24-Hour Activity Profiling in People Living with Arthritis: Habits Matter

Lynne M Feehan 1,2, Linda C Li 1,2, Na Lu 1 and Hui Xie 1,3
1) Arthritis Research Canada (ARC), 2) University of British Columbia (UBC), 3) Simon Fraser University (SFU).
Vancouver, BC, Canada

Background
- Too much sitting, too little light or higher intensity activity and too little or too much sleep are all associated with higher risk of all-cause mortality.1,3
- Interventions promoting changes in daily activity in adults living with arthritis tend to focus on supporting behavior change without consideration of an individual’s overall 24-hour activity profile.

Purpose
To identify:
1. 24-hour activity profiles in people living with arthritis.
2. Factors associated with 24-hour activity profile allocation.

Methods
Design: Secondary analysis baseline data from two randomized clinical trials studying effect of physical activity counselling for people with knee osteoarthritis (OA), rheumatoid arthritis (RA), or systemic lupus erythematosus (SLE).4,5

Self-reported Outcomes: Online surveys for age, sex, arthritis type, usual occupation, depression (PHQ-9 Depression scale), habitual sitting / walking behaviors (Self-reported Habit Index: SRHI).

Physical Activity: 24-hour activity measured by Sensewear Mini™ (Figure 1). Data included if 4 to 6 days with 20+ hours of wear. Data stratified by minutes off body, sleeping, resting, sitting, walking intermittently (< 50 steps / min) or walking purposefully (> 50 steps / min)

Statistical Analyses:
1. Latent Class Analysis (LCA) with Akaike’s and Bayesian Information Criterion (A/BIC) model fit analyses to define cluster number (SAS 9.4 software).
2. Multiple logistic regression, backward elimination, to identify factors predictive of cluster allocation relative to cluster with highest sitting (Odds Ratio, 95% CI) (SAS 9.4 software).

Results

Demographics: 172 individuals; mean age 58.1 years; 86% female; OA (30%), RA (49%), SLE (21%), mean daily steps 5990 (SD: 3234).

Cluster Allocation: (Figures 2, 3 & Table 1)
Relative to all participants [on average 11.3 hours sitting, 3.5 hours walking, 7.2 hours sleeping] we defined four distinct 24-hour activity profiles:
- Balanced Activity (n=40) [on average 9.4 hr sitting, 5.2 hr walking, 7.4 hr sleep]
- High Sleeping (n=45) [on average 10.4 hr sitting, 2.8 hr walking, 8.4 hr sleep]
- Low Sleeping (n=52) [on average 12.2 hr sitting, 3.9 hr walking, 6.5 hr sleep]
- High Sitting (n=35) [on average 13.2 hr sitting, 1.9 hr walking, 6.9 hr sleep]

Cluster Prediction: Age and habit strength for occupational sitting and walking outside predicted cluster allocation. Relative to individuals in the high sitting cluster, individuals in the other clusters were younger (OR: 0.95 to 0.98), had weaker occupational sitting habits (OR: 0.56 to 0.74) and stronger walking outside habits (OR: 1.09 to 1.43) (Table 2).

Table 1: Age, Sex, Daily Steps and Habit Strength x Cluster Allocation (mean (SD))

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Sex, Male (%)</th>
<th>Steps / day (mean (SD))</th>
<th>Sitting Habit – Usual</th>
<th>Sitting Habit – Home Leisure</th>
<th>Occupation</th>
</tr>
</thead>
<tbody>
<tr>
<td>54.9 (12.7)</td>
<td>12.5</td>
<td>9378.5</td>
<td>4.3 (1.5)</td>
<td>4.3 (1.3)</td>
<td>3.8 (1.8)</td>
</tr>
<tr>
<td>55.2 (14.2)</td>
<td>13.3</td>
<td>4229.1</td>
<td>4.8 (1.3)</td>
<td>4.7 (1.3)</td>
<td>4.7 (1.3)</td>
</tr>
<tr>
<td>60.5 (11.6)</td>
<td>7.7</td>
<td>2422.7</td>
<td>7.7 (1.8)</td>
<td>4.6 (1.6)</td>
<td>4.6 (1.6)</td>
</tr>
<tr>
<td>61.8 (15.0)</td>
<td>22.9</td>
<td>6706.0</td>
<td>7.7 (1.8)</td>
<td>4.5 (1.6)</td>
<td>7.7 (1.8)</td>
</tr>
</tbody>
</table>

Table 2: Prediction Factors x Cluster Allocation.

Odds Ratio (95% Wald Confidence Interval)

<table>
<thead>
<tr>
<th>Reference Cluster = High Sitting</th>
<th>Balanced Activity</th>
<th>High Sleeping Low Sleeping</th>
<th>High Sitting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Years)</td>
<td>0.95 (0.91-0.99)</td>
<td>0.98 (0.92-0.99)</td>
<td>1.09 (0.95-1.02)</td>
</tr>
<tr>
<td>Sex, Male (%)</td>
<td>1.06 (0.91-1.20)</td>
<td>1.00 (0.85-1.15)</td>
<td>1.10 (0.85-1.45)</td>
</tr>
<tr>
<td>Steps / day (mean (SD))</td>
<td>0.55 (0.41-0.76)</td>
<td>0.74 (0.55-1.01)</td>
<td>1.37 (1.04-1.79)</td>
</tr>
<tr>
<td>Sitting Habit – Usual</td>
<td>1.09 (0.83-1.43)</td>
<td>1.09 (0.83-1.43)</td>
<td>1.37 (1.04-1.79)</td>
</tr>
</tbody>
</table>

Factors eliminated from model: Sex, Type of Arthritis, Depression, and Home Leisure Sitting Habit

Conclusion
Tailoring activity interventions for individuals living with arthritis based on 24-hour activity profiles may be indicated; particularly in older adults with stronger habitual sitting or weaker habitual walking behaviors.