The Sedentary Time and Activity Reporting Questionnaire (STAR-Q):
A comprehensive tool to assess sedentary behaviour and activity energy expenditure

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ICDAM8 Rome, Italy
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Background

- Need for tools that assess all domains and dimensions of physical activity in large populations.

- 23 physical activity questionnaires validated against doubly labeled water for activity energy expenditure (TEE-REE) (Neilson et al. AJCN 2008).

- The Recent Physical Activity Questionnaire re-designed from EPIC—Norfolk PAQ (Besson et al. AJCN 2010).
Measuring Activity Related Energy Expenditure (MAREE) Study objectives:

- To develop a questionnaire specifically for the assessment of overall activity energy expenditure and sedentary behaviour.
- To test its validity and reliability.
Sedentary Time and Activity Reporting Questionnaire (STAR-Q)

- STAR-Q queries all domains of past-month activities for duration, frequency and intensity.

- Sedentary behaviour, posture (sitting/standing/reclining), stair-climbing, and sleeping duration also captured.

- Past-Year Total Physical Activity Questionnaire data reported by 18,000 participants in the Tomorrow Project used to identify common activities in design of the STAR-Q.
STAR-Q cognitive interviewing

- One-on-one interviews.
- Audio-taped.
- Six rounds of interviews.
- Five rounds of STAR-Q revisions.

Journal of Physical Activity and Health: in press
This questionnaire asks about your **physical activity and inactivity throughout the 24 hour period** during the **past 4 weeks (28 days)**.

Please tell us about the past 4 weeks even if your activities during this time were different than usual for you.

The questionnaire is organized into 15 sections, each asking about different types of activities in your life:

1. How to complete the questionnaire ............... 2
2. Sleeping and napping .............................. 4
3. Eating ............................................ 6
4. Personal and Medical Care ....................... 8
5. Occupation and Volunteer Work ............... 9
6. Transportation and Moving About ............. 14
7. Household ........................................ 17
8. Yard Work ....................................... 21
9. Caregiving ....................................... 24
10. Exercise, Sports and Leisure .................. 26
11. Light Leisure and Relaxing ...................... 31
12. Other Activities ................................ 34
13. Using the Stairs ................................ 36
14. Final Questions .................................. 37
15. Comments ...................................... 38
OCCUPATION AND VOLUNTEER WORK
The activities we take part in while working or volunteering fall into one of three categories: we sit, we stand or we move about.

But the effort we put into each type of activity can vary - we might sit quietly at a desk or we might drive a heavy truck while sitting. We might stand to do photocopying or we might stand to shovel grain.

Look through the examples below to locate the type of activities you did at your paid or volunteer job(s) over the past 4 weeks so that you can choose them on the charts on the next pages.

<table>
<thead>
<tr>
<th>Type of Activity</th>
<th>Examples of types of work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting, light effort</td>
<td>light office work, sitting in meetings, using a computer, driving a car, chemistry lab work, light use of hand tools, watch repair, light assembly, reading</td>
</tr>
<tr>
<td>Sitting, medium effort</td>
<td>driving a heavy truck, bus or tractor, operating heavy levers or heavy equipment, riding a mower/forklift, crane operator, teaching yoga while seated</td>
</tr>
<tr>
<td>Standing, light effort</td>
<td>bartender, store clerk, filing, photocopying, assembling, standing and talking at work</td>
</tr>
</tbody>
</table>

Paid or Volunteer Job #1: Please list your job title or describe your job:

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Choose the main activities at this job (choose all that apply) | Number of days in the past 4 weeks? | Average time per day you took part in this activity
--- | --- | ---
Sitting, light effort | [ ] days in past 4 weeks | [ ] hours [ ] minutes
Sitting, medium effort | [ ] days in past 4 weeks | [ ] hours [ ] minutes
Standing, light effort | [ ] days in past 4 weeks | [ ] hours [ ] minutes
MAREE Study validation and reliability testing:

- DLW Day 0
- DLW Day 14
- 3-months post-DLW Day 14
- 6-months post-DLW Day 14

TEE/AEE Validation

Reliability

- STAR-Q1
- STAR-Q2
- STAR-Q3

7-Day Physical Activity Diary (Started Day 15)

Participant recruitment and eligibility:

- from the Tomorrow Project and the community
- men and women 30 to 60 years of age.
- living in Calgary and vicinity.
- body mass index \( \leq 35 \).
- weight stable.
- not diagnosed with cancer or metabolic disorder
- not on medication that modifies water balance.
- not pregnant or breastfeeding.

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Reliability testing

1 vs 2
(n=95)

2 vs 3
(n=92)

STAR-Q1
Baseline
(n=102)

STAR-Q2
3-months
(n=100)

STAR-Q3
6-months
(n=100)

1 vs 3
(n=96)

Statistical tests:

• Intraclass correlation coefficients [ICCs (95% confidence intervals)]

• Exclusion of outliers: implausible reports.
## Results: Participants’ characteristics

<table>
<thead>
<tr>
<th>Characteristic [mean (SD)]</th>
<th>Men n=41</th>
<th>Women n=61</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>50.6 (6.9)</td>
<td>46.0 (8.6)</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>25.9 (3.1)</td>
<td>23.5 (2.9)</td>
</tr>
<tr>
<td>Percent body fat (BIA)</td>
<td>21.8 (6.2)</td>
<td>30.7 (6.5)</td>
</tr>
</tbody>
</table>

**Employment at enrollment (%):**

| Paid or volunteer work StarQ1 | 93.2 | 93.0 |
| Paid or volunteer work StarQ2 | 93.4 | 90.5 |
| Paid or volunteer work StarQ3 | 90.7 | 89.7 |
## Results: Energy expenditure [median(IQR)]

