

Construct validation of the Leisure Time Physical Activity Questionnaire for people with SCI (LTPAQ-SCI)

Martin Ginis, Kathleen A; Ubeda-Colomer, Joan; Alrashidi, Abdullah; Nightingale, Tom E.; Au, Jason; Currie, Katharine ; Hubli, Michele; Krassioukov, Andrei

DOI:

[10.1038/s41393-020-00562-9](https://doi.org/10.1038/s41393-020-00562-9)

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Document Version

Peer reviewed version

Citation for published version (Harvard):

Martin Ginis, KA, Ubeda-Colomer, J, Alrashidi, A, Nightingale, TE, Au, J, Currie, K, Hubli, M & Krassioukov, A 2020, 'Construct validation of the Leisure Time Physical Activity Questionnaire for people with SCI (LTPAQ-SCI)', *Spinal Cord*. <https://doi.org/10.1038/s41393-020-00562-9>

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2 Construct Validation of the Leisure Time Physical Activity Questionnaire for People with SCI

3

(LTPAQ-SCI)

4

5 Kathleen A. Martin Ginis^{1,2,3}, Joan Úbeda-Colomer^{2,3}, Abdullah A. Alrashidi^{2,4,5}, Tom E.6 Nightingale^{1,2,6}, Jason S. Au⁷, Katharine D. Currie^{2,8}, Michèle Hubli^{2,9}, Andrei Krassioukov^{1,2,10}

7

8 ¹Department of Medicine, Division of Physical Medicine and Rehabilitation, University of9 British Columbia, Canada; ²International Collaboration on Repair Discoveries (ICORD),10 University of British Columbia, Canada; ³School of Health and Exercise Sciences, University of11 British Columbia, Canada; ⁴Experimental Medicine, Department of Medicine, University of12 British Columbia, Canada; ⁵Physical Therapy Department, King Fahad Medical City, Saudi13 Arabia; ⁶School of Sport, Exercise and Rehabilitation Sciences, University of Birmingham, UK;14 ⁷Department of Kinesiology, University of Waterloo, Canada; ⁸Department of Kinesiology,15 Michigan State University, USA; ⁹Spinal Cord Injury Center, Balgrist University Hospital,16 University of Zurich, Switzerland; ¹⁰GF Strong Rehabilitation Centre, Vancouver Coastal

17 Health, Canada

18 Corresponding author: Kathleen A. Martin Ginis (kathleen_martin.ginis@ubc.ca)

19

20 **Abstract**

21 **Study design.** Cross-sectional construct validation study.

22 **Objectives.** To test the construct validity of the Leisure Time Physical Activity Questionnaire
23 for People with Spinal Cord Injury (LTPAQ-SCI) by examining associations between the scale
24 responses and cardiorespiratory fitness (CRF) in a sample of adults living with spinal cord injury
25 (SCI).

26 **Setting.** Three university-based laboratories in Canada.

27 **Methods.** Participants were 39 adults (74% male; *M* age: 42±11 years) with SCI who completed
28 the LTPAQ-SCI and a graded exercise test to volitional exhaustion using an arm-crank
29 ergometer. One-tailed Pearson's correlation coefficients were computed to examine the
30 association between the LTPAQ-SCI measures of mild-, moderate-, heavy-intensity and total
31 minutes per week of LTPA and CRF (peak volume of oxygen consumption [$\dot{V}O_{2\text{peak}}$] and peak
32 power output [PO_{peak}]).

33 **Results.** Minutes per week of mild-, moderate- and heavy-intensity LTPA and total LTPA were
34 all positively correlated with $\dot{V}O_{2\text{peak}}$. The correlation between minutes per week of mild
35 intensity LTPA and $\dot{V}O_{2\text{peak}}$ was small-medium ($r = .231, p = .079$) while all other correlations
36 were medium-large (r s ranged from .276 to .443, p s < .05). Correlations between the LTPAQ-
37 SCI variables and PO_{peak} were also positive but small (r s ranged from .087 to .193, p s > .05),
38 except for a medium-sized correlation between heavy-intensity LTPA and PO_{peak} ($r = .294, p =$
39 .035).

