

**A Case Study on the Pittsburgh Fatigability Scale: Language and Cross-Cultural Adaptations**

by

**Chloe Kim Wilson**

BA, University of Pittsburgh, 2021

Submitted to the Graduate Faculty of the  
Department of Epidemiology  
School of Public Health in partial fulfillment  
of the requirements for the degree of  
Master of Public Health

University of Pittsburgh

2023

UNIVERSITY OF PITTSBURGH

SCHOOL OF PUBLIC HEALTH

This essay is submitted

by

**Chloe Kim Wilson**

on

April 28, 2023

and approved by

**Essay Advisor:** Nancy W. Glynn, PhD, Associate Professor, Department of Epidemiology,  
School of Public Health, University of Pittsburgh

Essay Reader: Cynthia L. Salter, PhD, MPH, Assistant Professor,  
Department of Behavioral and Community Health Sciences, School of Public Health, University  
of Pittsburgh

Essay Reader: Sharon C. Welburn, PhD, Assistant Professor, Kinesiology and Health Sciences,  
Columbus State University

Copyright © by Chloe Kim Wilson

2023

# **A Case Study on the Pittsburgh Fatigability Scale: Language and Cross-Cultural Adaptations**

Chloe Kim Wilson, MPH

University of Pittsburgh, 2023

## **Abstract**

**Introduction:** The Pittsburgh Fatigability Scale (PFS) developed by Glynn et al. in 2015 is the first validated, self-report instrument measuring perceived fatigability in adults aged 60 and older. The PFS has been translated to 17 other languages. Translations of public health questionnaires must be properly translated and adapted to the target language/culture in order to minimize misreporting and bias when comparing findings across populations.

**Methods:** We performed a literature search using Google Scholar on April 10, 2023. Articles that validated translations/cultural adaptations of the Pittsburgh Fatigability Scale were included and assessed using Beaton et al.'s framework for translating measures and tools.

**Results:** A total of 7 papers were evaluated and included in this review. The PFS was adapted into the following languages: the Spanish, English (United Kingdom), Dutch, Simplified and Traditional Chinese, and Korean.

**Conclusions:** Almost all the translations used Beaton's stages of translation, however, the UK-PFS only warranted a cultural adaptation, and one paper did not list any method of translation, or the language used in the study. Future validations of translations and cultural adaptations should follow a systematic process and work with the original developer during the process. This is relevant to public health because fatigability is highly prevalent and associated with age-related deleterious outcomes; understanding its prevalence across populations will help identify at-risk older adults.

## Table of Contents

<b>Preface.....</b>	<b>vii</b>
<b>1.0 Introduction.....</b>	<b>1</b>
<b>1.1 Beaton’s Guidelines for Translations .....</b>	<b>1</b>
<b>1.2 Pittsburgh Fatigability Scale (PFS) .....</b>	<b>4</b>
<b>1.3 Gaps in Knowledge and Public Health Significance .....</b>	<b>8</b>
<b>2.0 Objectives.....</b>	<b>10</b>
<b>3.0 Methods.....</b>	<b>11</b>
<b>4.0 Results .....</b>	<b>12</b>
<b>4.1 Study Characteristics .....</b>	<b>12</b>
<b>4.2 Translations of the Pittsburgh Fatigability Scale .....</b>	<b>14</b>
<b>5.0 Discussion.....</b>	<b>20</b>
<b>5.1 Conclusion and Future Recommendations .....</b>	<b>23</b>
<b>Bibliography .....</b>	<b>25</b>

## List of Tables

<b>Table 1. Criteria of Cross-Cultural Adaptation.....</b>	<b>4</b>
<b>Table 2. Translations/Cultural Adaptations of the Pittsburgh Fatigability Score .....</b>	<b>7</b>
<b>Table 3. Characteristics of Translations of the Pittsburgh Fatigability Scale .....</b>	<b>12</b>

## Preface

I would like to thank my committee members, Dr. Nancy Glynn, Dr. Cynthia Salter, and Dr. Sharon Welburn for their guidance throughout the essay-writing process. I could not have completed this essay without their wonderful support and insights. A special thank you to Dr. Glynn for all the advice and support given ever since we met during my junior year of college. I truly would not have succeeded at Pitt Public Health without her.

I would also like to thank my friends who supported me throughout graduate school, especially Maddie Goldberg, Sabine O'Rorke, and Annamaria Fort. I could not have survived the past 2 years without you all.

To the music of Harry Styles, Taylor Swift, BTS, and Seventeen, thank you for giving me the motivation to finish graduate school. I would have lost my mind without their music accompanying me throughout this journey.

A final thank you to my parents who continuously supported me even though there were several points where I wanted to give up. None of this would have been possible without their unconditional love and encouragement throughout my entire life.

## **1.0 Introduction**

Epidemiologic research and measurement tools are often developed in the English language. To investigate racial, ethnic, or cultural differences in health outcomes across groups that do not use English, this necessitates translations and/or cultural adaptations of epidemiologic tools and measurements. The Pittsburgh Fatigability Scale was developed as a means to measure perceived fatigability in adults aged 60 and over. This measure provides an excellent example of an epidemiologic tool that has been translated into 17 languages. It is important to understand practices for translations and cultural adaptations of epidemiologic tools like the PFS because this allows for direct comparisons between varying populations and protects the integrity of results.