<table>
<thead>
<tr>
<th></th>
<th>STARQ1 n=102</th>
<th>STARQ2 n=96</th>
<th>STARQ3 n=97</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEE (kcal; KJ)</td>
<td>3235 (1295)</td>
<td>3251 (1090)</td>
<td>3282 (1105)</td>
</tr>
<tr>
<td></td>
<td>13,544 (5,422)</td>
<td>13,611 (4,564)</td>
<td>13,741 (4,626)</td>
</tr>
<tr>
<td>AEE (kcal; KJ)</td>
<td>1199 (628)</td>
<td>1242 (697)</td>
<td>1281 (643)</td>
</tr>
<tr>
<td></td>
<td>5020 (2629)</td>
<td>5200 (2918)</td>
<td>5363 (2692)</td>
</tr>
<tr>
<td>Total MET-hrs/d</td>
<td>30 (13)</td>
<td>32 (15)</td>
<td>32 (14)</td>
</tr>
<tr>
<td>PAL (TEE/RMR)</td>
<td>1.9 (0.6)</td>
<td>1.9 (0.8)</td>
<td>2.0 (0.8)</td>
</tr>
</tbody>
</table>
Hours reported for sleep and awake activities.

![Bar chart showing hours reported for sleep and awake activities.](chart.png)

**Legend:**
- Sleep Time ($\text{METs} \leq 1.5$)
- Sedentary Time ($1.5 < \text{METs} \leq 3.0$)
- Light Time ($3.0 < \text{METs} \leq 6.0$)
- Moderate Time ($\text{METs} > 6.0$)

**Groups:**
- STAR-Q1
- STAR-Q2
- STAR-Q3

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ICCs (95% CI) for TEE, AEE and MET-hours of sedentary, light, moderate and vigorous activities

<table>
<thead>
<tr>
<th>Energy Expenditure/Activity</th>
<th>STAR-Q 1 vs 2</th>
<th>STAR-Q 1 vs 3</th>
<th>STARQ 2 vs 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEE</td>
<td>0.83 (0.76;0.88)</td>
<td>0.73 (0.62;0.81)</td>
<td>0.76 (0.66;0.83)</td>
</tr>
<tr>
<td>AEE</td>
<td>0.73 (0.62;0.81)</td>
<td>0.60 (0.46;0.71)</td>
<td>0.62 (0.48;0.73)</td>
</tr>
<tr>
<td>Sedentary time: ≤1.5 METs</td>
<td>0.53 (0.37;0.66)</td>
<td>0.45 (0.28;0.59)</td>
<td>0.57 (0.42;0.69)</td>
</tr>
<tr>
<td>Light: &gt;1.5 to ≤3 METs</td>
<td>0.60 (0.46;0.71)</td>
<td>0.55 (0.40;0.67)</td>
<td>0.67 (0.54;0.77)</td>
</tr>
<tr>
<td>Moderate: &gt;3 to ≤6 METs</td>
<td>0.45 (0.28;0.60)</td>
<td>0.51 (0.35;0.64)</td>
<td>0.36 (0.17;0.52)</td>
</tr>
<tr>
<td>Vigorous: &gt;6METs</td>
<td>0.65 (0.52;0.75)</td>
<td>0.52 (0.36;0.65)</td>
<td>0.59 (0.44;0.71)</td>
</tr>
</tbody>
</table>
Hours reported for leisure, occupation, and transportation-related sitting.
## ICCs (95% CI) for leisure, occupation and transportation–related sitting MET-hours

<table>
<thead>
<tr>
<th>Activity</th>
<th>STAR-Q 1 vs 2</th>
<th>STAR-Q 1 vs 3</th>
<th>STAR-Q 2 vs 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leisure (Sit ≤1.5 METs)</td>
<td>0.56 (0.41;0.68)</td>
<td>0.33 (0.14;0.50)</td>
<td>0.46 (0.28;0.61)</td>
</tr>
<tr>
<td>Occupational (Sit ≤2.5 METs)</td>
<td>0.69 (0.57;0.78)</td>
<td>0.69 (0.57;0.78)</td>
<td>0.71 (0.59;0.80)</td>
</tr>
<tr>
<td>Occupational (Sit ≤1.5 METs)</td>
<td>0.71 (0.60;0.80)</td>
<td>0.72 (0.61;0.80)</td>
<td>0.72 (0.61;0.80)</td>
</tr>
<tr>
<td>Transportation (Sit ≤2.5 METs)</td>
<td>0.24 (0.04;0.42)</td>
<td>0.49 (0.32;0.63)</td>
<td>0.28 (0.08;0.46)</td>
</tr>
<tr>
<td>Transportation (Sit ≤1.5 METs)</td>
<td>0.25 (0.05;0.43)</td>
<td>0.29 (0.10;0.46)</td>
<td>0.41 (0.23;0.57)</td>
</tr>
</tbody>
</table>
The cognitively tested STAR-Q has demonstrated moderate to substantial reliability for the estimations of:

- **Sedentary, light** and **vigorous** intensity MET-hours of activity.
- **Leisure-time** and **occupational sitting**.
- **Total and activity energy expenditure.**
Next steps

- Compare TEE/AEE estimates with DLW-derived TEE/AEE estimates (gold-standard).

- Compare domain-, intensity- and posture- specific activities reported on the STAR-Q with Seven-Day Diaries.

- Additional validation: against accelerometers.

- Development of web-based STAR-Q.

- MAREE II: Past-year SIT-Q (Dr. Brigid Lynch).
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- Alberta Cancer Research Institute
Thank you!

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