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Original article

Canadian-French adaptation and test-retest reliability of the leisure time physical activity questionnaire for people with disabilities

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ABSTRACT

Objectives: The Leisure Time Physical Activity Questionnaire (LTPAQ) measures the duration of physical activities performed during the past 7 days, and results are expressed in minutes. This study aimed to translate this questionnaire into Canadian-French and to evaluate the content validity and its test-retest reliability in people with physical disabilities.
Methods: The LTPAQ was translated from English to French by forward and backward translation. To assess content validity, 9 adults with physical disabilities read and provided comments regarding the relevance, wording and understanding of the items of the preliminary Canadian-French version of the questionnaire. For test-retest reliability, 37 adults with physical disabilities completed the questionnaire 2 or 3 times at T1 (baseline), T2 (2 days from baseline) and T3 (7 days from baseline). The test–retest reliability was investigated by intra-class correlation coefficients (ICCs), paired *t* test and Bland and Altman tests.
Results: The translation and the content validation process resulted in a Canadian-French version of the LTPAQ (LTPAQ-CF). Total LTPAQ-CF scores between T1-T2 and T1-T3 featured strong ICCs, 0.90 and 0.75 ($P \leq 0.01$). Paired *t* tests and Bland and Altman analyses confirmed the good reproducibility of results.
Conclusion: The LTPAQ-CF has good test–retest reliability when self-administered or administered by interview to people with physical disabilities.

1. Introduction

Physical activity is part of a healthy lifestyle and can reduce secondary complications in people with physical disabilities [1–5]. Physical activity guidelines aiming to improve personal health have been established for different age groups and various populations [6]. However, studies show that a high percentage of people with physical disabilities are inactive and do not meet the guidelines [7–10].

Leisure time physical activity (LTPA) is defined as any physical activity people choose to do in their free time [4,11,12]. It can be assessed with standardized questionnaires such as the LTPA questionnaire (LTPAQ) for people with spinal cord injury [12]. This questionnaire assesses 3 main characteristics of LTPA performed in the past 7 days: type (cardiovascular or strengthening), duration (number of days and minutes/day), and intensity (mild, moderate and heavy). Then, the total time (in minutes) can be calculated for each physical activity intensity and exercise type [11,12]. The original English version of the LTPAQ has demonstrated construct validity and test-retest reliability in people with spinal cord injury [11]. With data collected from 103 men and women with spinal cord injury, the authors demonstrated statistically significant and positive correlations between scores on this questionnaire and the Physical Activity Recall Assessment [13]. A subset of 35 participants

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who completed the LTPAQ a second time, 7 days later, allowed for assessing its test-retest reliability, which was evidenced by significant intraclass correlation coefficients (ICCs) [11]. The LTPAQ for people with spinal cord injury showed promise as a measure of physical activity that can be administered by interview or self-administered in less than 5 min.

However, to our knowledge, no French version of this questionnaire is available, which would help in quickly assessing the level of physical activity in French-speaking communities. Even though translation methods allow for the creation of versions of questionnaires in other languages, the measurement properties of any language-adapted version must be investigated. Indeed, to ensure accurate measurements, the adaptation process of a questionnaire-based instrument should include not only translation but also assessment of measurement properties [14–16]. Moreover, the validation of the LTPAQ for multiple diagnoses is necessary for this instrument to be used as a generic tool for assessing physical activity in people with disabilities.

This study aimed to:

- translate the LTPAQ into Canadian-French (CF);
- examine its content validity;
- evaluate the test–retest reliability of the new CF version in people with physical disabilities.

2. Materials and Methods

This study was approved by the local ethics review board and all participants provided written informed consent before inclusion.