This essay demonstrates the best practices for translations of epidemiologic measures and shares an example using the Pittsburgh Fatigability Scale developed by Glynn et al. in 2015.

### **1.1 Beaton's Guidelines for Translations**

Beaton et. al. developed a framework for the cross-cultural adaptation of self-administered questionnaires in other countries and languages in 2000. It is important that there is a standardized method to translating and/or adapting self-reported health measures. If adjusted surveys are not translated properly, this could lead to misleading results and conclusions, and the inability to compare information across populations. Beaton listed criteria on when a translation and/or cultural adaptation is needed for a measurement tool (Table 1). There are five stages to a validated



translation/cultural adaptation: translation, synthesis, back translation, expert committee review, and pretesting.

Stage I consists of the forward translation, where the original/source language is translated to the target language, and it is recommended at least two independent forward translations are done to check for any possible discrepancies. The two forward translations are referred to as “T1” and “T2”. The translators should be bilingual, with their mother tongue being the target language, and have different backgrounds from each other. The two translators each yield a written report of their respective translation, with additional statements of any uncertainties. Translator 1 should be aware of the concepts present in the questionnaire and their translation is intended to deliver comparisons from a clinical point of view. Translator 2 should not be conscious or cognizant of the ideas being translated and should not have a medical/clinical background. This translator is more probable to identify dissimilar meanings of the original statements and offers a translation that reflects the language used by the intended population.

Stage II is the synthesis of the forward translations, where the two translators and a recording observer record the translation process based on the original questionnaire and two translated versions. The synthesized questionnaire is referred to as the “T-12” version.

Back translations occur in Stage III, where at least two independent translator whose native language is the original language translate the T-12 version back into the original language. These translators are unaware of the original version. The translations from this step are “BT1” and “BT2”. Any vague wordings in the translated version are often amplified during this process, as this stage checks that the translations reflect the same content as the original version and maintains consistency. Any vague wording is often amplified during this process.

Stage IV has an expert committee amalgamate all versions of the questionnaire (T1, T2, T-12, BT1, and BT2) and develop a prefinal version with written reports explaining the justification of each decision during stages I-III. At minimum, the committee is comprised of methodologists, health professionals, language professionals, and the back/forward translators from stages I and III. It is crucial that semantic, idiomatic, experiential, and conceptual equivalences are captured during this stage (Beaton et al). According to Beaton, semantic equivalence is defined as words having the same meaning in both languages, along with any possibilities of multiple meanings for one item and any grammatical difficulties in the translation. Idiomatic equivalence indicates the difficulties translating colloquialisms/idioms in the original language into other languages and adjusting accordingly. Beaton defines experiential equivalence is defined as similar questionnaire items that are experienced in the target culture. Conceptual equivalence refers to words/phrases in the original language replaced to a word/phrase in the target language that have the same concept (Beaton et al.). The translated concepts should be understood by the equivalent of a Grade 6 level of reading (Beaton et al.).

The final stage tests the prefinal version of the translation using 30-40 people in the target setting. Each participant completes the questionnaire, and interviews are conducted gathering the participants' thoughts on what questionnaire items and responses meant. This guarantees that the adapted form is preserving its correspondence for application. This provides some measure of quality in the content validity; however, this process does not deliver construct validity, reliability, or item response patterns essential to defining a successful cross-cultural adaptation.

After the adaptation is complete, all reports and forms are submitted to the designer of the instrument/measure or the committee tracking the translated version. This ensures validity the recommended process was followed, and a sensible translation was accomplished. Further testing

of the translation with larger sample sizes should occur to establish reliability and validity (Beaton et. al.).

**Table 1. Criteria of Cross-Cultural Adaptation**

Wanting to use a questionnaire in a new population described as follows:	Results in a change in...			Adaptation Required	
	Culture	Language	Country of Use	Translation	Cultural Adaptation
A. Use in same population. No change in culture, language, or country from source	-	-	-	-	-
B. Use in established immigrants in source country	Yes	-	-	-	Yes
C. Use in other country, same language.	Yes	-	Yes	-	Yes
D. Use in new immigrants, non-English-speaking, but in same source country	Yes	Yes	-	Yes	Yes
E. Use in another country and another language	Yes	Yes	Yes	Yes	Yes

Adapted from Beaton et al. 2000.

## 1.2 Pittsburgh Fatigability Scale (PFS)

Fatigue is defined as “a subjective lack of physical and/or mental energy that is perceived by the individual/caregiver to interfere with usual/desired activities” (Eldadah). Fatigability “classifies fatigue in relation to a defined activity of a specific intensity and duration” (Glynn et

al. 2015). The Pittsburgh Fatigability Scale, developed by Glynn et al., in 2015, is the first validated self-report tool to quantify perceived fatigability in older adults and offers a more objective and sensitive approach to determining the level fatigue restricts this population. The PFS is a “brief, simple tool designed to measure perceived fatigability in older adults that demonstrates high concurrent and convergent validity against measures of performance fatigability, mobility, physical function, and fitness” (Glynn et al., 2015). The PFS is a self-administered, ten-item questionnaire where participants score their level of physical and mental tiredness they expect or imagine they would feel immediately after completing each of the 10 listed activities from 0 (no fatigue) to 5 (extreme fatigue) (Glynn et al. 2015); (Renner et. al. 2021). The items on the Pittsburgh Fatigability Scale range from sedentary to higher intensity activity and include: leisurely walk for 30 minutes, brisk or fast walk for 1 hour, light household activity for 1 hour, heavy gardening or outdoor work for 1 hour, watching TV for 2 hours, sitting quietly for 1 hour, moderate-to-high intensity strength training for 30 minutes, participating in a social activity for 1 hour, hosting a social event for 1 hour, and high-intensity activity for 30 minutes (Glynn et al. 2015).

