Reliability and Validity of Scores of a Chinese Version of the Frenchay Activities Index

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Abstract

Objective—To develop a Chinese version of the Frenchay Activities Index (FAI-C) and evaluate the reliability and validity of its scores.

Design—A two-week test-retest study.

Setting—Chinese community in Vancouver, BC, Canada.

Participants—Data were collected using a convenience sample of Chinese immigrants living in Vancouver, BC, Canada. Of the 73 participants, data from 66 participants were included in the analysis. The total sample included two subsamples: community dwelling ($n = 32$), and assisted living ($n = 34$). Participants were 65 years or older, lived in Canada for more than five years and were able to read Chinese.

Interventions—Not applicable.

Main Outcome Measure—FAI-C scores.

Results—Test-retest reliability of the FAI-C scores assessed using intraclass correlation coefficient (ICC) was 0.86 (95% Confidence interval (CI) = 0.79–0.92) for the total sample, 0.89 (95% CI = 0.78–0.94) for the community dwelling subsample, and 0.71 (95% CI = 0.50–0.85) for the assisted living subsample. The minimal detectable difference (MDD) at 95% CI was 8.64. Correlations between the FAI-C and the Reintegration to Normal Living Index ($r = 0.61$, $p < 0.01$), Activities-specific Balance Confidence scale ($r = 0.55$, $p < 0.01$), and Timed Up and Go ($r = -0.68$, $p < 0.01$) were in the a priori hypothesized direction and magnitude.

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Location of the study: G F Strong Rehabilitation Centre, Vancouver, British Columbia

Conclusions—The FAI-C scores are reliable and there is support for validity. This tool enables us to measure social participation level in the Chinese-speaking population.

Keywords

Asian continental ancestry group; Rehabilitation; Reproducibility of results

A commonly identified limitation of many studies is that a certain contingent of the population may need to be excluded from the study because the instruments of interest were not available in the mother tongue of a section of the population. Chinese is the most common language in the world, yet many commonly used health-related outcome measures are not available in this language.

The Chinese community is one of the largest visible minorities in Canada. This is especially true in Vancouver, where the Chinese make up more than 18% of Vancouver's population.¹ According to 2006 Canadian Census, among the Chinese-speaking population, 35.7% declared Cantonese and 16.9% identified Mandarin as their first language; the remainder did not identify their dialect.² Mandarin and Cantonese use the same written characters with a few exceptions. Therefore, individuals who can understand either of the Chinese dialect can communicate with each other by writing.³

Many of our studies inquire about the activities participants perform in their own community. Despite representing such a large proportion of our population, we are often compelled to exclude Chinese-speaking participants from research studies because of language barriers. The exclusion of otherwise eligible immigrant population could lead to systematic bias when only representing the dominant ethnicity of the country.⁴ Therefore, it is imperative for outcome measures to be translated and validated in other languages.

Self-report questionnaires present a simple and very cost effective method of capturing information on what activities people perform. The Frenchay Activities Index (FAI) is a self-report questionnaire that captures information about daily and social activities by asking about the frequency with which individuals perform these activities.⁵ The FAI was initially designed⁶ and its scores were validated⁷ for use with individuals who had stroke. More recently it has been used in other populations including lower limb amputation,⁸ spinal cord injury,⁹ multiple sclerosis,¹⁰ traumatic brain injury,¹¹ elderly with various medical conditions,¹² and the general population aged 16 and older.¹³ The FAI has been widely and internationally used, and its scores have been validated in other languages including Japanese¹⁴ and Korean.¹⁵ The search of PubMed, CINAHL, EMBASE, and PSYCHINFO databases revealed no validated Chinese version of the FAI scores. The objective of this study was to develop a Chinese version of the FAI (FAI-C) and assess the reliability and validity of its scores.

Methods

In order to address the research objectives and in particular to establish the test-retest reliability of the FAI-C scores we used a two-week test-retest design.

Participants

A convenience sample of Chinese immigrants living in the Vancouver, BC, Canada region was recruited through advertisements posted in public areas populated by the Chinese community such as community centres, churches, multi-level care facilities, as well as Chinese assisted living centres. The assisted living centres provide housing, hospitality services (e.g. meal, housekeeping, and laundry), and personal assistance services (e.g. bathing, dressing, incontinence care, and medication assistance) to individuals who require help with activities of daily living.