The study was conducted in 3 phases. Phase 1 consisted of translating the LTPAQ into CF by using the recommended forward and backward translation method [17,18]. Phase 2 consisted of examining the content validity, the extent to which a questionnaire reflects the concept or variable to be measured [19]. This phase allowed for evaluating the relevance and validity of the items and the accuracy of their wording as a physical activity questionnaire for people with physical disabilities. Finally, phase 3 investigated the test-retest reliability of the new LTPAQ-CF. The methodological procedures of each phase are described in detail below.

2.1. Phase 1: Translation

First, 2 members of the research team verified whether the terminology used in the original questionnaire (English) included any cultural terms that might be inappropriate in the target language (CF). Then, the English questionnaire was independently translated into CF by 2 bilingual research assistants with knowledge of physical activity. The resulting CF version was translated back into English by 2 other bilingual research assistants blinded to the original English version of the questionnaire. The results were compared and any discrepancies in translations were highlighted. Then, during a consensus meeting, a committee of experts in physical activity reviewed all differences resulting from the parallel translations and agreed on the best CF wording. Finally, all translated terms were checked to ensure coherence in the whole questionnaire. This process yielded a preliminary CF version of the questionnaire.

2.2. Phases 2 and 3: Content validation and test-retest reliability

2.2.1. Participants

A convenience sample of 46 adults with chronic physical disabilities after different diagnoses (spinal cord injury, $n = 8$; stroke, $n = 11$; arthritis, $n = 8$; multiple sclerosis, $n = 8$; traumatic brain injury, $n = 6$; cerebral palsy, $n = 3$; and fibromyalgia, $n = 2$) was recruited through a community organisation to participate in phases 2 and 3 of the study. Eligible participants had physical disability and:

- were at least 18 years of age;
- identified French as their primary language;
- were able to read and understand written French;
- were able to complete a questionnaire (i.e., presenting no cognitive disorders that could compromise self-reported responses).

From the sample, 9 participants were involved in content validity analysis of the preliminary LTPAQ-CF (phase 2) and 37 in test–retest reliability evaluation (phase 3). Table 1 shows characteristics of both sub-samples.

2.2.2. Procedure for content validity analysis

Before a focus group, the 9 participants were asked to read and answer all of the items in the questionnaire individually to report any ambiguous wording that in their opinion may be open to various interpretations and potentially affect the accuracy of responses. They were also asked to determine the relevance of the items and to suggest new wording if necessary. During the focus group, participants discussed any concerns regarding the questionnaire completion.

Discussions were guided by the following questions:

- what do you think about the leisure time physical activity questionnaire in general?
- were any of the questions too long?
- were any of the questions unclear or hard to understand?
- do you think the questions were adapted to your situation? Why?
- what changes would you like to make to the questionnaire?

Participants' comments about the questionnaires were collected and analyzed. The resulting version was resubmitted to the participants for a second round of content validity assessment.

2.2.3. Procedure for test-retest reliability analysis

Participants completed the new CF version of the questionnaire 2 or 3 times at baseline (T1) and again 2 days (T2) and 7 days (T3) later. The questionnaire was self-administered or completed during an interview with a research assistant. Participants who could not attend our facilities for all assessment times during the data collection period or those who needed assistance in writing down their minutes of activity were assessed by interview. During the interview, the interviewer completed the questionnaire based on oral answers provided by the participant. Considering the chronic nature of the conditions of participants, we hypothesized that no significant change would be observed within a week (T1 and T3). However, because the questionnaire refers to the last 7 days, respondents might refer to different weeks at T1 and T3, which may cause non-reproducible answers if participants' physical activity routine varied during 2 consecutive weeks. To ensure the collection of test-retest data within the same reference week, another intermediate assessment time was added, so that the T2 measurement (2 days after T1) overlapped the T1 reference time. Before the addition of the intermediate assessment (T2), 7 participants had completed T1 and T3. Nevertheless, we analyzed data from all participants, including the 7 participants who had completed only 2 assessment times.

