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The Psychosocial Impact of Assistive Devices Scale (PIADS): Translation and preliminary psychometric evaluation of a Canadian–French version

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Abstract

This article reports on the Canadian–French translation of the Psychosocial Impact of Assistive Devices Scale (PIADS), a 26-item questionnaire that measures the quality of life (QoL) impacts of using assistive technologies from the person with disability's point of view. Following standard procedures, the study included forward and backward translations, committee reviewing, pre-testing with bilingual lay people, and psychometric evaluation of the translated questionnaire with subjects with mobility impairment (n = 83) and visual impairment (n = 37). The use of translators translating in their mother tongue and the participation of one author of the questionnaire contributed to the quality of the translation. We found that words that had equivalence in English and French did not necessarily cover the same areas of meaning. The subscales (n = 3) and total scale of the French PIADS achieved good test–retest stability (ICC of 0.77–0.90) and internal consistency (0.75–0.94). Concurrent validity with the source PIADS also produced acceptable coefficients (0.77–0.83). At the item level, non-significant *t* test ($p > 0.10$) results supported the premise that the scores were not different across languages, except for two items. The results are robust enough to recommend the use of the Canadian–French questionnaire for the investigation of the QoL impacts of assistive technologies for persons with disability.

Key words: Assistive technology measurement instrument, Psychometric testing, Psychosocial Impact of Assistive Devices questionnaire, Translation

Abbreviations: ADL – Activities of Daily Living; CI – Confidence Interval; EDSS – Expanded Disability Status Scale; F-PIADS – French version of the Psychosocial Impact of Assistive Devices Scale; ICC – Intraclass Correlation Coefficient; MS – Multiple Sclerosis; PIADS – Psychosocial Impact of Assistive Devices Scale; QoL – Quality of Life

Introduction

The measurement of quality of life (QoL) impact is considered to be very important in the management of assistive technology devices outcomes [1, 2]. Assistive technology devices are tools that enhance the independent functioning of individuals who have physical limitations or disabilities. They include products such as wheelchairs, low vision aids, prosthetic limbs, and environmental control devices. Emphasis on collecting data from the patient's perspective parallels a recent shift in theoretical premises in the field of rehabilitative technology, from a medical assessment model to a client-centered perspective [2, 3]. If we are to track assistive technology outcomes, there is indeed a need to look at their impacts on QoL. This task represents a considerable and unique challenge

compared to measuring the other important outcome domains, including clinical results, functional status, satisfaction, and cost, because it focuses on the individual's subjective experiences. As such, it is subject to multiple personal, technological and environmental influences.

To measure the QoL impact of assistive technology in a standardized, objective and measurable fashion requires specifically designed tools. One such tool, the Psychosocial Impact of Assistive Devices Scale (PIADS) [4] is available to the English-speaking community. It is presently being translated into Japanese. Researchers from French-speaking communities however are at a disadvantage as no French translation is currently available. The goal of this study was to develop a Canadian–French version of the PIADS (the F-PIADS) following strict international guidelines and to conduct preliminary evaluation of its psychometric properties.

Description of the PIADS

The PIADS is a 26-item self-report paper and pencil measure of the impact of rehabilitative technologies and assistive devices on the QoL of users. It captures, by mean of three subscales, the concepts of competence, adaptability and self-esteem, all subsumed as fundamental dimensions under QoL [4]. The competence subscale is composed of 12 items related to perceived functional capability, independence, and performance (examples: adequacy, efficiency, and skillfulness). The adaptability subscale is composed of six items that reflect inclination or motivation to participate socially and take risks (examples: ability to participate, willingness to take chances, and ability to take advantage of opportunites). The self-esteem subscale is composed of eight items reflecting self-confidence, self-esteem, and emotional wellbeing (examples: sense of control, happiness, and self-confidence).

