Portico Project Highlight-
Presence and Impact of Sleep and Rest-Activity Rhythms in Adolescents with Juvenile-Onset Fibromyalgia (JFM)

Wearable devices are frequently used to characterize sleep or physical activity. Dr. King’s group has been using actigraphs, which use an accelerometer to detect movement, to identify differences in sleep in youth with chronic pain. To assist in the ability to process large numbers of actigraphy files efficiently and reproducibly and to enable us to derive new sleep and 24-hour metrics, we developed a computational pipeline using the open-source R programming language (R Core Team, 2021).

Greater variability in sleep timing or duration have been associated with poor outcomes in several adult conditions, including Fibromyalgia. In our small pilot study in youth with JFM, we demonstrated differences in the total time asleep (e.g., duration) with the JFM group spending more time sleeping (see Table). In addition, the JFM group exhibited greater variability in sleep duration (moderate effect size), suggesting evidence of greater irregularity in sleep patterns. Our pipeline can use daily activity counts to calculate an individual’s 24-hour pattern of rest and activity, known as rest-activity rhythms (RAR). There is mounting evidence that disturbances in RARs (e.g., irregular rhythms, low daily activity, delayed activity) are associated with poorer health outcomes. Using our pilot data, we generated RAR profiles (see Figure A). Overall, youths with JFM exhibited lower activity levels, and later timing of activity was associated with greater pain intensity and pain sites in the JFM group (r’s = 0.35 to 0.55). Group differences in activity over 24 hours can also be represented visually (Figure B), which shows lower activity during the day, particularly in the afternoon.

<table>
<thead>
<tr>
<th>Sleep Metric</th>
<th>Control</th>
<th>JFM</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sleep Duration</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average (minutes)*</td>
<td>411.24 (± 44.78)</td>
<td>446.60 (± 76.25)</td>
<td>0.57</td>
</tr>
<tr>
<td>Intra-Individual Variability (minutes)</td>
<td>72.48 (± 26.52)</td>
<td>83.17 (± 33.24)</td>
<td>0.36</td>
</tr>
<tr>
<td><strong>Bedtime (Sleep Onset)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Timing (HH:MM)</td>
<td>11:53 pm (± 47.5)</td>
<td>11:45 pm (± 62.9)</td>
<td>0.15</td>
</tr>
<tr>
<td>Intra-Individual Variability (minutes)</td>
<td>62.1 (± 27.2)</td>
<td>63.9 (± 24.0)</td>
<td>0.07</td>
</tr>
<tr>
<td><strong>Rise Time (Sleep Offset)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Timing (HH:MM)</td>
<td>7:29 am (± 64.9)</td>
<td>7:58 am (± 85.1)</td>
<td>0.38</td>
</tr>
<tr>
<td>Intra-Individual Variability (minutes)</td>
<td>78.6 (± 33.7)</td>
<td>84.8 (± 33.4)</td>
<td>0.19</td>
</tr>
</tbody>
</table>

In future projects, we hope to extend our pilot data with a larger cohort and adapt our pipeline to accept other actigraphy devices. We are using our pipeline to characterize sleep and RARs at CCHMC following intensive interdisciplinary treatment for high impact chronic pain and percutaneous nerve stimulation for functional abdominal pain. Finally, we are open to new collaborations around the analysis of actigraphy data for Pediatric Musculoskeletal Diseases (PMSKD)—please reach out if you are interested!
PORTICO NEWSLETTER  VOLUME 2 ISSUE 1  January 2022

The Next Generation of Researchers-PORTICO Supports Summer Interns

PORTICO is offering to support 2 Summer Undergraduate Research Fellowships (SURF) or Biomedical Research Internships for Minority Students (BRIMS) in 2022.

If you have a PMSKD project and would like support for a summer student, send us a short summary of your project with the tasks that could be delegated to the summer student.

Please submit your application by February 15th to portico@cchmc.org.

Pilot and Feasibility Grant 2022 RFA

The PORTICO Executive Committee is pleased to announce that we are seeking applications as part of the PORTICO’s Pilot and Feasibility Program. While research in all pediatric musculoskeletal diseases are welcome, there is a special interest in pilot studies involving children with juvenile idiopathic arthritis, childhood-onset lupus, and juvenile fibromyalgia syndromes. Please apply by downloading the application form and submitting to portico@cchmc.org.

One award will be funded this year and applications are due April 30, 2022. The awardee will be notified in June with funding starting in July 2022. Support may include salary, supplies, and/or PORTICO Core services, up to a maximum of $30,000 per year of direct plus indirect costs.

PORTICO has supported three previous Pilot and Feasibility projects:
Scott Bonnette, PhD, in the Division of Sports Medicine at CCHMC investigated the movement profiles of patients with the study *JFM and activity avoidance’s effect on maladaptive biomechanics*.

Kristen Jastrowski Mano, PhD, Associate Professor of Psychology at UC, is currently examining Executive Functioning in Juvenile-Onset Fibromyalgia.

Mark DiFrancesco, PhD, Associate Professor of Radiology at CCHMC, is using the award to study Effect of Low-Dose Methotrexate on Brain Microstructure.

Large Datasets Available

PORTICO would like to highlight 2 large data sets available for researchers. The PORTICO methodologic core can provide support for data queries and analysis. For more information on these resources please reach out to us at portico@cchmc.org.

- TriNetX combines real world data from 120+ institutions for researchers
  - Both CCHMC and UC participate in TriNetX by providing medical records data
  - CCHMC users can access CCHMC data only
  - UC users can access entire network (80M+ pts)

- National Covid Cohort Collaborative (N3C) national data resource for COVID-19
  - The full list of available data includes demographics, symptoms, labs, etc.
  - Has data on a large number of patients including pediatric patients
PORTICO Metrics

The PORTICO Executive committee uses the following metrics to measure the impact PORTICO is having on the Pediatric Musculoskeletal Diseases (PMSKD) research community. Metrics are updated twice a year to document our progress.

<table>
<thead>
<tr>
<th>METRIC</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membership</td>
<td>63</td>
</tr>
<tr>
<td>Projects requesting Core support</td>
<td>24</td>
</tr>
<tr>
<td>PORTICO Seminars</td>
<td>22</td>
</tr>
<tr>
<td>Manuscripts acknowledging support</td>
<td>9</td>
</tr>
<tr>
<td>Publications by PORTICO Members</td>
<td>975</td>
</tr>
<tr>
<td>Grant applications from Core Support</td>
<td>6</td>
</tr>
<tr>
<td>Funded investigators from PORTICO community</td>
<td>32</td>
</tr>
<tr>
<td>National PMSKD researcher collaboration</td>
<td>15</td>
</tr>
</tbody>
</table>

Seminar Series

PORTICO has sponsored 22 seminars to date. If you missed any of the seminars or would like to watch a presentation again, please visit the PORTICO website. Email portico@cchmc.org to get the password to the archive page.

Upcoming Seminars:

02/03/2022 Dr. Heidi J. Sucharew: *Introduction to Latent Class Analysis: a latent variable approach to modeling in research*

03/11/2022 Dr. Jean Liew: *COVID Impacts on Persons with Rheumatic Conditions*

03/14/2022 Dr. Emily von Scheven: TBD

03/23/2022 Dr. Kristin Fisher: *Diagnostics of inflammatory brain diseases*

04/04/2022 Dr. Richard Ittenbach: TBD

For more information regarding PORTICO visit our website or contact us at portico@cchmc.org.

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