2.3. Statistical analysis

Analyses involved using SPSS v23 (SPSS Inc., Chicago, IL). Intraclass correlation analyses (2-way random effects, absolute agreement, single rater/measurement) were performed to examine

Table 1
Characteristics of participants.

Characteristics	Phase 2: Content validity analysis ($n = 9$)		Phase 3: Test-retest reliability analysis ($n = 37$)	
	Mean (SD)	n (%)	Mean (SD)	n (%)
Age (year)	54.9 (10.6)		58.7 (11.6)	
Duration since disability onset (years)	17.3 (10.3)		17.8 (15.6)	
Diagnoses				
Spinal cord injury		1 (11.1)		7 (18.9)
Stroke		2 (22.2)		9 (24.3)
Arthritis		–		8 (21.6)
Multiple sclerosis		4 (44.4)		4 (10.8)
Traumatic brain injury		2 (22.2)		4 (10.8)
Cerebral palsy		–		3 (8.1)
Fibromyalgia		–		2 (5.4)
Sex				
Men		6 (66.6)		18 (48.6)
Women		3 (33.3)		19 (51.3)
Marital status				
Married/common law		1 (11.1)		14 (37.8)
Single/divorced		8 (88.8)		23 (62.1)
Education level				
University		3 (33.3)		12 (32.4)
College		1 (11.1)		7 (18.9)
High school or less		5 (55.5)		18 (48.6)
Main occupation				
Employed		2 (22.2)		6 (16.2)
Retired		1 (11.1)		16 (43.2)
Unemployed		6 (66.6)		15 (40.5)
Mobility assistive aids				
Motorized wheelchair		2 (22.2)		8 (21.6)
Manual wheelchair		4 (44.4)		5 (13.5)
Assistive device (cane or quadripod)		2 (22.2)		10 (27)
None		1 (11.1)		14 (37.8)
Self-reported level of activity				
Active		6 (66.6)		13 (35.1)
Moderately active		2 (22.2)		17 (45.9)
Slightly active/inactive		1 (11.1)		7 (18.9)
Modality of physical activity practice				
Group-based activities		–		18 (48.6)
Individual activities with assistance		–		6 (13.5)
Individual activities without assistance		–		13 (35.1)
Time spent doing physical activity per week (minutes)	360 (336)		312 (222)	

the correlation between reported minutes of total, mild, moderate, and heavy LTPA at different measurement times and by administration method (self-report and interview). The minimum detectable change (MDC) was computed for 2- and 7-day interval test-retest analyses. We used Wilcoxon tests to assess mean rank differences between the 2 measurement times, for each intensity level and by administration method. Finally, Bland and Altman plots were used as alternative and supporting analyses to explore the reliability of the measurements between assessment times by intensity level.

3. Results

3.1. Phase 1

During the expert committee meeting to review the translations, immediate consensus was obtained for 7 of 18 questionnaire items. For the remaining 11 items, consensus was reached on 7 after discussion, and minor wording changes were made for 4. The number of items in the translated version remained the same as in the English version of the questionnaire.

3.2. Phase 2

During the focus group and individual interviews, participants raised concerns about the translated version of the questionnaire. All 9 participants reported that questions were too long and difficult to understand. They also suggested adding more concrete examples of aerobic and strength training activities. As a result of this analysis and to reduce the perceived burden of reading the questions, the format of the preliminary LTPAQ-CF was modified, with all items displayed in a 1-page table. Then, this modified version was resubmitted to the participants to validate the new format. Comments were obtained from individual interviews, with 6 of the 9 participants reporting their satisfaction with the new 1-page graphical questionnaire. Mainly, they reported that the wording was easy to understand and the table format made the reading of the questions easier than the initial 2-page text. Filling in the boxes in the table seemed to simplify the provision of answers to each item. The full version of the LTPAQ-CF is available in the supplementary data.

3.3. Phase 3

Participants reported 312 min of LTPA per week, on average, by using the LTPAQ-CF. Overall, the proportion was higher for participants with moderate- than mild- or heavy-intensity activities at each measurement time (Tables 2 and 3).