When administering the PIADS, respondents are asked to read a list of words or phrases that describe how using an assistive device may affect the person who wears or uses it. The respondents rate each item on a seven point Likert scale ranging from -3 'maximum negative impact' to $+3$ 'maximum positive impact' to indicate the extent to which they are affected by wearing or using their assistive device. The midpoint, 0, indicates no impact or no perceived change as a result of using the device. Although most of the items are positively scored, three items are negatively scored and need to be recoded before summing the ratings. The mean PIADS score is obtained by adding the numbers for all items of the scales and then dividing the total by 26 (range: -3 to $+3$). The mean scores of the subscales are derived by adding the numbers corresponding to the assigned items and then dividing by the number of items in each scale, so that each subscale has a mean score that ranges from -3 to $+3$.

The PIADS's measurement properties have been examined by the authors of the scale [4]. The series of evaluations were based on a sample of eyewear devices users ($n = 304$). With respect to internal consistency, Cronbach's α values were 0.95 for the PIADS total score and 0.92, 0.88, and 0.87 for the competence, adaptability, and self-esteem subscales, respectively. Test–retest stability was assessed with 60 respondents completing the PIADS twice, about a month apart. None of the t tests reached significant differences (p values ranging from 0.77 to 0.85), thus supporting the stability of the scale. The authors studied its construct validity by means of a principal component analysis using data from 146 subjects. The results yielded three distinct subscales, accounting for 61.1% of the total variance. In a replication study involving 150 subjects (second half of the original sample), this three-dimensional structure was confirmed. To further demonstrate construct validity, Day and Jutai examined the association of the PIADS with a measure believed to tap environmental impact on emotional responses: the Pleasure, Dominance and Arousal (PAD) scale [5]. The Pearson correlation coefficients (r_p) were significant at the 0.05 level between the PIADS subscales and the pleasure (r_p 0.46–0.59) and dominance subscales (r_p 0.21–0.34) but not with the arousal subscale (r_p 0.06–0.17). These results were interpreted as supporting the discriminant validity of the PIADS.

Methods

Instrument translation

The translation protocol was based on the first steps of Vallerand's methodology [6] and on Guillemin et al.'s [7] guidelines for cross-cultural ad-

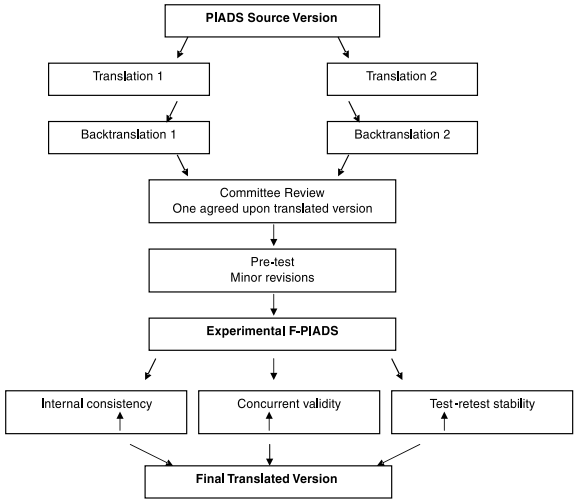

Figure 1. Translation procedures and preliminary psychometric studies for the French translation of the PIADS.

aptation and validation of health questionnaires. The procedures are outlined in Figure 1. The first step was the preparation of preliminary versions of the original instrument in the targeted language, including the questionnaire items, instructions, and introductory text. According to Guillemin et al. [7], translations are of higher quality when done by a team, with translators preferably translating into their mother tongue. Some, but not all of them, should be aware of the concepts involved in the original tool, in order to reliably restore the intended measurement [7]. In this study, two initial forward translations were made independently by one professional translator who had no health outcomes background and by a duo of bilingual researchers experienced in questionnaire development for French-speaking Canadians. French was the native language for these three persons. The two forward translations were then backtranslated into English by two bilingual rehabilitation researchers not associated with the project but familiar with scale development. Both were native speakers of English.