40 **Conclusions.** People with SCI who report higher levels of LTPA on the LTPAQ-SCI also
41 demonstrate greater levels of CRF, with stronger associations between moderate- and heavy-
42 intensity LTPA and CRF than between mild-intensity LTPA and CRF. These results provide

43 further support for the construct validity of the LTPAQ-SCI as a measure of LTPA among
44 people with SCI.

45 **Introduction**

46 Participation in exercise, sports and other forms of leisure-time physical activity (LTPA) has
47 significant positive effects on the fitness, health and well-being of people living with spinal cord
48 injury (SCI)^{1,2,3}. However, the vast majority of people with SCI are insufficiently active to derive
49 these benefits⁴ because they face so many barriers to participation⁵. Consequently, there is a need
50 to develop, test and implement strategies to increase LTPA participation in people living with
51 SCI.

52 Reliable and valid measures of LTPA are required to assess the effectiveness of LTPA-
53 enhancing interventions. Review articles^{6,7,8} have catalogued the measurement properties of
54 wearable and self-report physical activity measures that have been used in SCI research.
55 Although the reliability and validity of wearable measures is improving, a significant limitation
56 of these devices is that they cannot distinguish between LTPA and other types of physical
57 activity (e.g., household, transportation, occupational activity)⁷. Because LTPA is the only form
58 of physical activity that has been shown to significantly improve fitness in people with SCI¹, it is
59 crucial that scientists have valid and reliable methods to measure it. Another limitation of some
60 wearable devices (e.g., wrist-worn accelerometers), is that they underestimate the intensity of
61 wheeled activity on slopes and rough, uneven surfaces^{9,10,11}. The SCI exercise guidelines¹²
62 stipulate that exercise must be done at a moderate- to heavy-intensity in order to achieve
63 significant health and fitness benefits. Systems that track SCI exercise guideline adherence
64 require valid and reliable measures of the amount of activity performed at moderate- and heavy-
65 intensities. Given the limitations of wearable devices, self-report measures are considered

66 superior for feasibly collecting data on the types and amounts of LTPA performed by people
67 with SCI⁷.

68 Compared to all other measures of PA used in SCI research, the Physical Activity Recall
69 Assessment for People with SCI (PARA-SCI)¹³ has yielded the strongest evidence of reliability
70 and validity^{7,8,14}. Using a structured, standardized interview format, respondents are cued to
71 recall and rate the intensity of all LTPA and activities of daily living (ADL) that they have
72 performed over the previous 3 days¹⁵. The PARA-SCI has demonstrated positive evidence of
73 criterion validity (using both indirect calorimetry and doubly-labeled water as criteria), construct
74 validity and test-retest reliability^{13,16,14}. However, because the PARA-SCI was designed to
75 capture the types, frequencies, intensities and durations of *all* physical activities, it can create
76 unnecessary participant and clinician/researcher burden in situations where investigators are
77 interested only in measuring LTPA⁷. In response to these concerns, the Leisure Time Physical
78 Activity Questionnaire for People with SCI (LTPAQ-SCI) was developed¹⁷.

79 The LTPAQ-SCI is an SCI-specific, self-report assessment of LTPA that measures the
80 number of minutes of mild, moderate, and heavy intensity LTPA that a person performed over
81 the previous 7 days¹⁷. It can be self- or interviewer-administered in less than 5 minutes. The
82 reporting format used in the LTPAQ-SCI parallels the reporting structure of one of the most
83 widely used self-report measures of PA in the general population--the International Physical
84 Activity Questionnaire-Short Form¹⁸.

85 Research has produced positive evidence of the LTPAQ-SCI's test-retest reliability.
86 Intraclass correlation coefficients were significant for LTPAQ-SCI measures of mild, moderate,
87 heavy and total LTPA over a one-week test-retest period¹⁷. A recent study of the test-retest
88 reliability of a Canadian-French version of the questionnaire produced similarly strong ICCs¹⁹.