3.3.1. Reliability of the LTPAQ-CF by physical activity intensity

Correlations between T1 and T2 were high for total scores and sub-scores for mild, moderate and heavy physical activity intensity (ICC = 0.72–0.92; $P \leq 0.01$) (Table 2). Between T1 and T3 (Table 3),

Table 2
Average scores, *t* test and intraclass correlations coefficients (ICCs) between T1 and T2 (2-day interval; $n = 30$).

Physical activity intensity level	Test 1 (min/wk) Mean (SD)	Test 2 (min/wk) Mean (SD)	Difference (min/wk) Mean (SD)	*P*-value (Wilcoxon)	MDC (min/wk)	ICC
Mild	90.8 (179.7)	102.8 (189.0)	−12.0 (75.0)	0.42	143	0.92*
Moderate	194.5 (169.1)	170.67 (128.1)	23.8 (111.7)	0.68	249	0.72*
Heavy	52.7 (76.3)	44.3 (78.1)	8.3 (35.1)	0.27	69	0.90*
Total	338.0 (326.1)	317.8 (307.5)	20.2 (139.3)	0.84	279	0.90*

MDC: minimal detectable change.
* $P \leq 0.01$.

Table 3
Average scores, *t* test and ICCs between T1 and T3 (7-day interval; $n = 37$).

Physical activity intensity level	Test 1 (min/wk) Mean (SD)	Test 3 (min/wk) Mean (SD)	Difference (min/wk) Mean (SD)	*P*-value (Wilcoxon)	MDC (min/wk)	ICC
Mild	70.3 (186.7)	79.3 (159.4)	−9.1 (161.8)	0.72	339	0.57*
Moderate	184.6 (196.3)	170.8 (169.8)	13.8 (149.5)	0.33	312	0.67*
Heavy	47.4 (79.4)	66.1 (125.9)	−18.7 (100.3)	0.47	149	0.54*
Total	299.9 (289.7)	316.2 (309.6)	−16.4 (211.9)	0.63	398	0.75*

MDC: minimal detectable change.
* $P \leq 0.01$.

ICC values were lower for total and sub-scores (0.55–0.75; $P \leq 0.01$). However, we found no significant difference ($P \geq 0.27$) within the 2-day or 7-day test–retest interval (Tables 2 and 3). These tables also present the MDC for the 2- and 7-day intervals. In some cases, such as for the 7-day interval (Table 3), MDC values were higher than the mean values for total LTPA.

3.3.2. Reliability of the LTPAQ-CF by administration method

Table 4 presents reliability indices by questionnaire administration method: interview and self-report. Between T1 and T2, ICCs ranged from 0.85 to 0.99 for the total score and all sub-scores for interview-administered questionnaires and from 0.68 to 0.90 for self-reported questionnaires. Between T1 and T3 (7-day interval), inconsistencies were more marked and correlations were lower than between T1 and T2, but the ICCs were still moderate to very high for the interview method (0.61–0.93) and moderate to high for the self-report method (0.51–0.75). The mean differences were not statistically significant for both methods ($P \geq 0.22$).

Finally, Bland and Altman analyses showed that in all cases, no more than 3 participants had scores outside of the 95% limit of agreement, which indicates overall good reproducibility of results. In addition to ICC and paired *t* test, the Bland and Altman plot confirmed that participants provided reliable and consistent information regarding the minutes spent in LTPA when completing the CF version of the questionnaire. As highlighted in Fig. 1, participants reported more minutes of physical activity performed at moderate than mild and heavy intensity.

4. Discussion

The main aim of this study was to create a Canadian-French version of the LTPAQ, the LTPAQ-CF. This goal was achieved with 3 phases. This 3-phase cross-cultural adaptation study resulted in reducing the original 2-page questionnaire into a single-page questionnaire with all items summarized in a table (supplementary data). This new CF version exhibited good content validity and moderate to excellent reliability according to 2- and 7-day test-retest analyses. We also confirmed that the questionnaire can be administered by interview and self-report methods.