To be included, participants were required to: 1) be 65 years old and older; 2) be able to read Chinese; 3) be living in Canada for more than five years; 4) have minimal cognitive impairment (operationalized as scores >23 on the MMSE¹⁶); and 5) have no significant muscle, joint or neurological conditions, such as stroke, or Parkinson's disease. Only Chinese immigrants were enrolled in the study to ensure fluency in the Chinese language. While we did not formally assess the minimum literacy level of the participants in the Chinese language, all participants were required to read and sign the consent form which was written in Chinese at a grade 6 level. Approximately 70% of the Chinese population in Canada have a high school education or higher that would enable them to understand our consent form.¹⁷

A sample size of 42 was determined to be large enough for assessment of reliability by testing the hypothesis that the intraclass correlation coefficient (ICC) was 0.80 or higher based on having an $\alpha = 0.05$ and $\beta = 0.20$.¹⁸ Moreover, a sample size of at least 40 would enable us to determine statistically significant correlations of r greater than 0.45 ($\alpha = 0.05$ and $\beta = 0.20$) when assessing validity.¹⁹ We oversampled to account for potential drop-outs, and to control for testing multiple hypotheses.

Translation

A translation back-translation approach, performed by two bilingual translators, was used in this study. Specifically, one translated the FAI into Chinese and the other back-translated the Chinese version into English. Back-translation is a common practice to verify that translation was properly performed by ensuring that the content of the translated version is consistent with that of the original version.²⁰ The forward-translator completed a graduate degree in physical therapy at the University of Alberta and an undergraduate degree in physical therapy from the China Medical University in Taiwan. The back-translator was an undergraduate science student who was originally from China and was bilingual in Chinese and English. Discrepancies between the versions were resolved through discussion between the translators and a mediator who was also bilingual.

Procedure

All tests were administered by trained research assistants who were fluent in Chinese (Cantonese and Mandarin). Testing of community dwelling participants occurred at a hospital based research laboratory or at a community centre the participant frequented. Assisted-living participants were visited at their facility. Data were collected at two separate visits approximately two weeks (mean (SD) = 14.8(5.3) days) apart (baseline and retest).

The two-week test-retest reliability period was used to reduce memory bias while minimizing the likelihood that significant life changes, which could influence reliability, would occur.²¹ The Chinese version of the Mini-MMSE¹⁶ was also completed to determine eligibility related to cognition. At baseline, data were collected on participants' demographics (age, sex, marital status, number of years since immigration and co-morbid conditions). Participants were then asked to complete the FAI-C as well as a number of other self-report measures, and a test of basic mobility all of which were previously translated into Chinese. These measures were used to determine if there was support for validity of the FAI-C scores.

At retest, the participants completed the FAI-C and answered several questions asking whether any change in health status had occurred over the two past weeks that might explain a change in the scores. This study was approved by the behavioural research ethics board of the local university.

Measurements

The FAI captures information about daily and social activities by asking about the frequency with which individuals perform these activities. This 15-item questionnaire is partitioned into two parts: the first 10 items ask individuals to estimate the frequency of their participation in daily chores and activities such as preparing meals or washing clothes during the past 3 months. The next 5 items ask individuals to estimate their participation in other activities such as travelling, or gardening during the past 6 months. Response options range from 0 (never) to 3 (at least once a week). A summary score is derived by adding up the response of all items. The total score ranges from 0 (no participation) to 45 (frequent participation). Previous studies have shown that there is support for the validity of the FAI scores in a variety of adult populations.^{14, 21} The FAI scores have been also shown to have a high test-retest reliability within the lower limb amputation population⁸ (ICC = 0.79; 95% CI = 0.70–0.86), and the stroke population.²² Also, a high correlation ($r = 0.96$) has been shown between the test-retest scores in the general population.¹³

The ABC is a self-report measure of one's balance confidence when doing 16 activities. Participants are asked to rate how confident they are that they will not lose their balance while performing each of the 16 activities on a scale from 0 (not confident) to 100 (completely confident). A mean score is then calculated with higher scores indicating higher balance confidence. The Chinese version of the ABC was used in this study and its scores have been found to be valid and reliable.²³

The Reintegration to Normal Living Index (RNLI) measures the global function status of an individual after rehabilitation. This 11-item questionnaire asks individuals to evaluate their functional status on items such as "I can move around my living quarters as I feel necessary" or "I feel that I can deal with life events as they happen". Individuals can choose from 0 (it does not describe my current status), 1 (it partially describes my current status), or 2 (it perfectly describes my current status). Scores are summed and the total score can range from 0 to 22, with higher scores representing better reintegration. Reintegration is defined as the "reorganization of physical, psychological, and social characteristics of an individual into a harmonious whole so that one can resume well-adjusted living after incapacitating illness or

trauma.”²⁴ Despite this definition, we chose to include the RNLI because the items are instrumental activities of daily living-based (as are the FAI); the wording of the items is applicable to anyone; and the RNLI has been previously translated by others. The scores of the Chinese version of the RNL have been shown to be reliable and valid.²⁵