The second step was the evaluation of the preliminary versions and preparation of an experimental version. The French translations, English back-translations and English original version were circulated to a committee for review. This committee was composed of two investigators, an individual translator involved in the parallel back-translation, and one author of the instrument. These participants were instructed to verify the accuracy, in terms of conveying the same meaning, of items that were identical in the English and French versions, respectively. More importantly, they were asked to examine the discrepancies and determine, in light of the conceptual equivalence with the source items and the author's original purpose, what should be the most accurate and satisfying phrasing. A similar procedure applied for the instructions and tool's introductory text. Following the committee's work, the experimental F-PIADS was prepared, using the same format for presentation as the original tool.

As a third step, the experimental version was pre-tested to ensure that it was clear, written without ambiguity, and that it conveyed content validity. The pre-test involved four bilingual subjects – two women and two men aged 33–51 years – using eyewear assistive devices. They were asked to complete both the French and the original versions of the PIADS, in random order, and to indicate if they found any items, instructions, or section of the introductory text difficult or ambiguous. An investigator was present for debriefing. The items for which difficulties were encountered in the French translation but not in the original tool were slightly reworded as needed. Those items that were considered a bit upsetting or confusing in both languages were left unchanged. The participants' comments were scrutinized to ensure that there were no meaningful discrepancies that would suggest that both versions did not measure the same phenomenon. The subsequent step involved the evaluation of the scale's measurement properties.

Evaluation of the psychometric properties of the translated version

The analysis plan for the evaluation of the psychometric properties of the experimental F-PIADS involved assessing its reliability from two different approaches and assessing its concurrent validity. The first type of reliability, test–retest stability, refers to the stability of the F-PIADS ratings and scales scores at two different points in time. The assumption was that there would be no differences in the subscale test results within subjects across two different assessments. This part of the study involved collecting data from French-speaking

subjects twice, with 1 week between questionnaire administrations. The second type of reliability considered was internal consistency, where the focus was on the extent to which items of the composite scores substantively measured the same concept. The response to each item question should be correlated in a linear way to the subscales to which it belongs and also to the total score. In the context of this study, it was possible to compute an F-PIADS internal consistency coefficient from two different samples of subjects (described below).

In cross-cultural adaptation of test measurement, concurrent validity is empirically demonstrated when the translated version is strongly correlated with the source version [6]. In this study, the underlying assumption was that the responses to each question should be identical, notwithstanding which of the PIADS or F-PIADS was used. Bilingual subjects were evaluated twice using a different language version and the two sets of scores were compared. The measure of association would take into account two sources of variability: language and occasion. Another approach was employed to estimate the consistency of the ratings across items and subscales scores. It consisted of comparing the means of the measured variables between two samples of subjects who shared the same characteristics (disease severity, device category, mean age) but who were administered a different language version of the PIADS.

Samples

The study was conducted across two research sites in the province of Quebec, Canada. Table 1 provides a summary of the samples according to the languages spoken by the subjects, number of subjects, age and gender, assistive technology device categories, and studied psychometric properties.

The French translation of the PIADS was firstly conducted in Montreal, as part of a larger methodological study on assistive technology outcomes measures. The project involved 83 subjects with definite multiple sclerosis (MS) who used mobility devices such as walkers, manual and powered wheelchairs, and scooters. They scored 6.5 or over on the Kurtzke Expanded Disability Status Scale [8] (EDSS) which is a typical neurological assessment for the disease. Study participants were recruited from January 1999 to November 2000, primarily through the MS Clinic of the Montreal Neurological Institute and Hospital (n = 74) and, secondarily, through the Department of Neurological Sciences of the Jewish General Hospital (n = 9). More than 119 admissible candidates referred by the practitioner neurologists were contacted and invited to participate in the study. Reasons for non-inclusion were lack of interest or time (19/119), inability to get in touch with the candidate (10/119), and sickness or hospitalization (7/119). The response rate was therefore of 70% (83 of 119 eligibles). The mean age, sex distribution, and language spoken by the non-participants did not differ from those included in the study. As could be expected, EDSS scores were slightly higher, on average, among the non-participants, indicating higher disease severity. The evaluations were completed at home, with an interviewer being present to answer questions. The 83 participating subjects were divided into a French (n = 53) or English (n = 30) group, according to their pre-