The availability of the PFS in other languages allows for the global examination of perceived physical fatigability across populations and examine its relation to important health outcomes (Schrack et al. 2020).

To date, the PFS has been translated to 17 other languages other than English (US) (Table 2). All translations/cultural adaptations of the PFS were required to have a license issued by the University of Pittsburgh Innovation Institute. The scope of the license lists that licensees may use the PFS to collect data in conjunction with licensee non-commercial education and research:

- Make the approved translations of the PFS for use in conjunction with licensee non-commercial education and research
- Provide all such translations will be owned solely by university and the licensee promptly provides the university with a copy of the translation made
- Ensure that the translated version of the PFS is properly marked and contains a copyright notice clearly identifying the university as the owner of the copyrights
- Make copies of the PFS in sufficient quantity for use in licensee non-commercial education and research.

The licensee may not: redistribute, post, or otherwise enable or permit other individuals who are not involved in licensee non-commercial education and research to access or use the PFS except under the terms listed herein; modify, or create derivative works or translations based on the PFS other than as specified above; change the name of the instruments from PFS; copy the PFS other than as specified above; rent, lease, grant a security interest in, or otherwise transfer rights to the PFS; or remove any proprietary notices or labels on the PFS. The terms of usage are identical for each translation requested and managed by the University of Pittsburgh Innovation Institute. A sample copy of the license was provided by the original developer of the PFS (N.W Glynn).

**Table 2. Translations/Cultural Adaptations of the Pittsburgh Fatigability Score**

<b>Language</b>	<b>Country</b>	<b>Citations/Translators</b>	<b>Translation Validated/Published (Yes/No)</b>
<b>Spanish</b>	Spain	Perez et al.	Yes
<b>English</b>	United Kingdom	Cooper et al. (Cultural adaptation only)	Yes
<b>Dutch</b>	Netherlands	Feenstra et al.	Yes
<b>Simplified Chinese</b>	China	Hu et al.	Yes
<b>Traditional Chinese</b>	Taiwan	Lin et al.	Yes
<b>Korean</b>	South Korea	Kim et al.	Yes
<b>Danish</b>	Denmark	Bilingual investigators from the Long-Life Family Study in consult with original developer	No
<b>French</b>	Belgium	University of Hasselt	No
<b>German</b>	Germany	Agaplesion Bethanien Hospital in Heidelberg, Germany	No
<b>Telugu</b>	India	Internally translated by bilingual graduate student at the University of Pittsburgh	No
<b>Catalan</b>	Spain	Investigators from SITLESS Study	No
<b>Spanish</b>	United States	Professionally completed by the Mapi Institute	No
<b>Italian</b>	Italy and Switzerland	University of Applied Sciences and Arts of Southern Switzerland	No
<b>Arabic</b>	Saudi Arabia	King Abdulaziz University	No
<b>Hebrew</b>	Israel	Hebrew University of Jerusalem	No
<b>Japanese</b>	Japan	Tokyo Metropolitan Institute of Gerontology	No
<b>Portuguese</b>	Brazil	Federal University of Para	No

### 1.3 Gaps in Knowledge and Public Health Significance

Fatigability is an important public health issue as the average age of the population increases. This is a highly prevalent condition, where 42% of those age 60 years or older report physical fatigue and 24.8% report mental fatigability (LaSorda et al.); (Cohen et al.). Physical fatigability has been reported as high as 90% in the oldest old (LaSorda). Fatigability predicts physical and cognitive functional decline, along with being a robust independent indicator of mortality (Glynn et. al. 2022). Specifically, lower brain volumes of the hippocampus, putamen, and thalamus were related to high physical fatigability, and fatigability was associated with a 13-19% increased chance of significant decline for usual and fast gait speed, physical performance, and walking index (Wasson et al.); (Simonsick et al.). Perceived physical fatigability severity also predicts 2-fold higher risk of early mortality (Glyn et al. JGMS 2022).

Fatigability may stem from an assortment of factors including age-related changes in energy production/use, and inflammatory mechanisms (Eldadah 2010). Assessing fatigue and its impact on physical activity is difficult due to the tendency to alter activities to sustain feelings of fatigue within a tolerable range (Kim I. et al. 2018). Given the importance of fatigability among older adult populations and that the PFS is only existing, self-report measure of perceived physical and mental fatigability, it is important to validate the translated and culturally-adapted versions of the Pittsburgh Fatigability Scale.

