

Development of the Exercise Self-efficacy Scale for Chinese Older Adults

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ABSTRACT

Exercise self-efficacy is one of the most important factors that influences older person's exercise behavior. In China, it was reported that less than half of older people residing in urban areas engage in exercise regularly and lack of perception was alleged to be a major reason. This study was designed to develop and examine the psychometric properties of the Exercise Self-efficacy Scale for Chinese Older Adults (ESES).

An instrument development design was used and convenient sampling was employed to recruit 402 Chinese older adults to participate in this study. Five steps of the instrument development process included identifying the exercise self-efficacy concept, generating the items, determining the format, reviewing the items by expert and testing of validity and reliability. The ESES is a 30-item, 4-point Likert Scale. It comprises of six dimensions, namely, lack of motivation, lack of support, health condition, time barriers, lack of facilities and environmental barriers. The new scale demonstrates an acceptable content validity index and construct validity. Its criterion-related validity in line with the Physical Activity Questionnaire developed by Voorrips and colleagues was also reported. The ESES developed in this study can be used as research and clinical tools to measure exercise self-efficacy of Chinese older adults.

Key words: Scale development, Exercise self-efficacy scale, Chinese older adults

INTRODUCTION

In China, the older adult population is increasing at a rate of 3.2%, thus by 2020, the proportion of older adults will be increased to 16% (China Sustainable Development Institution, 2004). China, therefore has the largest older adult population in the world. With an increase of older adults, there is also a significant increase in chronic diseases, degenerative illness and co-morbidities. In China, a national survey showed that 60% to 70% of older adults are living with at least 2 chronic diseases (Zhang, 2004). Chronic diseases contribute to disability, dependence and diminished quality of life among older adults and ultimately increased

health and long-term care costs.

Physical activity has been found to be an independent risk factor for various chronic diseases and conditions that threaten the health of the nation (King, 2001). The linkage between exercise, the prevention of chronic disease and health promotion are also well established (Francis, 1999; Ruchlin and Lachs, 1999; Zhang, 2004). Exercise is defined as a type of intended, planned or structured physical activity. It involves repetitive bodily movement that improves or maintains one or more of the components of physical fitness (American College of Sports Medicine, 2001). Studies showed that exercise could slow or stop some of the physical changes associated with aging (Fiatarone and Garnett, 1997). Furthermore, exercise can reduce the severity of chronic conditions and prevent complications of chronic diseases, such as in hypertension and diabetes (U.S. Preventive Services Task Force, 1996). Additionally, exercise has been found to help older adults enrich their spare time, enhance their social life, decrease loneliness and improve their self-esteem (Zhang, 2004). Thus, exercise is essential and a sufficient way to help older adults maintain and improve function and overall quality of life (Ellingson and Conn, 2000).

Recently, self-efficacy has received considerable support as a predictor of initiation and maintenance of health-related behaviors, including exercise (Pender et al., 2002), and it is defined as people's judgments of their capabilities to execute a certain level of performance (Bandura, 1986). Exercise self-efficacy refers to the judgment of an individual's capabilities to exercise with moderate intensity three or more times a week regularly in the face of identified obstacles to participation (McAuley et al., 2003). It has been identified as one of the primary psychological variables impacting exercise behavior among older adults (Glenn, 2002; Allison and Keller, 2004). However, appropriate instrument needs to be developed for specific conditions, for a variety of developmental levels, and in client's native languages before an educational intervention can be implemented and studied (McDermott and Palchanes, 1992; McAuley et al., 1999). Bandura (1997) suggested that perceived efficacy should be measured against levels of task demands that represent gradations of challenges or impediments to successful performance. Perceived exercise self-efficacy is usually assessed in terms of beliefs that one can mobilize the effort needed to perform exercise in the face of various impediments such as fatigue, dysphoric mood, time constraints, competing conditions and unfavorable environment conditions (Bandura, 2005).

From the literature, several self-efficacy measures have been used in exercise researches (Bandura, 1997; U.S. Cancer Prevent Research Center, 2005). However, the target populations for the majority of existing exercise self-efficacy scales were not for older adults, and the items in existing exercise self-efficacy scales developed for western people may not address the challenges and barriers to exercise in Chinese older adults. For example, in Chinese culture, the role of family is critically important; the sense of self is much more interconnected with others, especially the significant family members (National Chronic Care Consortium, 2005). Thus, lack of previous exercise experience and concern about social desirable performance can also influence their perceived ability when participat-

ing in exercise. Therefore, the cultural sensitive, reliable and valid instrument is needed to measure the exercise self-efficacy among Chinese older adults. The objectives of this study were to develop an instrument to measure exercise self-efficacy among Chinese older adults, and to conduct a psychometric evaluation of the newly-developed exercise self-efficacy instrument in terms of validity and reliability.