89 Evidence of the measure's criterion validity was shown by significant correlations between
90 LTPAQ-SCI measures of mild, moderate, heavy and total LTPA minutes per week and PARA-
91 SCI measures (i.e., the criterion) LTPA minutes per day at these same intensities¹⁷.

92 Support for the LTPAQ-SCI's construct validity has been generated in hypothesis-testing
93 studies²⁰. For example, LTPAQ-SCI measures of LTPA have been shown to increase
94 significantly in response to LTPA-enhancing interventions delivered to adults with SCI²¹ and
95 multiple sclerosis²². LTPAQ-SCI measures of LTPA have also been shown to differ in predicted
96 directions between adults with SCI with low versus high depressive symptomatology,²³ and
97 between athletes with disabilities who participate in sport at lower (recreational, developmental)
98 versus higher (provincial, state, national) competitive levels²⁴. It is important to note, however,
99 that construct validation is an ongoing process, and no one single experiment can 'prove'
100 construct validity²⁰. Rather, each supportive study serves to strengthen the construct's
101 nomological network,²⁵ by demonstrating that the construct operates predictably within a system
102 of key concepts.

103 Cardiorespiratory fitness (CRF) is a key concept in relation to LTPA. It is well-established
104 that participation in moderate- to heavy-intensity exercise (a specific type of LTPA) imparts
105 significant improvements in the CRF of adults with SCI^{1,26}. If the LTPAQ-SCI is to be used as a
106 measure of LTPA, then its construct validation should include tests of its associations with CRF
107 (these types of tests are sometimes referred to as tests of 'convergent validity'²⁰). Therefore, the
108 purpose of the present study was to examine the association between the number of minutes per
109 week of mild, moderate, heavy and total LTPA reported by adults with SCI who completed the
110 LTPAQ-SCI, and their CRF. It was hypothesized that number of minutes per week of LTPA
111 would be positively correlated with participants' CRF.

112 **Method**

113 **Participants**

114 Participants were 51 individuals who completed the LTPAQ-SCI and CRF assessment during
115 baseline testing for CHOICES (NCT01718977), a multicentre, randomized controlled clinical
116 trial assessing the effects of two different exercise interventions on cardiovascular health
117 outcomes in adults with SCI²⁷. This construct validation study was planned *a priori*, as a
118 secondary analysis of data that were being collected as part of the CHOICES protocol.

119 CHOICES study inclusion criteria were: male or female; 18-60 years of age; chronic (>1 year
120 since injury), traumatic, motor-complete SCI [American Spinal Injury Association Impairment
121 Scale (AIS) A and B]; and neurological level of injuries (NLI) between the cervical fourth and
122 thoracic sixth vertebrae (C4-T6). AIS and NLI were determined using the International
123 Standards for neurological Classification of SCI²⁸. Participants were excluded if they had: any
124 medical history of symptoms of cardiovascular disease; major trauma or surgery in the last six
125 months; fracture within the previous 12 months; or any psychological or cognitive dysfunction
126 that prevented understanding English instructions. All study procedures were approved by the
127 research ethics board at each trial site and all participants provided written informed consent
128 prior to any of the study procedures.

129 **Measures**

130 *LTPAQ-SCI*. The LTPAQ-SCI was administered during an interview conducted by a
131 research assistant (face-to-face interview at two sites and telephone interview at one site).
132 Consistent with the LTPAQ-SCI administration instructions,¹⁷ participants were first presented
133 with a standardized definition of LTPA: “physical activity that you choose to do during your free
134 time, such as exercising, playing sports, gardening, and taking the dog for a walk (necessary