As use of the PFS expands to more countries and research studies, careful evaluation of the translations/cross-cultural adaptations should be monitored. The public health significance of this topic is if a measurement tool such as the Pittsburgh Fatigability Scale is not properly translated according to the initial intent of the developers and/or culturally competent, results could be misreported and could potentially over or under-estimate prevalence rates. Inaccuracies of the

measurement could impact its associations with outcome measures, leading to incorrect conclusions.



## **2.0 Objectives**

The objectives of this essay were to evaluate the translations based on use of Beaton et al.'s framework and cultural adaptations of the Pittsburgh Fatigability Scale, a newer measurement that has emerged as an important marker of phenotypic aging.

### **3.0 Methods**

The Google Scholar index tracker for the number of citations for the paper “The Pittsburgh Fatigability Scale for Older Adults: Development and Validation” by Glynn et al. 2015 was pulled on April 10, 2023. All articles referencing the original publication of the PFS were pulled for review. The articles were determined to be eligible by the researcher examining their abstracts and the year of publication. The search yielded 117 results, and 109 were excluded because the studies either took place in the United States (i.e., conducted using English (US) version of the PFS), were published prior to 2015, or were not validations of a translation/cultural adaptation of the Pittsburgh Fatigability Scale. All citations were stored in Zotero. Translations of the PFS were evaluated using Beaton’s Guidelines for the Process of Cross-Cultural Adaptation of Self-Report Measures (Beaton et al. 2000).

## 4.0 Results

### 4.1 Study Characteristics

Six papers that published translations of the PFS were included in the review completed for this essay; the Spanish (Spain), English (UK), Dutch, Korean, Simple and Traditional Chinese translations are the only published validated translations currently available. One Chinese translation included in this essay was not validated by the original developer. All characteristics of the translations are listed in Table 3.

**Table 3. Characteristics of Translations of the Pittsburgh Fatigability Scale**

<b>Study</b>	<b>Country</b>	<b>Period</b>	<b>N</b>	<b>Population</b>	<b>Method of Translation</b>
<b>Pérez et al., 2019</b>	Spain (Spanish)	-	79	Community-dwelling adults aged 70 and older	Used Beaton's recommended stages
<b>Cooper et al., 2019</b>	United Kingdom (English)	-	1,580	Socially stratified sample of births from one week in 1946 in mainland Britain at the age of 68	Only changed spelling of words based on U.K. English alphabet, done with original developer
<b>Feenstra et al., 2020</b>	Netherlands (Dutch)	April 2018-April 2019	233	Prospective cohort of hospitalized patients aged 70 and older	Used adapted Beaton; Included the Three-Step Test Interview Method during pre-testing stage

<b>Ma et al., 2020</b>	China (no dialect listed)	-	376	Patients aged 50-97 years admitted to the Department of Geriatrics in Xuanwu Hospital Capital Medical University who were relatively healthy without acute illness	None listed
<b>Hu et al., 2021</b>	China (Simplified Chinese)	November 2018-July 2019	457	Senior citizens aged 60 and older living in a retirement community	Used modified Beaton
<b>Lin et al., 2022</b>	Taiwan (Traditional Chinese)	-	114	Community-dwelling adults aged 60 or older	Used modified Beaton
<b>Jang et al., 2021 and Kim et al., 2022</b>	South Korea (Korean)	June-September 2018 (Jang et al. 2021)	196 (Jang et al. 2021); 18 (Kim et al. 2022)	Convenience sample of women with breast cancer from Yonsei Medical Center in Seoul (Jang et al.); Native Korean speakers aged 20 and older who are healthy individuals or breast cancer survivors who completed active treatments (surgery,	Used modified Beaton; Included Cognitive Interviewing (CI) (Both articles used this method)

				chemotherapy, and radiation therapy) (Kim et al.)	
--	--	--	--	--	--

#### 4.2 Translations of the Pittsburgh Fatigability Scale

The first validated translation of the Pittsburgh Fatigability Scale was the Spanish (Spain) translation. The method used in this version was translation-retrotranslation, where two independent Spanish-speaking researchers did a forward translation from English to Spanish. The differences between T1 and T2 were examined before the primary version of the PFS was assessed by three independent Spanish-speaking researchers. Their suggestions were integrated into the final version. This version was evaluated by two older Spanish-speaking community members to properly understand the scale items. After this process, the last form of the Spanish translation was retro translated into English by a bilingual researcher. The retro translation and translated versions of the PFS were tested for accuracy by an independent bilingual individual, and no further changes were needed (Pérez et. al.).

The Spanish PFS was validated by “assessing convergent validity against several measures of physical performance, physical activity, physical function, and disability in a sample of inactive adults” (Pérez et. al.). The Spanish PFS was tested using 79 participants who were community-dwelling adults aged 70 and older; these participants self-reported deficient physical activity based on the ideal standards recommended by the World Health Organization, along with preserved mobility. This version of the PFS needed to be administered with oral guidance due to the low educational level and advanced age of the participants. No other cultural modifications were needed for the Spanish translation of the Pittsburgh Fatigability Scale.

The PFS used in the United Kingdom (only physical) did not use any of Beaton's method of translation since the measure was already in English. However, the spelling of this version was changed to match the proper spelling according to the British version of the English alphabet (Cooper et al.). The original version and British version were directly compared to each other for any discrepancies. Anecdotally, the original developer (Dr. Nancy Glynn) stated that some activities were deleted since they were not relevant in typical British life.