The Timed Up & Go (TUG) test is a performance based measure of basic mobility function. Participants are instructed to stand from a seated position, walk 3 meters, turn and walk back to the chair and sit down. The time it takes to complete the entire process is recorded to the nearest second. The TUG scores have been found to have excellent test-retest reliability and evidence of supporting validity has been reported.^{26–27}

Statistical Analysis

We analyzed the data based on the total sample, the sub-sample of community-dwelling individuals, and the subsample of assisted-living individuals because we hypothesized that the two subsamples would be different. Means, SDs, and frequency tables were derived for the descriptive variables to demonstrate the description of the sample and the FAI-C scores. The utility of the FAI-C was tested by calculating the percentages of its floor and ceiling effects for the total sample and the two subsamples. A desirable measure should not have 20% or more of its scores lumped at the scoring extremes of the measure’s distribution.²⁸

The test-retest reliability of the FAI-C scores was examined using ICC (1, 1)²⁹ and 95% CIs were derived. The ICC (1, 1) designates an ICC calculated using one-way analysis of variance from single scores obtained from each subject in each trial. We hypothesized that the ICC for the FAI-C scores would be 0.80 or higher, which has been suggested to signify excellent reliability.³⁰ Bland-Altman plots were employed to show evidence of reliability with minimal bias between the two-week test-retest measurements of the FAI-C scores.³¹ This was achieved by plotting scattergrams of the mean of the baseline and retest FAI-C scores against the difference between those scores. The 95% limits of agreement (2 SD from the mean of the difference scores) were considered acceptable.

The minimal detectable difference (MDD) of the FAI-C scores at 95% CI was calculated according to the following formula:¹⁹ $MDD = 1.96 \times SEM \times 2$. SEM is the standard error of the mean and it is computed by: $SEM = S_x \sqrt{1 - r_{xx}}$, where S_x is the SD and r_{xx} the reliability coefficient. The MDD provides the meaningful change beyond measurement error.

Validity of the FAI-C scores was examined by demonstrating its correlation with the RNL, ABC, and TUG test. The Spearman correlation coefficient was used because all of the outcome measure distributions, except the FAI-C, were not normal. A correlation value greater than 0.75 is indicative of an excellent to good relationship, between 0.75–0.50 represents good to moderate relationship, and between 0.50–0.25 suggests fair relationship.¹⁹ We hypothesized that there would be a moderate positive correlation between the scores of the FAI-C and the ABC, and RNL, and a moderate negative correlation between the FAI-C and the TUG. To further investigate validity we hypothesized that there would be differences on the FAI-C scores depending on whether the participants lived in the community or assisted-living facilities. The independent *t* test was used to examine the between-subsample difference. Independent *t* tests were also used to assess differences in the

scores of the RNLI, ABC, and TUG to reinforce our position that the subsamples were different. A P value of less than 0.01 was considered statistically significant for the t tests in order to decrease the potential for type I error that may arise from the multiple testing. We chose to use this conservative method of controlling for multiple comparisons in order to increase our confidence that the stated relation was statistically significant. Data analyses were performed using SPSS for windows version 17.

Results

Table 1 presents the characteristics of the 66 participants (32 community-dwelling, 34 assisted-living) included in this study. The mean (SD) age of the mostly female (71%) sample was 79.0 (8.5) years while the assisted-living subsample was approximately 10 years older than the community-dwelling subsample.

On average, it took about five minutes for the participants to complete the FAI-C. The mean FAI-C score was 22.05 (8.33) for the total sample [Table 2]. The assisted-living subsample had a significantly lower FAI-C mean score than the community dwelling subsample. The floor (scores 0–9) and ceiling (scores 36–45) effects for the total sample at baseline were 10.61% and 3.03%, and 6.06% and 6.06%, respectively at retest. Table 3 presents the original items of the FAI along with the translated items (FAI-C).