135 physical activities such as physiotherapy, grocery shopping, pushing/wheeling for transportation
136 are not considered LTPA).” Next, participants were given a validated,¹³ SCI-specific definition
137 of mild-intensity LTPA and were asked to recall a) the number of days, over the past 7 days, that
138 they did mild-intensity LTPA and b) on those days, how many minutes they usually spent doing
139 mild-intensity LTPA. These steps were repeated for moderate-intensity and heavy-intensity
140 LTPA. Mild-intensity activities were defined as “activities that require you to do very light work.
141 You should feel like you are working a little bit but overall you shouldn’t find yourself working
142 too hard.” Moderate-intensity activities were defined as “activities that require some physical
143 effort. You should feel like you are working somewhat hard but you should feel like you can
144 keep going for a long time”. Finally, heavy-intensity activities were defined as “activities that
145 require a lot of physical effort. You should feel like you are working really hard (almost at your
146 maximum) and can only do the activity for a short time before getting tired. These activities can
147 be exhausting”. The number of minutes per week of LTPA performed at each intensity (mild,
148 moderate and heavy) was calculated by multiplying the days of activity by the minutes of
149 activity. Total LTPA was calculated as a sum of LTPA at each intensity, thus yielding the total
150 number of minutes of LTPA undertaken in the past week.

151 *Cardiorespiratory fitness (CRF)*. All participants underwent an incremental exercise test
152 using an electronically braked arm-crank ergometer (Lode BV, Groningen, The Netherlands;
153 Vancouver site, Monark 881E, Monark Exercise AB, Vansbro, Sweden; Toronto and Hamilton
154 sites) until the point of volitional exhaustion. Heart rate was recorded continuously using a chest
155 strap HR monitor (T31; Polar Electro Inc., Woodbury, NY, USA). Respiratory gases were
156 collected using a metabolic cart that was calibrated, prior to each use, according to the
157 manufacturer’s instructions (Parvomedics Truemax 2400, Sandy, Utah, USA; Vancouver site:

158 Vmax Encore, SensorMedics, California, USA; Toronto site: Moxus Metabolic System, AEI
159 Technologies, Illinois, USA; Hamilton site).

160 Participants were asked to empty their bladders prior to the test to minimize the influence
161 of autonomic dysreflexia. The test protocol began with a warm-up of arm cranking at 0 Watts for
162 two minutes. Afterwards, the protocol continued with 1-minute stages, with a resistance
163 increment of 5-10 Watts per stage depending on the participant's neurological level of injury²⁹.
164 Participants were instructed to maintain a cycling cadence of 50 revolutions per minute (rpm)
165 throughout the duration of the test with continuous motivation delivered by the assessor. The test
166 continued to the point of volitional exhaustion or when the cadence dropped below 30 rpm.
167 Borg's rating of perceived exertion (RPE) 6-20 was administered at the end of every stage³⁰.
168 The highest volume of oxygen consumption ($\dot{V}O_2$) of 20-second averaging during the test was
169 recorded as peak volume of oxygen consumption ($\dot{V}O_{2\text{peak}}$). Peak power output (PO_{peak}) was
170 defined as the highest PO achieved, unless volitional exhaustion occurred within 20-seconds of
171 the beginning of the stage, in which case PO_{peak} was recorded as the PO at the second-last
172 completed stage of the test.

173 **Procedure**

174 At two sites (Hamilton and Vancouver), the LTPAQ-SCI was administered during the
175 baseline testing session, prior to the CRF test. At one site (Toronto), the LTPAQ-SCI was
176 administered 8 days after the fitness test but before starting exercise in the CHOICES trial. This
177 timing was deliberate to avoid participants reporting any LTPA that was performed as part of the
178 CHOICES baseline testing or training protocols.

179 *Data Management and Analyses*

180 The respiratory exchange ratio (RER) was used to corroborate attainment of $\dot{V}O_{2\text{peak}}$
181 during the fitness test. Analyses were conducted only on participants who exhibited an RER \geq
182 1.00, representing a conservative yet reliable lower-range of expected peak RER responses in
183 SCI and healthy adults^{29,31}. People with tetraplegia cannot achieve the same $\dot{V}O_{2\text{peak}}$ and PO_{peak}
184 as people with paraplegia due to more severe autonomic and upper-body motor impairments³².
185 Consequently, the distributions of these values differ for people with tetraplegia versus
186 paraplegia³². Therefore, the measures of CRF (i.e. $\dot{V}O_{2\text{peak}}$ and PO_{peak}) were standardized for
187 lesion level (i.e., paraplegia or tetraplegia) through transformations to z-scores prior to analysis.