The Dutch translation of the PFS also followed the same forward-backward translation process that the Spanish translation used. However, the Dutch translation applied an expert panel of the original developer, a linguistic, the translators, and a geriatrician for the review and syntheses of the translations. The population for this translation was a prospective cohort of hospitalized patients aged 70 years to 95 (median age 76), and most of the cohort had at least a high school education (Feenstra et al.). Acute and elective patients from the University Medical Center of Groningen's cardiology, oncology, vascular and hepatobiliary, trauma, and internal medicine units were screened for participation.

Pre-testing in the field for the target population used the Three-Step Test Interview Method during interviews. The Three-Step Test Interview Method produces "observational data on actual response behavior of respondents who respond to a self-completion questionnaire" (Hak et al.). The three steps of this method are concurrent think aloud aimed at collecting observational data, focused interview aimed at remedying gaps in observational data, and a semi-structured interview aimed at eliciting experiences and opinions.

During the forward translation to Dutch, some language complications were found. Specifically, the translation of the answer category "extreme fatigue", along with the terms "senior center", "hiking", and "Zumba". These were fixed with the assistance of an independent person

and consensus was reached. The unit pounds (lbs.) had to be converted into kilograms since the Dutch language uses the metric system. Participants also reported some difficulties discriminating between physical and mental fatigue during the pre-testing phase. Two types of participants were recognized: those who could differentiate physical from mental fatigue using different definitions for both concepts and those who did not characterize these two ideas. All interviewed participants stated that both physical and mental fatigue were related to each other. When requested, the concept of mental fatigue was clarified. Once these issues were resolved, no additional alterations to the Dutch translation were necessary.

The Simplified Chinese version of the PFS was completed using the recommended method of retro-translation (Hu et al.). Simplified Chinese is spoken in mainland China, and this study was conducted in Beijing. The population was 457 voluntary participants aged 60 years or older living in a retirement community. Two independent Chinese-speaking researchers independently translated the original PFS into the target language, and any inconsistencies were discussed. The inconsistencies were resolved by consensus, and the SC-PFS was dispensed to two Chinese older-community-dwellers. The two community-dwellers evaluated the proper understanding of elements used in the scale (Hu et al.). After this step, the SC-PFS was retro-translated into English by a bilingual researcher and verified for accuracy by another independent bilingual individual. This translation had to be culturally adjusted for some of the original example activities such as dusting, straightening up, baking, raking, aerobic machines, and Zumba, and replaced with relevant activities such as Ping-Pong. The convergent and discriminant validity for the SC-PFS was assessed against physical measures such as the Short Physical Performance Battery and the Timed Up and Go Test, along with daily living performance processes such as the Barthel Index and Instrumental Activity of Daily Living (Hu et al.).

The Traditional Chinese (TC) translation of the Pittsburgh Fatigability Scale was conducted in Taiwan with a population of 114 community dwelling adults aged 60 or older. The target population of this translation was a subset of the community dwellers categorized with late-life depression, mild cognitive impairment, and cognitively normal older controls. This version of the PFS used an English to Chinese forward translation and back translation by a bilingual person. The two translations were reviewed by the original author of the PFS and a person who was a native speaker of Chinese but also fluent in English. The TC-PFS added an 11<sup>th</sup> item in this version (“moderate household activity”) due to some apprehension that the original item, “heavy gardening or outdoor work” was not culturally relevant to Taiwanese older adults (Lin et al.). However, the additional 11<sup>th</sup> item was dropped during testing for reliability as it found that the new item did not outperform any of the original 10 items. Pearson’s correlation was used to test construct validity, and group comparison was used for discriminative validity (Lin et al.).

The Korean translation of the PFS is the newest validated translation out of the five translations included in this essay. The K-PFS translation by Kim et al. had a population of 18 participants who were at native Korean speakers at least 20 years of age. The participants were either healthy individuals or cancer survivors who completed active treatments such as surgery, chemotherapy, and radiation therapy. The forward translation to Korean used two independent native speakers, one who was acquainted with PFS-related terminology and another who was not accustomed with the vocabulary of this measure. The backward translation had two independent native English speakers translate the K-PFS into English, and neither translator had any understanding of the instrument (Kim et al. 2022).

The K-PFS utilized Cognitive Interviewing (CI) after the forward and back translations were completed and is comprised of four stages. The four stages are comprehension, information



retrieval, judgment formation, and response editing. CI was conducted in three rounds with six participants in each round. The first round of CI interviewed six female participants who experienced breast cancer and found that only three of the ten translated items were understood. The second round also interviewed six women who survived breast cancer but did not participate in the previous round. The participants were interviewed for the seven items that were not understood by the round one's participants and found that two items needed further revisions. The final round of CI interviewed two breast cancer patients, two healthy women, and two healthy men for generalizability. All six participants completely understood the revised items from round 2. The ten items post revisions were back-translated into English again and received confirmation from the author of the PFS to resolve the CI stage (Kim et al. 2022).