The translation-validation process we used led to consensus regarding the most appropriate CF wording that best reflected the English language items. This study was based on well-known methods for translating questionnaires [17,18,20]. Following these recommended step-by-step approaches led to validation of the LTPAQ-CF. As in many other studies [21,22], the accuracy in the translation was optimized by the independent forward and backward translation. The pre-test of the preliminary LTPAQ-CF allowed for resolving issues regarding the readability and usability of the questionnaire for people with various physical disabilities. These methods have been recommended [17,18] and used by many other studies that reported on the translation and validation of questionnaires [21,23]. Our sample of people with physical disabilities provided valuable comments that led to a concise and clearer CF version of the questionnaire. Synthesizing the questionnaire into 1 page reduced the perceived burden of its completion. This synthesis is very important especially for people with disabilities. Indeed, the length of a questionnaire and redundancy in wording are potential threats to the reliability of self-reported scores. Despite some studies reporting conflicting evidence regarding the validity and reliability of recalling physical activity, [24–26] simple and short questionnaires may prove higher reliability [27,28].

As part of the validation process, this study also examined the test-retest reliability of the questionnaire over 2-day and 1-week periods and with 2 different administration modes: interview and self-report. Overall, the LTPAQ-CF exhibited good test-retest reliability, with significant and high correlation coefficients. Similar to the study by Martin Ginis et al. (2012), investigating the reliability of the original English version of the questionnaire, [11] our results confirm that recall of physical activity over a 1-week period with the LTPAQ-CF is reliable. People can recall activity over the past 7 days, [29,30] even though from their systematic review, Doma et al. (2017) recommended caution when interpreting physical activity level with questionnaires [31]. Other studies have examined the evaluation of the test-retest reliability of physical activity questionnaires, and the results are comparable to our findings. Van der Ploeg demonstrated good test–retest reliability ($r = 0.77$) with the Physical Activity Scale for Individuals with a Physical Disability questionnaire completed by people with different physical disabilities on a self-report basis over a 7-day period [32]. Another study by Hassett showed that the Physical Activity Scale for Individuals with a Physical Disability questionnaire had a very good reliability (ICC = 0.85) over a 7-day interval in a population with severe traumatic brain injury [33]. Furthermore, in patients with chronic neurological conditions or multiple sclerosis, the Physical Activity Disability Scale demonstrated high

Table 4
ICCs and test-retest mean difference in total time per week (min) by data collection method: interview or self-report.

Physical activity intensity level	Interview				Self-report			
	2-day interval ($n = 10$)		7-day interval ($n = 10$)		2-day interval ($n = 20$)		7-day interval ($n = 27$)	
	ICC	Mean difference	ICC	Mean difference	ICC	Mean difference	ICC	Mean difference
Mild	0.99	0.0	0.93*	7.5	0.90*	−18.0	0.51*	−15.2
Moderate	0.85*	−12.5	0.70*	22.9	0.68	42.0	0.66*	10.4
Heavy	0.91*	4.0	0.61*	5.5	0.89*	10.5	0.53*	−27.6
Total	0.88*	−8.8	0.77*	35.9	0.91*	34.5	0.75*	−35.7

* $P \leq 0.05$.