Table 1. Samples characteristics and research strategy

Research site	Language	Sample size	Demographics		Category of assistive technology devices	Psychometric property
			Mean age (range)	Female (%)		
Montreal	French Canadian	53	47.8 (24–62)	25 (47%)	Mobility	Concurrent validity
	English Canadian	30	47.9 (26–62)	22 (73%)	Mobility	Internal consistency
Quebec City	Bilingual	18	61.9 (42–86)	12 (67%)	Mobility (n = 8) Low vision (n = 5) Communication (n = 5)	Concurrent validity
	French Canadian	19	56.1 (32–80)	9 (47%)	Low vision (n = 14) Communication (n = 3) Mobility (n = 2)	Test–retest stability

ferred language of use. There were no missing data.

The second research site was Quebec City. Two samples of subjects with visual impairment were recruited from the Montreal Association for the Blind and the Institut de réadaptation en déficience physique du Québec between August and November 2000. The first sample was comprised of 18 bilingual subjects and the second sample included 19 French-speaking individuals. They were all referred by the low-vision clinics' rehabilitation professionals previously briefed on the project. In the preceding year or before, all subjects had been provided with assistive technologies and they were asked to assess any technical aid that was considered important to them. Accordingly, the range of devices was large and included: closed-circuit television (n = 9), magnifying glass (n = 4), tape recorder (n = 4), long cane for detection (n = 4), support cane (n = 3), glasses (n = 2), sun filter (n = 2), telescopic system (n = 2), guide dog (n = 2), computer/speech synthesizer (n = 2), brailler (n = 1), talking calculator (n = 1), and manual wheelchair (n = 1). The PIADS and F-PIADS questionnaires were completed on the site of the participating clinics, with the assessment scheduled to coincide with a professional visit whenever possible. An interviewer was present to read the questions to the subjects, answer questions, and write down the responses. In the two sites, three individuals cancelled their participation. The reasons given were conflicting timetables (n = 2), and sickness (n = 1). One admissible subject was removed from the sample because of aberrant responses (same rating across all items, including those that were negatively scored). There were no missing data.

Statistical analyses

Data collected for test–retest stability (n = 19) and concurrent validity (n = 18) were analysed using the intraclass correlation coefficient (ICC) [9]. The ICC expresses measurement error and agreement as the relation between true and observed variance. Using analysis of variance results, it is possible to calculate six forms of ICCs, among which the ICC_3 was chosen. This particular statistic measures the interrelatedness of the individual ratings, across a fixed time period (or a fixed set of languages). The ICC takes on values of 0–1 and has a value of 1 only when all subjects' test scores are identical. There is no consensus on what of the ICC indicates an acceptable degree of reliability, although most authors would agree that ICC values of at least 0.70 are required [10].

The Cronbach's α statistic was used to examine internal consistency. It is based on the average correlation among the items and the number of items in the scale or subscale. Theoretically, α can take on values from 0 to 1. According to DeVellis [11], α values can be interpreted as follows: below 0.60, unacceptable; 0.60–0.64, undesirable, 0.65–0.69, minimally acceptable, 0.70–0.79, respectable, 0.80–0.90, very good; α values greater than 0.90 indicate that there may be some redundant items in the scale.