188 Descriptive statistics were calculated as means, standard deviations, medians and
189 minimum-maximum for continuous variables, and as percentages for the categorical variables.
190 Shapiro Wilk tests were used to check the normality assumption. Because the LTPAQ-SCI
191 variables presented significant deviations from the normal distribution, a square root
192 transformation was carried out on these variables. Using the transformed variables, one-tailed
193 Pearson correlation coefficients were calculated between the LTPAQ-SCI measures of mild,
194 moderate, heavy and total LTPA and the measures of CRF (i.e. $\dot{V}O_{2\text{peak}}$ and PO_{peak}). Since the
195 hypotheses were directional (i.e. all the correlations were expected to be positive), one-tailed
196 tests were used. All analyses were conducted using IBM SPSS Statistics v. 26. Alpha was set at
197 .05 for all analyses and was not adjusted for multiplicity given that all hypotheses were specified
198 a priori (cf.³³). Cohen's conventions were used to interpret the magnitude of the correlations (i.e.,
199 *rs* of .10, .30, .50 constitute small, medium and large correlations, respectively)³⁴.

200 **Results**

201 **Preliminary analyses**

202 After excluding data from 12 participants who did not achieve $RER \geq 1.00$, 39
203 participants remained for the main analyses. Excluded participants presented significantly lower
204 PO_{peak} and VO_{2peak} values than the included ones. In addition, all excluded participants had
205 tetraplegia. No significant differences were found between excluded and included participants
206 regarding sex, age, age at injury, time since injury, body mass or height, or LTPAQ-SCI values.
207 Exploratory analyses indicated neither age nor years since injury were significant bivariate
208 correlates of PO_{peak} or VO_{2peak} . In exploratory regression analyses, neither age nor years since
209 injury were significant predictors of any LTPAQ-SCI variable. Therefore, for parsimony, these
210 variables were not included in subsequent analyses. Subsequent analyses were conducted with
211 data from the remaining 39 participants. Table 1 shows the demographic data for both the full
212 sample and the final sample, as well as the p -values of the tests performed to detect potential
213 differences between included and excluded participants

214 **Correlations between the LTPAQ-SCI measures of LTPA and aerobic fitness**

215 Table 2 presents the full correlation matrix. Minutes per week of mild-, moderate- and
216 heavy-intensity LTPA and total LTPA were all positively correlated with $\dot{V}O_{2peak}$. The
217 correlation between $\dot{V}O_{2peak}$ and mild-intensity LTPA was small-medium ($r = .231, p = .079$),
218 while the correlations of $\dot{V}O_{2peak}$ with moderate-intensity LTPA ($r = .276, p = .045$) and heavy-
219 intensity LTPA ($r = .443, p = .002$) were medium-large.
220 Correlations between the LTPAQ-SCI variables and PO_{peak} were also positive. However, the
221 correlations of PO_{peak} with mild-intensity LTPA ($r = .087, p = .300$) and moderate-intensity
222 LTPA ($r = .193, p = .119$) were trivial to small, while the correlation between heavy-intensity
223 LTPA and PO_{peak} ($r = .294, p = .035$) was medium-sized.

224 **Discussion**

225 The purpose of this study was to conduct a test of the construct validity of the LTPAQ-SCI.
226 As hypothesized, minutes per week of LTPA reported on the LTPAQ-SCI were positively
227 correlated with participants' CRF. Correlations tended to be stronger for heavy versus mild-
228 intensity LTPA and for $\dot{V}O_{2\text{peak}}$ than for PO_{peak} .

229 Overall, the pattern and size of the correlations were similar to correlations reported between
230 CRF and other self-report measures of PA for people with and without SCI. For instance, in prior
231 tests of the PARA-SCI's construct validity,¹⁶ correlations between CRF and moderate- and
232 heavy-intensity LTPA were medium-sized, while the correlation between CRF and mild-
233 intensity LTPA was small. These findings align with research demonstrating that in order to
234 produce significant CRF benefits, adults with SCI must exercise at a moderate- to heavy-
235 intensity¹. Exercise of a mild intensity is insufficient³⁵. Our results show that the LTPAQ-SCI
236 does indeed capture CRF-enhancing LTPA in adults with SCI.

