Archives of Gerontology and Geriatrics 58 (2014) 257–262

Contents lists available at ScienceDirect

Archives of Gerontology and Geriatrics

journal homepage: www.elsevier.com/locate/archger

Concurrent and convergent validity of the mobility- and multidimensional-hierarchical disability categorization models with physical performance in community older adults

Ming-Hsia Hu [a,b,c], Chih-Jun Yeh [d,e], Tou-Rong Chen [f,g], Ching-Yi Wang [e,h,i,*]

[a] Graduate Institute of Physical Therapy, College of Medicine, National Taiwan University, Taipei, Taiwan
[b] Institute of Brain and Mind Sciences, National Taiwan University, Taiwan
[c] Center of Physical Therapy, National Taiwan University Hospital, Taiwan
[d] Institute of Public Health, College of Health Care and Management, Chung Shan Medical University, Taichung, Taiwan
[e] Center for Education and Research on Geriatrics and Gerontology, Chung Shan Medical University, Taichung, Taiwan
[f] School of Medical Imaging and Radiological Sciences, Chung Shan Medical University, Taichung, Taiwan
[g] Department of Medical Image, Chung Shan Medical University Hospital, Taichung, Taiwan
[h] School of Physical Therapy, Chung Shan Medical University, Taichung, Taiwan
[i] Physical Therapy Room, Chung Shan Medical University Hospital, Taichung, Taiwan

ARTICLE INFO

Article history:
Received 15 March 2013
Received in revised form 3 September 2013
Accepted 25 September 2013
Available online 10 October 2013

Keywords:
Validity
Aging
Mobility disability
Hierarchical disability

ABSTRACT

A valid, time-efficient and easy-to-use instrument is important for busy clinical settings, large scale surveys, or community screening use. The purpose of this study was to validate the mobility hierarchical disability categorization model (an abbreviated model) by investigating its concurrent validity with the multidimensional hierarchical disability categorization model (a comprehensive model) and triangulating both models with physical performance measures in older adults. 604 community-dwelling older adults of at least 60 years in age volunteered to participate. Self-reported function on mobility, instrumental activities of daily living (IADL) and activities of daily living (ADL) domains were recorded and then the disability status determined based on both the multidimensional hierarchical categorization model and the mobility hierarchical categorization model. The physical performance measures, consisting of grip strength and usual and fastest gait speeds (UGS, FGS), were collected on the same day. Both categorization models showed high correlation ($\gamma_s = 0.92$, $p < 0.001$) and agreement (kappa = 0.61, $p < 0.0001$). Physical performance measures demonstrated significant different group means among the disability subgroups based on both categorization models. The results of multiple regression analysis indicated that both models individually explain similar amount of variance on all physical performances, with adjustments for age, sex, and number of comorbidities. Our results found that the mobility hierarchical disability categorization model is a valid and time efficient tool for large survey or screening use.

1. Introduction

The goal of active aging is to maintain older adults' independence for as long as possible in order to extend the active life expectancy and reduce the years of dependence. To achieve this goal, older adults in early stages of physical function decline need to be identified so that they can be provided with timely health care programs to maintain and improve their physical independence. Although physical performance tests such as grip strength and gait speeds provide a factual and reliable measurement to detect early physical decline (Fried et al., 2001), the measurement instrument and physical space might not be feasible in a large community screening setting or a (telephone) survey type of research. The authors are interested in testing the validity of an abbreviated instrument, the mobility hierarchical categorization model, to identify older adults in early stages of functional decline. The finding should have great implications for identifying a valid, time-efficient and easy-to-use instrument for busy clinical settings, large surveys, or community screening.

A comprehensive multidimensional hierarchical model of physical disability can be used to classify older adults into different stages of physical decline (Barberger-Gateau, Rainville, Letenneur, & Dartigues, 2000). This model is based on the

* Corresponding author at: School of Physical Therapy, Chung Shan Medical University, No. 110, Sec. 1, Jian-Guo N. Road, South District, Taichung City 402, Taiwan. Tel.: +886 4 24730022x12393.
E-mail addresses: cywang@csmu.edu.tw, cywang.taichung@gmail.com (C.-Y. Wang).

0167-4943/$ – see front matter © 2013 Elsevier Ireland Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.archger.2013.09.004

hierarchical progression of physical disability in the majority of older adults, which begins with difficulty in mobility, followed by the domains of instrumental activities of daily living (IADL) and activities of daily living (ADL) (Harris, Kovar, Suzman, Kleinman, & Feldman, 1989; Hoeyman, Feskens, van den Bos, & Kromhout, 1996; Jette & Branch, 1981). This model of the multidimensional hierarchical development of physical disability has been validated in a longitudinal study (Barberger-Gateau et al., 2000). Based on this hierarchical model, severity of physical disability can be categorized into four groups: all able (independent in all three domains), mildly disabled (dependent in mobility domain only), moderately disabled (dependent in mobility and IADL, but not ADL), and severely disabled (dependent in mobility, IADL, and ADL) (Barberger-Gateau et al., 2000).

