Assessing 24-Hour Physical (In)Activity and Sleep In People With Early Rheumatoid Arthritis

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Evidence Based Medicine (EBM)


Background

• UNCLEAR how daily physical (in)activity is affected in people living with rheumatoid arthritis (RA) using ‘objective’ measures.¹

• Accelerometers: Provide ‘objective’ measures of PA.

• ‘Objective’ measures will help us understand the relationship between physical activity and sedentary lifestyle and poor health outcomes in RA.


Purpose

24-hour Differences

Primary: Examine time spent at different intensity of PA (day) and sleep (night).

Secondary: Explore ‘Selected’ PA and sleeping behaviors.

People living with recently diagnosed RA compared to age and gender matched healthy peers
**Methods**

**Well In Hand Study:**

*Bone Health and Physical Activity (PA) in Early RA (ERA)*

**Design:**
- Prospective, Longitudinal (1-year), Cohort (ERA vs. Non-RA)

**Recruitment:** Adults (19 y+)
- RA: Dx by rheumatologist with RA in last year
- Controls: Age and gender matched (no inflammatory arthritis)

**Excluded:** No consent, Unable read / speak English.

**Baseline (Cross sectional) PA Data**

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Feethan L et al, ACR / AHRP 2012
```

**Methods (Data Processing)**

**Primary:**
- Raw data downloaded Sensewear Professional (v 7)
- Exported to Excel (v 19)
- Extracted time (min) in 8 categories

<table>
<thead>
<tr>
<th>Night - Sleep</th>
<th>Day ~ Off body</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sedentary (≤ 1.6 METs)</td>
<td>Light (1.6-3 METs)</td>
</tr>
<tr>
<td>Mod_3 (3-4 METs)</td>
<td>Mod_4 (4.5-5 METs)</td>
</tr>
<tr>
<td>Mod_5 (≥ 5 METs)</td>
<td>Vig_6 + (≥ 6 METs)</td>
</tr>
</tbody>
</table>


**Secondary:**
- Defined & Extracted
- ‘Bouted’ Sedentary: ≥ 20 min (Sustained)
- ‘Bouted’ MVPA: ≥ 10 min (1 min tolerance)
- Day Sleep (min)
- Day Steps (#)

**Additional Features**
- Accurate Off-Body time (On / Off Switch).
- Sleep Detection (Proprietary Algorithm).
- Reliable and Valid estimates of Energy Expenditure in people living with RA.
- Excellent ability to differentiate between Sedentary and Light PA

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2. Almeida et al, Phys Ther. 2011
```

**Primary Analysis:**
- 2 x 8 MANOVA (SAS v 9.2)
  - Initial: RA Status-Overall Difference (Multivariate Wilks’ Lambda F-test)
  - Post-hoc: 8 Factors-Individual Differences (Univariate F-tests / 15 Means)

**Hypotheses:**
- ERA / Non-ERA Sig Diff; ERA > (Sleep, Sed, Light) & ERA < (3+ METs)

**Methods (Data Analyses)**

**Secondary Analyses:**
- Selected PA Behaviors (SPSS v 19)
- Non-MVPA vs. MVPA Behaviors: Between Group Differences (Paired St T-test)

**Hypotheses:**
- ERA > Non-MVPA ‘Behaviors’ & ERA < MVPA ‘Behaviors’

**Results**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>RA (n=30)</th>
<th>Non-RA (n=30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>Mean [SD], range</td>
<td>Mean [SD], range</td>
</tr>
<tr>
<td>Male/Female</td>
<td>6, 24</td>
<td>6, 14</td>
</tr>
<tr>
<td>BMI [kg/m²]</td>
<td>Mean [SD], range</td>
<td>Mean [SD], range</td>
</tr>
<tr>
<td>24.8 (4.4), 19 to 38</td>
<td>23.6 (4.6), 17 to 44</td>
<td></td>
</tr>
</tbody>
</table>