To see if the population values of the two samples of persons with MS were different at the item level, we used the *t* test statistic for independent samples [12]. As a preliminary step, the Levene's test for equality of variances was performed to assess if the spread of the F-PIADS and source PIADS groups were equal. There were six items for which the assumption was violated, that is independence, confusion, efficiency, usefulness, performance, and ability to adapt to activities of daily living (ADL). For these variables the calculations were based on separate variance estimates (loss of degrees of freedom from a possible maximum at 81). Non significant *t* tests results would indicate that the alternate forms do not produce different responses across languages. Vallerand [6] has suggested a significance level of 0.10 (rather than the conventional 0.05) for this type of analysis. Based on a standard deviation of 1.0 (as estimated from the data) and accepted calculations [12], 30 subjects would have been sufficient to derive a difference between two means of 0.75 points with an α level at 0.05 and a statistical power of 80%. Accordingly, the samples of persons with MS were large enough to detect differences between item mean scores of 0.75 or more. In a recent study involving 41 users of electronic aids to living living, Jutai et al. [13] used 0.50 points and 1.0 points as meaningful mean score differences to assess the stability of the PIADS.

Results

Translation of the PIADS into French

Table 2 displays the content of the English and French versions of the PIADS. For the majority of items (n = 14), no translation problems were encountered. Translated versions concurred and back-translated versions were consistent with the source version. These terms, promptly ratified by the review committee, included: competence, independence, confusion, self-esteem, productivity, security, frustration, usefulness, self-confidence, well-being, QoL, performance, ability to participate, and ability to adapt to ADL.

For the remaining items (n = 12), either one or both back-translated versions did not match with the source item. Discussions within the review committee led to the acceptance of one of the French options for the following eight items: adequacy, efficiency, expertise, skillfulness, sense of power, sense of control, eagerness to try new things, and ability to take advantage of opportunity. The accurate meanings of the items adequacy and skillfulness were, however, difficult to translate because the French word 'aptitude' could theoretically apply to both. To help resolve the issue, the participating author of the tool provided a glossary of the terms (unpublished material), that had been developed to help administer the PIADS when an interviewer is being present. Accordingly, adequacy, which refers to being capable of handling life situations and handling little crisis, could be translated by 'se sentir à la hauteur'. The

Table 2. Source items, French translations, and item-level concurrent validity (MS samples of 53 and 30 subjects)

	English	French	Concurrent validity	
			Mean difference (95% CI)	*t* Test and *p* value
Competence subscale	Competence	Compétence	−0.34 (−1.05;0.38)	−0.93; $p = 0.36$
	Adequacy	Sentiment d'être à la hauteur	−0.36 (−1.06;0.33)	−1.04; $p = 0.30$
	Efficiency	Efficacité	−0.33 (−1.06;0.39)	−0.97; $p = 0.33$
	Productivity	Productivité	−0.13 (−0.83;0.58)	−0.36; $p = 0.72$
	Usefulness	Sentiment d'utilité	−0.66 (−1.26;−0.01)	−2.22; $p = 0.03$*
	Expertise	Savoir-faire	0.00 (−0.73;0.66)	−0.09; $p = 0.93$
	Capability	Sentiment d'être capable	−0.24 (−0.90;0.41)	−0.74; $p = 0.46$
	Performance	Performance	−0.42 (−1.00;0.16)	−1.44; $p = 0.16$
	Skilfullness	Aptitude	−0.31 (−0.99;0.38)	−0.89; $p = 0.37$
	Independence	Indépendance	−0.62 (−1.32;0.01)	−1.76; $p = 0.08$*
	Quality of life	Qualité de vie	−0.20 (−0.89;0.49)	−0.58; $p = 0.56$
	Confusion	Confusion	−0.37 (−0.97;0.23)	−1.24; $p = 0.22$
Adaptability subscale	Willingness to take chances	Disposition à prendre des chances	−0.43 (−1.15;0.29)	−1.19; $p = 0.24$
	Ability to participate	Capacité à participer	−0.17 (−0.86;0.51)	−0.51; $p = 0.61$
	Eagerness to try new things	Désir de tenter de nouvelles experiences	0.00 (−0.64;0.71)	0.09; $p = 0.93$
	Ability to adapt to activities of daily living	Capacité de s'adapter aux activités de la vie quotidienne	−0.49 (−1.17;0.20)	−1.52; $p = 0.13$
	Ability to take advantage of opportunities	Capacité à saisir les occasions	−0.23 (−0.96;0.50)	−0.63; $p = 0.53$
	Well-being	Bien-être	0.00 (−0.75;0.68)	−0.09; $p = 0.93$
Self-esteem subscale	Self-esteem	Estime de soi	−0.12 (−0.98;0.75)	−0.27; $p = 0.79$
	Security	Sécurité	0.32 (−0.31;0.94)	1.01; $p = 0.32$
	Sense of power	Sentiment de pouvoir	−0.23 (−0.94;0.47)	−0.66; $p = 0.51$
	Embarrassment	Sentiment d'être mal à l'aise	0.64 (−0.15;1.44)	1.60; $p = 0.11$
	Happiness	Sentiment d'être heureux	−0.11 (−0.92;0.71)	−0.26; $p = 0.80$
	Sense of control	Sentiment de contrôle	−0.01 (−0.74;0.61)	−0.18; $p = 0.86$
	Frustration	Frustration	−0.31 (−1.17;0.55)	−0.72; $p = 0.47$
	Self-confidence	Confiance en soi	−0.11 (−0.84;0.63)	−0.29; $p = 0.78$