Since mobility disability develops at an earlier age and earlier in the process of physical function decline, disability in the mobility domain is considered to indicate the risk of developing further disability in IADL or ADL (Barberger-Gateau et al., 2000). Hence it is possible that an abbreviated system of the multidimensional hierarchical disability categorization system, the mobility hierarchical categorization system, may provide a more efficient and equally effective way to identify older adults in an early stage of physical decline. An individual can be classified based on the total number of items of dependence in the mobility domain only (Ostir, Volpato, Kasper, Ferrucci, & Guralnik, 2001). Individuals reporting a higher number of dependent items in the mobility domain tend to have worse physical performance (Wang, Olson, Gleeson, & Protas, 2005).

It is unclear whether the mobility disability hierarchical categorization model is as effective as the multidimensional hierarchical categorization model in identifying community-dwelling older adults with poor physical performance. The purpose of this study was to examine the validity of the mobility disability hierarchical categorization model first by comparing its correlation and agreement with the multidimensional hierarchical disability classification model and second by triangulating the models with physical performance measures in a group of community-dwelling older adults. We hypothesized that the two categorization models would have good concurrent validity and agreement and both be significantly correlated to and explain similar amounts of variance in physical performance measures in community-dwelling older adults.

2. Methods

2.1. Participants

Subjects were recruited from local community centers through announcements and notifications from the administrators of the centers and through flyers posted in the centers. In addition, a research physical therapist actively approached older adults who appeared at the centers to participate in leisure or social activities. Inclusion criteria were (1) living in their home alone or with someone else in the community, (2) aged 60 years or older, (3) able to walk independently with or without walking aids, and (4) able to understand the instructions and perform the physical tests. Individuals who had health considerations and those who could not perform the tests in this study were excluded. Subjects read and signed informed consent forms approved by the Institutional Review Board prior to testing.

2.2. Procedure

The participants were all interviewed face-to-face to gather their demographic (age, sex) and general health information. General health information consisted of body mass index (BMI, kg/m^2), self-perceived health status compared to their peers (healthier, same, less healthy), and number of comorbidities (physician's diagnosis of the following diseases: high blood pressure, diabetes, heart disease, pulmonary disease, stroke, arthritis, eye problem, hearing problem, cancer, Parkinson's disease). Their mental status was assessed by the Chinese version of the Mini-Mental State Examination (C-MMSE), which has a score range from 0 to 30 (Chiu, Lee, Chung, & Kwong, 1994).

Self-reported measures of function were assessed by asking them to report if they were "able", "needed help", or "unable" to perform the tasks in mobility, IADL, and ADL domains by themselves. The three activities in the mobility domain were as follows: walk 800 m, climb stairs up/down to 2nd floor, and perform heavy housework. The five activities in the IADL domain (using the telephone, shopping, outdoor transportation, responsible for own medication, and handling finances) were assessed for both men and women. Two more IADL activities were added when assessing on women (food preparation, light housekeeping). The five activities in the ADL domain were as follows: eating, dressing, bathing, grooming, and transferring from bed to chair. An item was coded "independent" if they reported "able"; otherwise, it was coded "dependent". A domain was coded "able" if all items in that domain were coded "independent"; otherwise, it was coded as "disabled".

Disability status was classified using both the multidimensional hierarchical disability categorization and the mobility disability hierarchical categorization system. In the multidimensional hierarchical disability classification system, the participants were categorized into one of the four multidimensional hierarchy subgroups: all able (mobility, IADL, and ADL domains all able), mildly disabled (mobility disabled only), moderately disabled (both mobility and IADL domains disabled, but not ADL), and severely disabled (mobility, IADL, and ADL domains all disabled) (Barberger-Gateau et al., 2000). The mobility hierarchical classification, based on the total numbers of items reported dependent in the mobility domain only, categorizes participants into one of four subgroups: all able, 1 item disabled, 2 items disabled, and 3 items disabled. The main difference between administering the multidimensional- and mobility-hierarchical disability categorizations is that in the former, all three domains (mobility, IADL, and ADL) must be finished, which takes about 3 min, whereas in the later, only the mobility domain is used, which takes less than 1 min.

Physical performance was assessed by grip strength and usual and fastest gait speeds (UGS, FGS). Grip strength of the dominant hand (the hand used in performing heavy tasks or using heavy tools) was measured with a Jamar dynamometer in the second handle position for all subjects. Subjects were seated with the arms by the trunk, the elbow flexed to 90° and in a neutral position, and the wrist in slight extension. Subjects were told to squeeze the dynamometer as hard as they could when they heard, "Ready, go." The mean of two consecutive squeezes was used in data analysis. At three community centers, UGS and FGS were assessed by recording the time (in s) required to walk a distance of 15.24 m, with subjects starting from a standing posture. At four community centers, due to space limitations, gait speed was measured over an 8-m distance with the middle 4 m as the measuring distance (Wang, Chen, Lin, Liu, & Chen, 2012). The participants walked twice consecutively, and the mean of two trials was used for calculation of gait speed and for data analyses. The test–retest reliabilities of the UGS and FGS have been found to be excellent (intra-class correlation coefficient$_{(2,1)}$ = 0.80–0.95) (Wang, Sheu, & Protas, 2009), as has that of grip strength (ICC $\geq$ 0.92) in a group of community-dwelling older Asian adults (Wang & Chen, 2010). The total duration for collecting all data was approximately 20 min for each participant.