**RA Group:**
- 73% RF or anti-CCP positive
- Time Since Dx: Mean 8 m (SD:5)
- Low Functional Limitation and Disease Activity
  - HAQ [DI: Mean 0.6 (SD:0.6); Pain VAS: Mean 21 (SD: 16)]
  - Fatigue [MAF-GFI: Mean 22.5 (SD: 10.9)]
  - ≤ 10 Tender & Swollen Joints [Mean 2.9 (SD: 2.7)]

**ALL Early DMARDs / 50% Glucocorticoids** (No Biologics)
Results

**Excluded PA Data:** \( n=6, \) 3 pairs (< 4 days wear)

**Included PA Data:** \( n=54, \) 27 pairs

- # days worn (min 4, max 6): 5.8 d (SD: 0.2)] (Both Groups)
- # hours / day :
  - ERA 23.52 h (14.36)
  - Non-RA 23.52 h (10.67)

### Results

**MVPA (\( \geq 3 \) METs)**

<table>
<thead>
<tr>
<th></th>
<th>ERA</th>
<th>NON-RA</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERA 1 ¼ Hours <strong>LESS MVPA</strong></td>
<td><strong>1.7 h</strong></td>
<td><strong>2.9 h</strong></td>
</tr>
<tr>
<td>ERA LESS (65% vs. 75%)</td>
<td><strong>Bouted MVPA</strong></td>
<td><strong>MVPA [( \geq 4 ) h]</strong></td>
</tr>
<tr>
<td>ERA LOWER Intensity (3.7 vs. 4.2 METs)</td>
<td><strong>Bouted MVPA</strong></td>
<td><strong>Steps</strong></td>
</tr>
<tr>
<td>ERA LESS (6500 vs. 9500)**</td>
<td><strong>Steps</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Results

**ALL Sedentary (Night + Day)**

<table>
<thead>
<tr>
<th></th>
<th>ERA</th>
<th>NON-RA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ERA 30 min MORE</strong></td>
<td><strong>Night + Day SLEEP</strong></td>
<td><strong>ERA 30 min MORE (( \geq 10 ) min)</strong></td>
</tr>
</tbody>
</table>

### Results

**Non-MVPA (< 3 METs)**

<table>
<thead>
<tr>
<th></th>
<th>ERA</th>
<th>NON-RA</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERA 1 ¼ Hours <strong>MORE Non-MVPA</strong></td>
<td><strong>7.6 h</strong></td>
<td><strong>7.3 h</strong></td>
</tr>
<tr>
<td>ERA <strong>MORE</strong></td>
<td><strong>ER 20 min</strong></td>
<td><strong>ERA 40 min</strong></td>
</tr>
<tr>
<td>ERA <strong>MORE</strong></td>
<td><strong>ERA 15 min</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Discussion

**Consistent Recent Publications**

- RA More Sedentary & Less MVPA
  - Prioreshci et al, 2013, *Rheum*
  - Paul et al, 2013, *Scand J Rheum*
**Strengths**
- SenseWear Mini to examine 24-hour differences in physical (in)activity and sleep in individuals living with and without ERA

**Limitations**
- Small n = 54 (27 pairs)
- Powered ‘Imaging’ not ‘Sedentary’
- No adjustments for multiple comparisons

**Clinical Implications:**
- Important to monitor PA participation and sedentary lifestyle behaviours in individuals living with Early RA.
- Accelerometry may contribute to our ability to monitor and inform PA recommendations in the clinic.

**Future Research Plans:**
- Longitudinal Changes / Differences - 12 months.
- Association PA and Bone Health, Fatigue, Functioning and RA Disease Status.

**Conclusions**
People living with recently diagnosed RA have markedly different overall patterns of sleep and physical (in)activity throughout their day compared to age and gender matched peers.

ERA: More Sleep and Less MVPA participation

Trends towards more Sedentary time