237 Our results are also similar to the medium-sized correlations reported in validation studies of
238 the IPAQ-SF, one of the most widely-used self-report measures of PA for the general population.
239 For instance, across three studies that reported correlations between the IPAQ-SF measure of
240 total minutes per week of PA and $\dot{V}O_{2\text{max}}$, the median correlation was $r = .30$ ³⁶. We found a
241 correlation of $r = .33$ between LTPAQ-SCI total LTPA and $\dot{V}O_{2\text{peak}}$. It is worth noting that only
242 ~50% of the variance in CRF can be explained by environmental factors, such as physical
243 activity, with the rest attributed to hereditary/genetic factors³⁷. Furthermore, additional variance
244 in CRF within the SCI population can be attributed to the severity and exact level of neurological
245 injury sustained, contributing to the degree of autonomic and functional impairment³⁸. Thus, it is
246 encouraging to observe similar, if not slightly better, associations between LTPA and $\dot{V}O_{2\text{peak}}$ in

247 individuals with high-level SCI, supporting the construct validity of the LTPAQ-SCI in the
248 context of other well-used self-report measures of PA.

249 Our analyses suggested that LTPA was more strongly correlated with $\dot{V}O_{2\text{peak}}$ than PO_{peak} .
250 This finding differs from results from the PARA-SCI validation studies in which CRF tended to
251 be more strongly correlated with PO_{peak} than $\dot{V}O_{2\text{peak}}$ ¹⁶. These discrepancies are likely a statistical
252 artefact. There was greater variability in PO_{peak} values in the PARA-SCI validation study than in
253 the present study. When data variability is reduced, correlations may be lower than expected³⁹.
254 Nevertheless, as the correlations with PO_{peak} were all positive, and stronger for moderate- and
255 heavy-intensity LTPA than mild-intensity LTPA, we take this as further support for the construct
256 validation of the LTPAQ-SCI as a measure of CRF-enhancing LTPA.

257 Importantly, scale validation studies do not confirm that the scale itself is valid. No study can
258 ‘validate’ a scale. Rather, validation studies substantiate the inferences that can be made about
259 people based on their scale scores (e.g., the amount of LTPA they do each week)²⁰ and that the
260 scale is valid for use with a particular group of people in a particular context²⁰. The present study
261 was conducted with a sample of men and women with chronic, motor complete cervical or high
262 thoracic injuries. Although we would expect the results to generalize to individuals with
263 incomplete, lower-level injuries,¹⁶ this hypothesis should be tested in heterogenous samples.

264 There is also a need to conduct LTPAQ-SCI validation studies in countries other than
265 Canada, because definitions of LTPA may differ across cultural contexts⁴⁰. For instance, the
266 instructions for completing the LTPAQ-SCI stipulate that physiotherapy should not be counted.
267 This stipulation is included because during development of the PARA-SCI and LTPAQ-SCI,
268 many of the physiotherapy activities reported by Canadians with SCI, were neither leisure-time
269 nor fitness-enhancing activities (e.g., passive stretching, practicing transfers, practicing using

270 mobility equipment)¹⁵. However, in other countries or contexts, physiotherapy may routinely
271 include exercise or sport activities and may therefore be counted as LTPA. In a similar vein,
272 active transportation is uncommon among Canadians with SCI⁴¹ because climate, terrain and
273 long distances are significant barriers. In some countries, however, it may be more common for
274 people with SCI to use active forms of transportation (e.g., handcycling in European countries⁴²)
275 in order to get exercise. In these circumstances, it may make sense to report such activities on the
276 LTPAQ-SCI. By testing the relationships between CRF and LTPAQ-SCI scores, including and
277 excluding physiotherapy and active transportation activities, users of the LTPAQ-SCI can better
278 define and measure LTPA in their contexts.