Reliability Data

The test-retest ICC was 0.86 (95% CI = 0.79–0.92) for the total sample, 0.89 (95% CI = 0.78–0.94) for the community subsample, and 0.71 (95% CI = 0.50–0.85) for the assisted-living subsample. The MDD was 8.64. The Bland-Altman plots [Figures 1–3] revealed that the majority of the datapoints were distributed within 2 SDs from the mean (95% CI). The mean difference of the test and retest scores of the total sample was -0.15 . Ideally, the individual data points should be spread around the zero point and the mean difference should be zero when little or no change has occurred. The positive or negative sign of the mean difference represents the direction of measurement bias, i.e. lower or higher scores in the retest. There were 5 individuals who had large variation (> 2 SD) in their baseline and retest scores, with higher scores recorded at the retest. This may indicate the possibility of measurement bias. Post-hoc analyses revealed that 4 out of the 5 individuals were from the assisted living subsample. Moreover, 2 of them indicated having a change in health (back pain and cold) within the retest period.

Validity Data

All of the hypothesized correlations were in the predicted direction and magnitude. The Spearman correlation coefficients were $r = 0.61$ between the FAI-C and RNLI scores, r equal to 0.55 between the FAI-C and ABC scores, and r equal to -0.68 between the FAI-C and TUG scores.

The t tests revealed a significant difference between the mean scores of the baseline FAI-C, RNL, ABC, and TUG of the community-dwelling and the assisted-living subsamples.

When we removed the 5 outliers from the sample and re-ran the analyses, the ICC value increased to 0.92 (CI = 0.87 – 0.95) and the correlations of the FAI-C with the RNLI, ABC, and TUG remained relatively consistent (0.60, 0.52, and – 0.70, respectively).

Discussion

In this study, we translated the FAI into Chinese (FAI-C) and assessed the reliability and validity of the FAI-C scores. The small, observed percentages of floor and ceiling effects (< 20%) show that the FAI-C has a property of measuring the differences among individuals over a wide range. This is a desirable characteristic of a health-related outcome measure as defined by Andresen.²⁸ The FAI-C was quick and easy to complete and score.

Consistent with our hypotheses, the test-retest reliability of the FAI-C scores revealed excellent reliability for the total sample and the community-dwelling subsample, and good reliability for the assisted living subsample. Our ICC value for the total sample is similar to the ICC value (ICC = 0.79) reported by Miller et al. in amputee population.⁸ Turnbull et al. have also reported a high correlation between test and retest FAI scores ($r = 0.96$) in the general population which could be an indication of high test-retest reliability.¹³ The Bland-Altman scattergram of the total FAI-C scores revealed that the majority of the scores were within 2 SDs from the mean, reinforcing the notion that the test-retest reliability is strong. The 5 outliers who showed large variation in their scores suggest the possibility of measurement bias. Previous studies that investigated the test-retest reliability of the English version of the FAI using Bland Altman scattergram revealed similar patterns with a few individuals exhibiting measurement bias.^{8, 22} An infinite number of biases could have contributed to the observed change in the retest scores, many of which could be related to changes in health that occurred within the two-week retest period. We partly controlled for this by asking questions inquiring about health changes within the retest period. Of the 5 outliers, 2 individuals reported having a change in health within the retest period. In addition, given that most of these individuals were from the assisted-living subsample, the difference in scores may be related to their living situation including the opportunity to engage in activities. Alternatively, it may be related to recall or learning of the scale which occurred over the two weeks causing the participants to respond to the retest FAI-C with more or less paid attention.

The FAI-C scores were correlated with the RNLI, ABC, and TUG scores in the a priori hypothesized direction and magnitude, indicating support for validity. The strong correlation between the FAI-C and RNLI scores supports findings from previous studies between the scores of the English versions of the FAI and RNLI in an elderly stroke population in the UK,³² and between the scores of the FAI and the validated Chinese version of the RNL in a sample of Chinese individuals who had a chronic stroke.²⁵ The associations between the FAI-C and the ABC, and TUG scores were similar to those reported by Miller et al.⁸ in a sample of individuals with lower-extremity amputations.

In consensus with our hypothesis, the FAI-C was able to discriminate between the assisted-living and community-living subsamples. As observed by the different sample scores on all the measures, these groups are different. Therefore, finding that the FAI-C score for the

community-living subsample was statistically higher than that of the assisted-living subsample is not unexpected and is in fact reassuring.

Study Limitations

This study has several limitations. First of all, the study sample was drawn using a convenience sampling technique from Chinese immigrant population in Vancouver, BC, Canada. It is plausible that the results of this study may be different if the study sample was drawn from all eligible Chinese population across the world. In addition, it is plausible that the FAI-C may not be culturally valid across all countries. While it is reasonable to think that a resident of a western society may have the opportunity to 'drive a car', this may not be true for someone living in rural mainland China. Future studies may consider assessing the cultural relevance of the individual items the FAI-C for individuals living in eastern societies. Nonetheless, most of the items of the FAI-C are about activities of daily living and are expected to be universal regardless of culture (e.g. washing clothes) for individuals living in North America. Second, this study considered only older adult Chinese population; thus the results of this study may not be generalizable to the younger Chinese population. Third, as part of the eligibility criteria we were compelled to exclude individuals with cognitive disorders. Future studies are required to assess the participation level among Chinese individuals with different forms of cognition problems. A validated caregiver version may be designed for the FAI-C to further investigate the activity level among the cognitive group.

