-Prevent Heart Failure (Eaton)
3. Novel methods for analyzing accelerometry data (Di)
4. Unraveling Physical Activity and Sedentary Behavior Associations with Cancer Combining Two Cohorts (Evenson)
5. Sedentary Time Interrupted P01 (LaCroix, Kerr)
6. Evidence to Inform Guidelines Regarding Physical Activity and Sedentary Behavior to Reduce Fracture Risk in Older Women (Crandall)
7. Non-fracture fall-related injuries (Strotmeyer)
New WHI Investigators
Junior Faculty and Doctoral Students

• Aladdin Shadyab, PhD (LaCroix)
• John Belletiere (LaCroix)
• Kelsie Full (Kerr)
• Andrew Hua (Buchner)
• Dori Rosenberg, PhD (LaCroix)
• Priya Palta (Evenson)
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   William Haskell

Harvard
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UNC
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University of Buffalo
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UAB
   Beth Lewis

Johns Hopkins
   Ciprian Crainiceanu
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