The K-PFS was validated for the psychometric properties in 2021 (Jang et al.). Jang et al. used Beaton's suggested method of translation/cultural adaptation of a measure, along with cognitive interviews following translation. Translators worked with the original developer of the Pittsburgh Fatigability Scale. The validation of the K-PFS had a population of 196 women with breast cancer who were at least 20 years of age, received a diagnosis at least 1 year prior, and had completed active cancer treatment (radiotherapy and/or chemotherapy).

The cultural adjustments in the K-PFS were made to be more intently connected with and/or daily life contexts particularly for women who had experienced cancer. Specifically, examples for "outdoor work" such as mowing and raking were replaced with "indoor/outside work" since most Korean homes lack a garden/lawn. Other examples used to demonstrate familiar activities of the anticipated level are squats, sit-ups, and free gymnastics (chejo in Korean) for "moderate- to high-intensity", along with substituting jang-gi (widely known as "Go") for "playing cards/bridge" (Kim S. et al. 2022).

Ma et al. used a Chinese translation of the PFS; however, no method of translation was listed, and the article did not state what dialect was used. At this point in time, no validated Chinese translation was publicly available. Only the scores were listed in the paper, and the PFS was only used as a quality-of-life measure.

## 5.0 Discussion

An evaluation of the published translations of the Pittsburgh Fatigability Scale reveal that almost all the currently published translations used Beaton's recommended method of translation. This demonstrates a systematic approach for all currently published translations. The translations established why cultural context was important for the Pittsburgh Fatigability Scale. Many of the translations mentioned how some example activities in the original PFS had to be swapped for ones that were culturally relevant.

Although the PFS is a measure that included activities that were America-centric, but the activities as needed were adapted or changed for other cultures if they had the same intensity according to the Ainsworth Compendium (Ainsworth et al.). The Ainsworth Compendium is used worldwide "to quantify the energy cost of physical activity in adults for surveillance activities, research studies, and to write the physical activity recommendations in clinical settings, and to assess energy expenditure in individuals" (Ainsworth et al.). Specifically, the Dutch, Korean, and both Chinese translations mentioned how the example activity of Zumba had to be replaced. The Simplified and Traditional Chinese, and Korean translations had to stress the activity of gardening/yard work from the original version due to most people living in urban areas.

A key methodological importance when the translating words and activities chosen in the target language is to maintain the integrity of the initial intensity of the activity remains to properly measure fatigability. If care is not taken when translating activities such as these, this could lead to the original meaning of words or phrases in the questions being lost, which could in turn lead to the misclassification of fatigability prevalence and severity.

Each translation has its strengths and weaknesses. The Spanish translation by Perez et al. was the first of the six included in this essay to be validated and published. The strengths of this translation are Beaton's method was used while also working with the original developer of the PFS. However, a weakness is the population used to validate the Spanish PFS had a low education level, along with having a small sample size of 79. This creates a possible issue of interviewer bias with the potential for priming, compared to most other translations were self-reported and filled out by the participants.

The British adaptation only changed the spelling of the PFS to the proper spelling of words according to the U.K. alphabet; however, this was not cited in the article. Based on Beaton's criteria in Table 1, this variation of the PFS only necessitated a cultural adaptation, not a translation. A comparison was done while working with the original developer between the original PFS and the UK-PFS for any differences. The UK-PFS deleted the example activities such as shoveling snow as the developers for this version did not think these examples were relevant.

The strengths of the Dutch translation are it had a large sample size and used the Beaton method of adaptation. However, the population of this study were hospitalized patients, and the patients' health could impact how they answered the questionnaire and its results. This creates an issue of generalizability since most of the general population are not hospitalized.

The PFS-X version used by Ma et al. did not mention any method of translation and did not state what dialect was used. The translators also did not work with the original developer of the PFS. The only mention of this version of the PFS was when quality of life measures was discussed. The one strength of this paper was a large sample size of 376 participants. This paper demonstrates the danger of using a translation that is not validated; the PFS scores listed in their results cannot be trusted to measure the intended value. The results of Ma et al. may have lost the

original intensity of the activities included in the PFS and there is no way to verify original meaning of the questions were upheld. We may be reluctant to trust their prevalence rates from this translation.

The Simplified Chinese PFS also had the strength of a large sample size; and all participants did not have any significant health conditions (Hu et al). There are not any known weaknesses of this translation.

The Traditional Chinese version of the PFS had a large sample size, however, over half of the population in this study either had a diagnosis of late-life depression or had mild cognitive impairment (Lin et al.). This could affect the adjustments made to the TC-PFS, along with the results of the scores themselves.

Both Korean PFS translations used Beaton's method of translating measurement tools; however, Kim et al. had a very small sample size of 18. Both Jang et al. and Kim et al. validated the Korean translation of the PFS for breast cancer patients, and this could create issues surrounding generalizability for the rest of the population. A major strength both K-PFS translations have is the use of Cognitive Interviewing during the translation process. This guarantees that the measurement tool is fully understood by the target population and specifically pinpoints what terms/phrases/example activities need to be adjusted.