279 Strengths of this study include standardized administrations of the LTPAQ-SCI and the
280 CRF test. While multi-site data collection was a strength insofar as it facilitated participant
281 enrolment and statistical power, it may also be considered a limitation that introduced variability
282 through different CRF testing equipment and testers at each site. A further limitation is that only
283 one aspect of physical fitness was measured. Muscular strength and endurance are two additional
284 physical fitness aspects that should correlate positively with LTPAQ-SCI scores¹⁶ and should be
285 examined in future construct validation studies. Furthermore, if study participants engaged
286 primarily in strength-training LTPA (e.g., lifting weights), the correlation between their LTPAQ-
287 SCI measure of minutes per week of LTPA and their CRF may have been attenuated relative to
288 individuals who engaged primarily in CRF-enhancing LTPA (e.g., arm cycling).

289 Another study limitation is that data collected from nearly half of the tetraplegic
290 participants (12 out of 27) could not be used because they terminated the CRF test before
291 achieving criteria indicative of a peak exercise test (i.e., RER \geq 1.00). Because of arm fatigue
292 during exercise testing, peripheral ratings of perceived exertion increase much faster in those

293 with tetraplegia than paraplegia⁴³ prompting participants to terminate the test before achieving
294 peak. Given this challenge, researchers should consider other feasible, valid measures of CRF
295 that could be used in LTPAQ-SCI construct validation studies involving participants with
296 tetraplegia, for example, individualized ramp tests, submaximal aerobic endurance, or
297 submaximal predictive equations such as the 6-minute arm test validated for individuals with
298 SCI⁴⁴. An alternative construct validation approach may be to assess associations between
299 LTPAQ-SCI scores and 7-day overall physical activity levels measured via wearable devices.
300 While limitations of accelerometers attached to a single anatomical location or wheelchair have
301 been noted in people with SCI^{7,9}, the estimation of physical activity intensity can be improved by
302 utilising multi-sensor devices that incorporate physiological signals (such as galvanic skin
303 responses or heart rate) and utilising complex or individualised modelling approaches^{45,46}.
304 Combined with the use of diaries or logs to distinguish periods of LTPA from other physical
305 activity types, assessing the associations between outputs from multi-sensor wearable devices
306 and the LTPAQ-SCI may be a way to test the validity of this measure while overcoming some of
307 the challenges noted with assessing CRF in individuals with tetraplegia.

308 In conclusion, the results of the present study demonstrate that self-reported LTPA, as
309 measured by the LTPAQ-SCI, is positively correlated with CRF in adults with chronic, motor
310 complete cervical or high thoracic SCI, being the associations stronger for moderate- and heavy-
311 intensity LTPA. When considered with previous research showing that LTPAQ-SCI scores vary
312 in predictable ways across meaningful groups and in response to behavioural interventions^{17,19-24},
313 these results provide further support for the construct validity of the LTPAQ-SCI as a measure of
314 LTPA for adults with SCI. Further construct validation studies are needed to demonstrate the

315 validity of the LTPAQ-SCI for use as a measure of LTPA in more heterogeneous samples of
316 people with SCI and in other countries and contexts.

317 **Data archiving:** The datasets generated during and/or analysed during the current study
318 are available from the corresponding author on reasonable request.

319 **Acknowledgements:** We thank Adrienne Sinden for her assistance with manuscript
320 preparation.

321 **Ethics:** Ethics approval was obtained from the University of British Columbia (H12-
322 02945-11), McMaster University (12-672) and Toronto Rehabilitation Institute – University
323 Health Network (12-5797).

324 **Conflict of interest:** The authors declare that they have no conflict of interest.

325 **Author contributions:** KAMG was responsible for conceptualizing and designing the
326 study, interpreting results and writing the report. JU-C was responsible for analyzing the data,
327 writing the results, creating tables and providing feedback on the report. AAA was responsible
328 for collecting and cleaning the data, drafting the methods section and providing feedback on the
329 report. TEN was responsible for assisting during data collection, drafting the methods section,
330 assisting with data interpretation, and providing feedback on the report. JSA was responsible for
331 assisting in the design of the study protocol, drafting the methods section, assisting with data
332 interpretation, and providing feedback on the report. KDC was responsible for assisting during
333 data collection and providing feedback on the report. MH was responsible for assisting during
334 data collection and providing feedback on the report. AK is the Principal Investigator for the
335 CHOICES study and was responsible for designing and overseeing implementation of all aspects
336 of the CHOICES protocol and providing feedback on the report.