* $p < 0.10$, below the generally accepted $\alpha = 0.05$ level.

French word 'aptitude' was retained for skillfulness, which refers to being able to show your expertise and being able to perform tasks well. The translation of expertise also gave rise to some discussion. The literal translation of expertise in French carries a connotation of occupational specialization which is not as strongly embodied in the English word. For this reason, the expression 'savoir-faire', back-translated into know-how, was preferred by the review committee.

Words other than those generated by the forward translation were used to translate the following four items: happiness, capability, embarrassment, and willingness to take chances. The problems encountered with these items are described next. The literal translation of happiness, 'bonheur', was perceived as inappropriate because it conveys a sense of blissfulness that is not in agreement with the intention of the authors who view happiness as gladness, pleasure and satisfaction with life. The expression 'sentiment de bonheur' was considered more appropriate. With respect to capability, the literal translation is 'capacité', which can be interpreted as able to cope but also as a volumetric characteristic. The expression 'sentiment d'être capable' was found to be a more acceptable equivalent. Similarly, the two French translations for embarrassment were ambiguous and the back-translated expressions did not replicate the source item. Based on the clarifications provided by the author, the expression 'mal à l'aise' was chosen. Finally, the item willingness to take chances posed a problem. The word chance had been replaced with 'risque' (risk) in both French translations. The two words (chance and risk) appear to express the same idea, but from positive and negative perspectives, respectively. The committee review opted for the more conservative approach and the literal translation of chance by 'chance' rather than by 'risque'. This agreed upon translated version of the PIADS was pre-tested and, following upon minor rewordings, the experimental version was ready to be tested empirically.

Descriptive statistics of subscales

Descriptive statistics for the French and English versions of the PIADS appear in Table 3. As mentioned previously, the PIADS subscale scores can theoretically take on values within negative

Table 3. Description of three scales of the PIADS and F-PIADS according to study samples

Scale	Descriptive data	Montreal site		Quebec City site	
		MS French-speaking sample N = 53	MS English-speaking sample N = 30	Visually impaired French-speaking sample N = 19	Visually impaired bilingual sample (T1) N = 18
Competence (12 items)	Mean score	1.41	1.74	2.08	1.99
	Standard deviation	1.11	0.91	0.61	0.83
	Percentiles				
	25th	0.75	1.38	1.69	1.50
	50th	1.50	1.79	2.17	2.38
	75th	2.46	2.44	2.58	2.67
Adaptability (6 items)	Mean score	1.21	1.43	1.62	2.02
	Standard deviation	1.10	1.27	0.75	0.93
	Percentiles				
	25th	0.42	0.66	1.00	1.00
	50th	1.00	1.33	1.50	2.33
	75th	2.17	2.71	2.42	2.72
Self-esteem (8 items)	Mean score	1.09	1.09	1.73	1.59
	Standard deviation	1.08	1.12	0.93	0.68
	Percentiles				
	25th	0.50	0.00	1.06	1.38
	50th	1.13	0.94	1.81	1.63
	75th	1.88	2.00	2.45	2.13