This essay overall has some strengths and weaknesses that should be noted. First, this is a single case study examining the translations of one instrument, the Pittsburgh Fatigability Scale. A major strength is the accepted standard of translations/cultural adaptations, Beaton et. al.'s framework, was used in this case study. All except one of the translations included are validated and involved the original developer. The strengths are the items included in each version of the PFS are tailored to older adults, and most used rigorous translation methods and consulted with

the original developer to approve any changes made. Another strength is some translations, such as the Dutch and Korean versions, used focus groups to guide the process. However, a considerable weakness is the few number of studies available to evaluate. Several translations are currently in progress and future efforts should examine those to add to this work. The review was limited to articles published in English and was reviewed by a single reader. Also, any papers that did not cite usage of the Pittsburgh Fatigability Scale were not captured in this literature search.

### **5.1 Conclusion and Future Recommendations**

In summary, the objectives of this essay were to describe and assess each translation/cultural adaptation of the Pittsburgh Fatigability Scale and offer a case report of on translations/cultural adaptations of the PFS. This essay discovered that most of the translations/cultural adaptations used a systematic process using Beaton's guidelines and worked directly with the original developer of the Pittsburgh Fatigability Scale. This ensured that none of the original meaning was lost in the target languages once translations occurred. If future translations are not done systematically and in conjunction with the original developer, this would introduce possible loss of intended meaning. The Ma et al. study demonstrates this exact issue, and the results of this study are in question since it seemingly is lacking a validated translation.

Future translations of the Pittsburgh Fatigability Scale should also follow Beaton's guidelines and directly work with the original developer of this measure. This ensures that the same process is followed across all versions and the intended implication of the measure is not lost during the translation procedure. Also, the PFS should be validated in additional populations for

the currently published versions. Some of the translations did not validate the PFS for the general population, and this puts the generalizability into question.

Improperly translated or adapted questionnaires can be problematic because the intended meanings of activities, by measure of intensity and duration, could be altered or even lost. This would make the adapted measure inaccurate and possibly lead to misclassification, along with the inability to compare fatigability in different populations. It is imperative that we accurately capture fatigability severity and is of public health relevance to understand the impact of this age-related measurement for older adults to best identify those most at-risk of deleterious outcomes.

## Bibliography

- Ainsworth, B. E., Haskell, W. L., Herrmann, S. D., Meckes, N., Bassett, D. R. J., Tudor-Locke, C., Greer, J. L., Vezina, J., Whitt-Glover, M. C., & Leon, A. S. (2011). 2011 Compendium of Physical Activities: A Second Update of Codes and MET Values. *Medicine & Science in Sports & Exercise*, *43*(8), 1575. <https://doi.org/10.1249/MSS.0b013e31821ece12>
- Beaton, D. E., Bombardier, C., Guillemin, F., & Ferraz, M. B. (2000). Guidelines for the Process of Cross-Cultural Adaptation of Self-Report Measures. *Spine*, *25*(24), 3186.
- Cohen, R. W., Meinhardt, A. J., Gmelin, T., Qiao, Y. (Susanna), Moored, K. D., Katz, R. D., Renner, S. W., & Glynn, N. W. (2021). Prevalence and severity of perceived mental fatigability in older adults: The Long Life Family Study. *Journal of the American Geriatrics Society*, *69*(5), 1401–1403. <https://doi.org/10.1111/jgs.17075>
- Cooper, R., Popham, M., Santanasto, A. J., Hardy, R., Glynn, N. W., & Kuh, D. (2019). Are BMI and inflammatory markers independently associated with physical fatigability in old age? *International Journal of Obesity*, *43*(4), Article 4. <https://doi.org/10.1038/s41366-018-0087-0>
- Eldadah, B. A. (2010). Fatigue and Fatigability in Older Adults. *PM&R*, *2*(5), 406–413. <https://doi.org/10.1016/j.pmrj.2010.03.022>
- Feenstra, M., Smidt, N., van Munster, B. C., Glynn, N. W., & de Rooij, S. E. (2020). Translation and validation of the Dutch Pittsburgh Fatigability Scale for older adults. *BMC Geriatrics*, *20*(1), 234. <https://doi.org/10.1186/s12877-020-01630-8>
- Glynn, N. W., Gmelin, T., Santanasto, A. J., Lovato, L. C., Lange-Maia, B. S., Nicklas, B. J., Fielding, R. A., Manini, T. M., Myers, V. H., de Rekeneire, N., Spring, B. J., Pahor, M., King, A. C., Rejeski, W. J., Newman, A. B., & for the Lifestyle Interventions and Independence for Elders Study Group. (2020). Impact of Baseline Fatigue on a Physical Activity Intervention to Prevent Mobility Disability. *Journal of the American Geriatrics Society*, *68*(3), 619–624. <https://doi.org/10.1111/jgs.16274>
- Glynn, N. W., Gmelin, T., Renner, S. W., Qiao, Y. (Susanna), Boudreau, R. M., Feitosa, M. F., Wojczynski, M. K., Cosentino, S., Andersen, S. L., Christensen, K., Newman, A. B., & for the LLFS Research Group. (2022). Perceived Physical Fatigability Predicts All-Cause Mortality in Older Adults. *The Journals of Gerontology: Series A*, *77*(4), 837–841. <https://doi.org/10.1093/gerona/qlab374>
- Glynn, N. W., Santanasto, A. J., Simonsick, E. M., Boudreau, R. M., Beach, S. R., Schulz, R., & Newman, A. B. (2015). The Pittsburgh Fatigability Scale for Older Adults: Development and Validation. *Journal of the American Geriatrics Society*, *63*(1), 130–135. <https://doi.org/10.1111/jgs.13191>