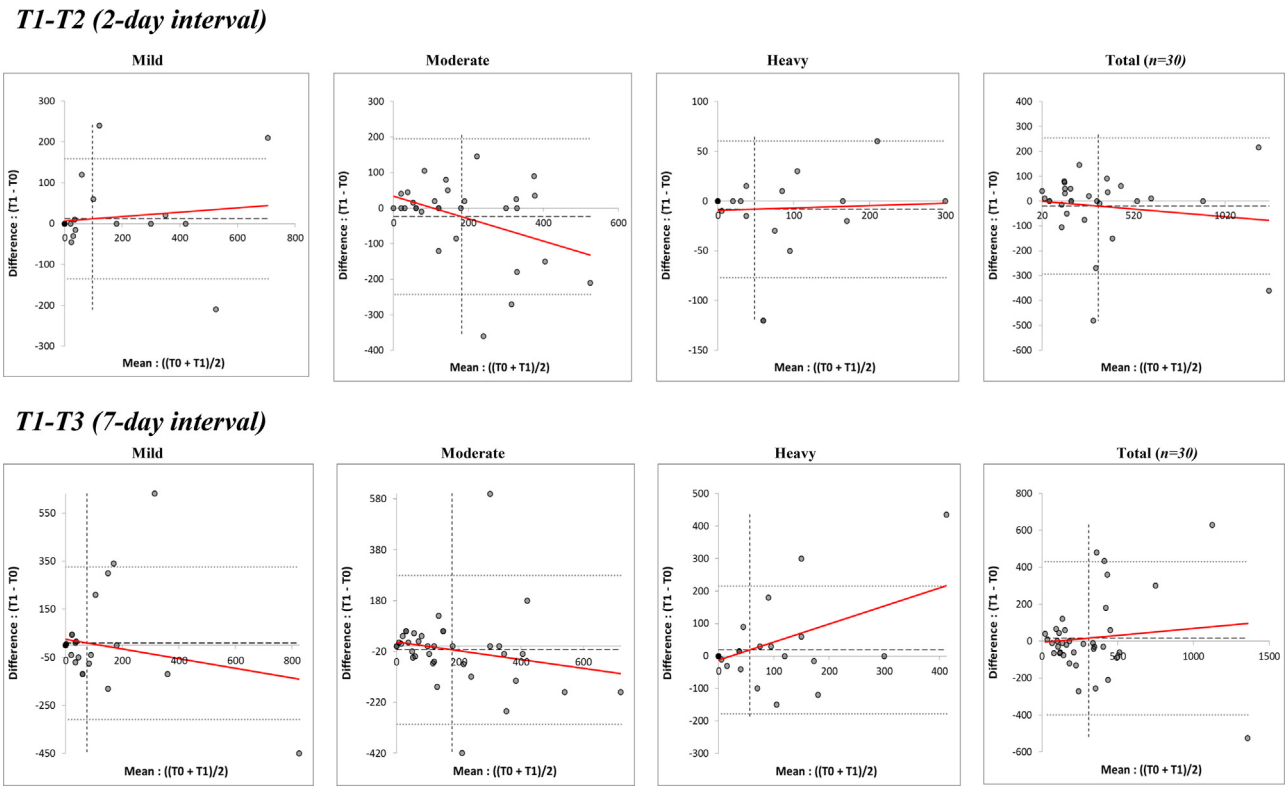

Fig. 1. Bland and Altman plots for leisure time physical activity (LTPA) intensities. A negative slope indicates a tendency of participants with the most initially reported higher LTPA duration at T1 to overestimate the duration at T2. A positive slope means the opposite and a flat slope means that the differences between measurements are constant for all participants.

correlation coefficients between repeated tests over a 3-day interval (ICC = 0.87) and 7-day interval (ICC = 0.92) [34,35].