and positive endpoints. The data from this study, however, are strongly skewed toward the positive end of the scale, with mean scores and percentiles values much above zero. Frequency distributions, given by the 25th, 50th, and 75th percentiles values, are consistent within the samples of persons with MS and within the sample of persons with visual impairment of the Montreal and Quebec City sites, respectively. Data dispersion, however, tends to be somewhat larger for the MS subjects. It is also interesting to note that the ratings are lower, on average, for the samples of persons with MS than for the subjects with visual impairment.

Psychometric properties

The ICC values for the test–retest stability range from 0.77 to 0.90, as shown in Table 4. All these point estimates are above the level of acceptability of 0.70 [10], although the stability of the adaptability subscale scores appear to be somewhat lower than the competence and self-esteem subscales and total scale. The second column of Table 4 displays concurrent validity results. For practical reasons, the F-PIADS and the PIADS could not be administered simultaneously to the subjects. Therefore, the concurrent validity estimates are affected by two sources of variation. The first is due to language differences, our primary interest, and the second is due to test–retest variations. Indeed, the ICC coefficients tend to be lower than those obtained for test–retest stability. They range from 0.77 to 0.83, all above the 0.70 cutoff level for acceptability. It can be noted that the adaptability subscale performs somewhat differently, with a concurrent validity coefficient of 0.79, compared to a test–retest coefficient of 0.77. The confidence intervals are quite wide and indicate a relative lack of precision.

Based on the sample of persons with MS, the internal consistency of the F-PIADS is determined to be very good, with α values ranging from 0.80 to 0.94, for the three subscales and total scale. The estimates are slightly lower for the sample of subjects with visual impairment, with values ranging from 0.75 to 0.91. According to current standards, they are nonetheless considered acceptable to very good.

A general appraisal of the p values displayed in Table 2 reveals that a majority of F-PIADS items and subscales scores – 27 out of 29 (93%) – are above the 0.10 level for p values. These results indicate that the scores are not different across languages, supporting the concurrent validity of the questionnaire. However, the items' usefulness and independence performed somewhat differently, with p values of 0.03 and 0.08, respectively. These are the only two items from the F-PIADS for which concurrent validity needs to be reconsidered.

Discussion

The objectives of this study were to describe the procedures used to translate and evaluate the Canadian–French version of the 26-item PIADS and to present preliminary results on its reliability and concurrent validity. Translation was carried out according to a standardized set of procedures. The strengths of this approach included the inclusion of several independent translations and back-translations, the use of qualified translators translating into their mother tongue, the consti-

Table 4. Test–retest stability, concurrent validity and internal consistency of the F-PIADS scores

Scale	Test–retest stability	Concurrent validity	Internal consistency	
	Visually impaired French-speaking sample N = 19	Visually impaired bilingual sample N = 18	MS French-speaking sample N = 53	Visually impaired joined samples N = 37
	ICC (95% CI)	ICC (95% CI)	Cronbach's α	Cronbach's α
Competence	0.90 (0.75–0.96)	0.77 (0.48–0.91)	0.91	0.85
Adaptability	0.77 (0.49–0.91)	0.79 (0.51–0.91)	0.81	0.77
Self-esteem	0.88 (0.71–0.95)	0.83 (0.60–0.93)	0.80	0.75
Total F-PIADS	0.90 (0.76–0.96)	0.81 (0.57–0.92)	0.94	0.91

tution of a committee review incorporating one author of the PIADS, and the pre-test of the source and experimental versions with bilingual lay people. Improvements that could be made to these methods is more input from broader groups of persons with disability and the provision of a glossary of terms earlier in the translation process. The methodology used to translate the PIADS should prove useful for translating other outcome measures in the field of rehabilitation and assistive technology.