- Hak, T., van der Veer, K., & Jansen, H. (2004). *The Three-Step Test-Interview (TSTI): An observational instrument for pretesting self-completion questionnaires* (ERS-2004-029-ORG). Article ERS-2004-029-ORG. <https://repub.eur.nl/pub/1265>
- Hu, Y., Zhang, H., Xu, W., Zhao, M., Liu, J., Wu, L., Zou, L., Zuo, J., Liu, Y., Fan, L., Bair, W.-N., Qiao, Y. S., & Glynn, N. W. (2021). Validation of perceived physical fatigability using the simplified-Chinese version of the Pittsburgh Fatigability Scale. *BMC Geriatrics*, *21*(1), 336. <https://doi.org/10.1186/s12877-021-02275-x>
- Jang, M. K., Kim, S., Park, C. G., Collins, E. G., Quinn, L. T., Glynn, N. W., & Ferrans, C. E. (2021). Psychometric properties of the Korean version of the Pittsburgh Fatigability Scale in breast cancer survivors. *Health and Quality of Life Outcomes*, *19*(1), 179. <https://doi.org/10.1186/s12955-021-01815-8>
- Kim, I., Hacker, E., Ferrans, C. E., Horswill, C., Park, C., & Kapella, M. (2018). Evaluation of fatigability measurement: Integrative review. *Geriatric Nursing (New York, N.Y.)*, *39*(1), 39–47. <https://doi.org/10.1016/j.gerinurse.2017.05.014>
- Kim, S., Kim, I., Glynn, N. W., & Jang, M. K. (2022). Translation and linguistic validation of the Pittsburgh Fatigability Scale for Korean breast cancer survivors: A cognitive interviewing study. *Cancer Care Research Online*, *2*(4), e029. <https://doi.org/10.1097/cr9.0000000000000029>
- LaSorda, K. R., Gmelin, T., Kuipers, A. L., Boudreau, R. M., Santanasto, A. J., Christensen, K., Renner, S. W., Wojczynski, M. K., Andersen, S. L., Cosentino, S., & Glynn, N. W. (2019). Epidemiology of Perceived Physical Fatigability in Older Adults: The Long Life Family Study. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, *75*(9), e81–e88. <https://doi.org/10.1093/gerona/glz288>
- Lin, C., Glynn, N. W., Gmelin, T., Wei, Y.-C., Chen, Y.-L., Huang, C.-M., Shyu, Y.-C., & Chen, C.-K. (2022). Validation of the Traditional Chinese Version of the Pittsburgh Fatigability Scale for Older Adults. *Clinical Gerontologist*, *45*(3), 606–618. <https://doi.org/10.1080/07317115.2021.1914258>
- Ma, L., Chhetri, J. K., Zhang, Y., Liu, P., Chen, Y., Li, Y., & Chan, P. (2020). Integrated Care for Older People Screening Tool for Measuring Intrinsic Capacity: Preliminary Findings From ICOPE Pilot in China. *Frontiers in Medicine*, *7*, 576079. <https://doi.org/10.3389/fmed.2020.576079>
- Pérez, L. M., Roqué, M., Glynn, N. W., Santanasto, A. J., Ramoneda, M., Molins, M. T., Coll-Planas, L., Vidal, P., & Inzitari, M. (2019). Validation of the Spanish version of the Pittsburgh Fatigability Scale for older adults. *Aging Clinical and Experimental Research*, *31*(2), 209–214. <https://doi.org/10.1007/s40520-018-0959-0>
- Renner, S. W., Bear, T. M., Brown, P. J., Andersen, S. L., Cosentino, S., Gmelin, T., Boudreau, R. M., Cauley, J. A., Qiao, Y. S., Simonsick, E. M., & Glynn, N. W. (2021). Validation of Perceived Mental Fatigability Using the Pittsburgh Fatigability Scale. *Journal of the American Geriatrics Society*, *69*(5), 1343–1348. <https://doi.org/10.1111/jgs.17017>

- Simonsick, E. M., Glynn, N. W., Jerome, G. J., Shardell, M., Schrack, J. A., & Ferrucci, L. (2016). Fatigued, But Not Frail: Perceived Fatigability as a Marker of Impending Decline in Mobility-Intact Older Adults. *Journal of the American Geriatrics Society*, *64*(6), 1287–1292. <https://doi.org/10.1111/jgs.14138>
- Schrack, J. A., Simonsick, E. M., & Glynn, N. W. (2020). Fatigability: A Prognostic Indicator of Phenotypic Aging. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, *75*(9), e63. <https://doi.org/10.1093/gerona/glaa185>
- Wasson, E., Rosso, A. L., Santanasto, A. J., Rosano, C., Butters, M. A., Rejeski, W. J., Boudreau, R. M., Aizenstein, H., Gmelin, T., & Glynn, N. W. (2019). Neural correlates of perceived physical and mental fatigability in older adults: A pilot study. *Experimental Gerontology*, *115*, 139–147. <https://doi.org/10.1016/j.exger.2018.12.003>