Conclusions

Considering good reliability and validity, it is conceivable to conclude that the FAI-C scores are reliable and this tool has the ability of measuring participation level among the Chinese population.

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List of Abbreviations

ABC	Activities-specific Balance Confidence scale
ADL	Activities of daily living
CI	Confidence interval
FAI	Frenchay Activities Index
FAI-C	Chinese version of the FAI
ICC	Intraclass correlation coefficient
IADL	Instrumental activities of daily living
MDD	Minimal detectable difference

MMSE	Mini-Mental State Exam
RNL	Reintegration to Normal Living Index
SD	Standard deviation
TUG	The Timed Up and Go

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Figure 1.
Bland-Altman plot of the mean versus difference for the total sample

Figure 2.
Bland-Altman plot of the mean versus difference for the community dwelling subsample

Figure 3.

Bland-Altman plot of the mean versus difference for the assisted living subsample

Table 1

Demographic characteristics of the sample *

Parameters	<u>Total, n=66</u>	<u>Community living, n= 32</u>	<u>Assisted living, n= 34</u>
	No. of cases = (%)	No. of cases = (%)	No. of cases = (%)
Female	47 (71.2)	20 (62.5)	27 (79.4)
Married	26 (39.4)	19 (59.4)	7 (20.6)
Attended college	23 (34.8)	16 (50.0)	7 (20.6)
Mean Age (SD)	79.03 (8.50)	73.91(5.92)	83.85(7.75)
Mean years in (SD)	22.41 (10.27)	18.91 (10.20)	25.91 (9.21)
Mean no. of co- morbidities (SD)	2.15 (1.48)	1.88 (1.72)	2.41 (1.18)

* Parameters presented as binary; only one of the factors is shown (e.g., male data not presented).

Table 2

Means and standard deviations of the variables

Variables	Total, n=66		Community living, n=32		Assisted living, n=34		95% CI of the mean difference	
	Mean (SD)		Mean (SD)		Mean (SD)		Lower	Upper
FAI-C (baseline)	22.05 (8.33)		26.97 (7.17)		17.41 (6.53)		-12.93	-6.19
FAI-C (retest)	22.20 (8.11)		26.75 (7.15)		17.91 (6.52)		-12.20	-5.48
RNL	16.28 (4.84)		19.16 (3.83)		13.41 (3.99)		-7.70	-3.80
ABC	61.22 (25.51)		73.05 (23.55)		50.07 (22.30)		-34.25	-11.70
TUG	15.91 (6.26)		12.61 (4.81)		19.01 (5.93)		3.73	9.06

Table 3

Individual items of the FAI and the FAI-C

Frenchay Activities Index (FAI)

活動指數 (FAI-C)

We are interested in finding out how often you carry out some common activities.

Please check ☒ the box which best describes how often you perform each activity.

我們對您參與一般性的活動的頻率感興趣，請在下面空格中☒選擇最符合您的情況。

在過去三個月中，您參與以下活動頻率如何？

	Never 從來沒有	Less than once per week 一星期少於一次	1 or 2 times per week 一星期 1 到 2 次	Most days 大部分的日子都有
1) Prepare a main meal (not just a snack) 準備正餐（並非只有點心）。	☐	☐	☐	☐
2) Wash up (cleaning up after a meal, by yourself or sharing the task) 清理（你自己或與別人一起作餐後清理）。	☐	☐	☐	☐
	Never 從來沒有	Once or twice 只有 1 或 2 次	1 to 4 times per month 每月 1 到 4 次	At least once per week 至少一週一次
3) Wash clothes (e.g. loading and unloading the washing machine) 洗衣服（將衣服放入或取出洗衣機）	☐	☐	☐	☐
4) Light housework (e.g. dusting or tidying) 簡單的家事（除塵或收拾家裡）。	☐	☐	☐	☐
5) Heavy housework (e.g. vacuuming or making beds) 粗重的家事（吸塵或鋪床）	☐	☐	☐	☐
6) Local shopping (e.g. groceries or clothes) 短程距離的購物（家庭日用品或衣服）。	☐	☐	☐	☐
7) Attend social activities (e.g. go out	☐	☐	☐	☐