337 **Funding:** This study was funded by a project grant from the Canadian Institutes of
338 Health Research (CIHR) with the funding reference number (TCA 118348). The first author
339 holds the Reichwald Family Southern Medical Program Chair in Chronic Disease Prevention.

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529 Table 1. Characteristics of Participants in the Full Sample and the Analyzed Sample and p-
 530 values of Tests to Detect Differences Between Included and Excluded Participants.

	Excluded (n=12) n (% total); M \pm SD; Median, min-max	Analyzed Sample (n=39) n (% total); M \pm SD; Median, min-max	p-value
Sex			.964
Male	9 (75%)	29 (74%)	
Female	3 (25%)	10 (26%)	
Age (years)	40 \pm 10 42, 23-58	42 \pm 10 43, 22-60	.638
Age at injury (years)	25 \pm 9 22, 15-49	29 \pm 14 25, 3-57	.252
Years post-injury	16 \pm 11 14, 2-30	13 \pm 11 10, 1-42	.502
Level and severity of injury			<0.001
Tetraplegia AIS A	8 (67%)	8 (21%)	
Tetraplegia AIS B	4 (33%)	7 (18%)	
Paraplegia AIS A	0	24 (61%)	
Body mass (kg)	76.3 \pm 19.1 74.0, 46.9-101.9	79.2 \pm 17.3 78.5, 44.9-135.7	.764
Height (cm)	180 \pm 13 181, 158-200	175 \pm 8 176, 158-188	.201
BMI (kg/m ²)	23.33 \pm 4.04 23.95, 15.43-28.83	25.87 \pm 5.44 25.57, 16.49-42.83	.203
VO _{2peak} (mL/kg/min)	7.97 \pm 1.66 7.53, 5.49-11.70	13.93 \pm 5.49 13.60, 6.07-29.84	<.001
PO _{peak} (Watts)	28 \pm 16 28, 10-61	60 \pm 28 60, 10-130	.001
Mild LTPA (min/wk)	152 \pm 148 98, 10-450	221 \pm 308 135, 0-1680	.555
Moderate LTPA (min/wk)	61 \pm 89 28, 0-240	115 \pm 124 60, 0-480	.093
Heavy LTPA (min/wk)	45 \pm 115 0, 0-405	60 \pm 96 20, 0-480	.260
Total LTPA (min/wk)	260 \pm 226 188, 10-730	395 \pm 431 240, 0-2405	.291

531 AIS is the ASIA Impairment Scale. BMI is Body Mass Index. $\dot{V}O_{2peak}$ is peak volume of oxygen
 532 consumption and PO_{peak} is peak power output during the cardiorespiratory fitness test. LTPA is
 533 Leisure Time Physical Activity.

534 Table 2. Correlation Matrix Showing Pearson Correlation Coefficients for Cardiorespiratory Fitness and LTPAQ-SCI Measures of
 535 Mild, Moderate, Heavy and Total Leisure-Time Physical Activity (LTPA)

<i>Measure</i>	VO _{2peak}	PO _{peak}	Mild LTPA	Moderate LTPA	Heavy LTPA	Total LTPA
VO _{2peak} (mL/kg/min)	1					
PO _{peak} (Watts)	.773**	1				
Mild LTPA (min/wk)	.231	.087	1			
Moderate LTPA (min/wk)	.276*	.193	.315*	1		
Heavy LTPA (min/wk)	.443**	.294*	.225	.499**	1	
Total LTPA (min/wk)	.330*	.176	.815**	.729**	.591**	1

536 Note. *p<0.05; **p<0.01 (one-tailed).

537 LTPAQ-SCI is the Leisure Time Physical Activity Questionnaire-Spinal Cord Injury. VO_{2peak} is peak volume of oxygen consumption
 538 and PO_{peak} is peak power output during the cardiorespiratory fitness test.