As hypothesized, our results show higher correlations between assessments within a 2-day period (ICC = 0.72–0.92) than a 7-day period (ICC = 0.55–0.75). This result is not surprising given that the questionnaire asks for recalling physical activities performed during the last 7 days. Thus, two repeated assessments over 2 days requires recalling physical activities within a nearly common reference period, whereas comparisons of 2 assessments separated by a 7-day interval refer to 2 consecutive weeks, so different reference periods. This result agrees with a recent systematic review concluding that past-week self-reported physical activity questionnaires exhibit better measurement properties, especially stronger correlation with direct measures, than usual-week physical activity questionnaires [31]. Nonetheless, the reliability of the questionnaire over a 7-day period is acceptable at the group level. This finding may be explained by the routine nature of the physical activity behavior of our participants. Indeed, participants were recruited through community organisations that promote physical activity in people with disabilities. Thus, most of these participants were involved in regular LTPA. The reliability of the English version of the LTPAQ was previously tested with only a 7-day interval and the results showed slightly higher correlations, ICCs of 0.74, 0.62, 0.93, and 0.83 for mild, moderate, heavy and total physical activity intensity, respectively [11], as compared with the CF version.

Regarding the administration procedure of the questionnaire, correlation coefficients seemed slightly higher for interview-based physical activity scores (ICC = 0.61–0.99; $n = 10$) than self-report-based scores (ICC = 0.51–0.90; $n = 27$). Two possible hypotheses can explain this difference. First, the sample size was unbalanced between interview- and self-reported-based procedures: the total number of participants for the self-report procedure was more than 3 times that for the interview-based procedure. Second, during the interview, participants may have asked for additional or clarifying explanations, which was not available during the self-report procedure. Despite these differences, both procedures had acceptable values, which indicates that both administration methods can be used.

Regarding minutes of LTPA, in the English-version validation study, only interviews were used to collect the data [11]. In comparing minutes of physical activity, data obtained from our CF

interview method are similar to those in the English-version validation study for moderate-intensity and total physical activities but not mild- and heavy-intensity activity. English-speaking participants reported more mild-intensity recreational activity, a mean of 256.7 (SD 312.1) min, [11] whereas in our study, participants reported more moderate-intensity activities. This difference may be explained by the fact that in our study recruitment was carried out via an organization that promotes physical activity, provides support for people with disabilities, and facilitates their access to sports facilities. Similar to Martin Ginis et al. (2012), our study revealed a large between-subject variability regarding minutes of physical activity over a week. In both the original study by Martin Ginis et al. (2012) and the present study, this large dispersion was illustrated by the standard deviations that were mostly higher than the means for different intensity levels. The use of median and interquartile values might be an alternative solution for describing the sample, given the large between-subject variability. However, to reflect this variability that is often associated with reported physical activity levels, means and standard deviations have been used in different studies.

According to the present study, the computed MDC values were higher than mean values in some cases, as shown in Tables 2 and 3. This finding is due to the large between-subject variations generally observed when assessing physical activity levels. Because standard error of measurement, which is calculated from the standard deviation, is part of the values used to compute MDC, these statistics are related, so large standard deviations lead to high MDC values. More participants would contribute to reducing the standard deviations. Because the validation of a questionnaire cannot be fully achieved with a single study, further studies on this questionnaire will allow for refining statistics regarding the MDC.

4.1. Study limitations

This study did not evaluate the construct validity of the French version of the LTPAQ. Future studies are encouraged to evaluate the association between the LTPAQ-CF scores and objective data collected with wearable devices such as accelerometric tools and heart rate monitors. This association is particularly important because studies have reported moderate correlations between self-reported and objectively measured physical activity in adults [36,37]. The reported MDC may have a potential impact on the interpretation of significance of change at individual level. Therefore, in addition to construct validity, the responsiveness of this questionnaire must be investigated because both construct validity and sensitivity to change are important to establish the quality of a newly developed or adapted questionnaire [38,39]. Finally, even though this CF version of the LTPAQ presents good content validity and test–retest reliability in North America (Quebec), users should be aware that some minor adaptations of wording might be required in other French-speaking contexts.

5. Conclusion

The LTPAQ-CF has demonstrated good content validity and test-retest reliability within a sample of people living with physical disabilities. The questionnaire can be administered by both interview and self-report methods.

Disclosure of interest

The authors declare that they have no competing interest.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.rehab.2018.12.002.

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