The cross-cultural adaptation of a questionnaire is a very demanding task. Although a word in English may have an equivalent in French, in terms of form, the two words can cover different areas of meaning that may overlap but not be synonymous [14]. The effect of context, in interpretating the meaning of these words, may also differ from one language to the other [14]. With the F-PIADS, the problem was anticipated and corrected for the word expertise but went undetected for the word independence. Subsequent psychometric results showed strong concurrent validity between expertise and 'savoir-faire' and, conversely, weak convergence between independence and 'indépendance'. Moreover, an English word can often be translated by more than one French expression. In the preliminary versions, unmatched translations (back-translation was not word to word) were produced for a number of PIADS items (46%). In most cases, one alternative was chosen and, for three items, the committee review decided upon an entirely different expression. This situation does not, however, undermine the validity of the translation. Perneger et al. [15] have shown that differences in wording of two French-language adaptations of the same questionnaire produced similar responses distributions and that there is no single superior translation.

Overall, the results of the preliminary psychometric study support the use of the F-PIADS. For test–retest stability, all ICCs point estimates are well above the acceptability level of 0.70, thus indicating good reliability. Internal consistency coefficients, given by cronbach's α values, are also within acceptable limits. α values obtained from the sample of persons with visual impairment are somewhat weaker, compared to the sample of persons with MS, which may be explained, at least in part, by more positively skewed response distributions and less data variability. In assessing the source PIADS, Day and Jutai [4] produced larger and more consistent α values, ranging from 0.87 to 0.95. The adaptability and the self-esteem subscales of the F-PIADS show wider departures from these data than do the competence and total F-PIADS scales. Because of the inevitable adjustments and wording compromises involved in the process, it was expected that the F-PIADS questionnaire would produce weaker psychometric results than the source version [6, 14].

With respect to concurrent validity, results involving item level and scale level data are discussed. As noted previously, all but two items show good concurrent validity, based on the MS data. Overall, these results are very encouraging. The specific items usefulness and independence had not raised any particular concerns throughout the translation procedures, on the basis of their face validity. The unexpected findings emphasize the importance of integrating objective testing, in terms of psychometric evaluation, in the mostly subjective translation procedures. There was however a risk that a t test would be significant at the 0.05 level as a pitfall of performing multiple statistical tests. This is the reason why a liberal p value cutoff of 0.10 was chosen. As a consequence of the results of the t tests, it is recommended that the faulty items be reworded. Considered alternatives are 'autonomie' and 'sentiment d'être utile', for independence and usefulness, respectively (suggestions need further testing). The lower performance of these items may have had an impact on the concurrent validity of the competence subscale as a whole which was estimated at 0.77, still above acceptability level. The results are slightly higher and satisfactory for the adaptability, self-esteem, and total F-PIADS. One important methodological issue to raise when examining these last results (ICCs) is the use of bilingual subjects [1,6]. Because no specific criteria had been specified, there is no assurance that they were truly fluent in both languages. Any misunderstanding may have increased divergence in ratings and, consequently, had a negative impact on the estimates of concurrent validity.

In conclusion, this first study of the F-PIADS included the translation from the source version, refinements of the translation, and preliminary studies of reliability and concurrent validity. The

results achieved are robust enough to recommend the use of the questionnaire in the investigation of the QoL impacts of assistive technologies for persons with disability. However, as with any instrument, the validation of a translated questionnaire is an ongoing process. In a next step, studies on a larger scale are needed to confirm the results from this study and generate more precise estimates of the scale properties. As much as reliability and validity, the applicability of the F-PIADS and its ability to distinguish between categories of assistive technologies and categories of persons with disability need to be addressed.

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