MATERIALS AND METHODS

Study design and sample

The methodological study was employed to develop the Exercise Self-efficacy Scale (ESES) for Chinese older adults. The study was divided into two phases: (1) development and pre-testing of the instrument and (2) evaluation of the psychometric properties of the ESES. Phase I composed of identification of construct and content of ESES, generation of item pool, determination of content validity, determination of clarity and readability and pre-testing for determination reliability. Phase II comprised of reliability testing for stability and internal consistency, and testing for construct and criterion-related validity. The target population was the Chinese older adults living in one of the five districts, namely, Heping district, Shenhe district, Tiezi district, Dadong district and Yuhong district. Convenient sampling was employed for both phases. In phase I, 15 Chinese older adults were purposively employed by the inclusion criteria for an in-depth interview and the determination of clarity and readability of the ESES. For pre-testing of the ESES, 108 older Chinese participants were selected. In phase II, 50 Chinese older adults were selected to test the stability of the ESES, and 402 Chinese older adults were recruited to test internal consistency reliability, and 64 Chinese older adults were purposively sampled to test for criterion-related validity.

Instruments

1. Demographic Data Form was developed by the researchers to gather personal data of the participants. It was a self-report form on gender, age, level of education, working situation, personal income and exercise behavior.

2. The Mini-Mental State Examination (MMSE) is a screening tool for assessing cognitive impairment (Folstein et al., 1975). The MMSE examines five areas of cognitive function: orientation, registration, attention and calculation, recall and language and praxis. Correct answers are summed, score ranges from 0-30. At a cut-score of 23/24, impairment has been classified into three levels: 24-30 (no impairment), 18-23 (mild impairment) and 0-17 (severe impairment). The internal consistency reliability of MMSE was reported as .96. It was translated into Chinese.

3. The Physical Activity Questionnaire (PAQ) developed by Voorrips and colleagues contained domains of household activities, sports/exercise activities and leisure time activities (Voorrips et al., 1991). Stability reliability of PAQ with a time interval of 20 days was .89. The Spearman's correlation coefficients between the PAQ and the two reference methods, physical activity recall

and use of a pedometer, were .78 and .72, respectively (Voorrips et al., 1991). This study utilized only the sports/exercise activity sub-scale including type of activity, frequency and duration of activity to test the criterion-related validity of the newly-developed ESES scale.

4. Interview guidelines developed by the researchers were used to explore older adults' exercise behaviors and situations that inhibit their action. It contained open-ended questions in which the participants were asked to express how they define exercise, who or what may affect their participation in exercise and what are the barriers that inhibit them from participating in exercise.

Data collection

The study was approved by the Research Ethics Review Committee of Faculty of Nursing, Chiang Mai University. Participants were provided with a detailed explanation of the study and promised confidentiality prior to signing the study informed consent.

Phase I: Development and pre-testing of the instrument

Step 1, identification of construct and content of the ESES, was conducted via an intensive review and in-depth interview with 15 Chinese older adults to identify the forms of challenges and barriers to exercise which the Chinese older adults are faced with and generate the item pool. Thirty-eight items were generated and tested for clarity and readability with the same 15 Chinese older adults. The ESES was revised based on comments and suggestions from 5 experts and Chinese older adults.

Phase II: Evaluation of the psychometric properties

Internal consistency and stability reliability testings were conducted with 402 Chinese older adults who met the inclusion criteria. For the stability reliability, 3-week interval was used to distribute the 1st and 2nd ESES. To evaluate criterion-related validity of the ESES, both ESES and the sports/exercise sub-scale of PAQ were distributed to 64 Chinese older adults.

Data Analysis

Phase I: Development and pre-testing of the instrument

For item pool development, content analysis was used to classify the items based on the results from the in-depth interviews. The content validity was analyzed by using inter-rater agreement and the index of content validity (CVI). A CVI of .80 was acceptable. Cohen's Kappa was used to test inter-rater reliability in determining the valence (positive or negative) of each descriptor. A coefficient value of .80 or higher was acceptable. Item analysis was used to confirm reliability of the ESES with the criteria: (1) inter-item correlation matrix between .30 and .70, (2) a corrected item-total correlation coefficient greater than .30 and (3) alpha estimate for internal consistency if an item was deleted. Pearson's product moment correlation was calculated to determine item-total, item-subscale and subscale-subscale correlations. Additionally, Cronbach's alpha coefficient

and Spearman's rank correlation coefficient were calculated to identify internal consistency and stability reliability of ESES. For internal consistency reliability, Cronbach's alpha coefficient above .70 was considered satisfactory for the new scale. An explanatory factor analysis with principal component, and orthogonal rotation was used to explore the numbers of factor for determining the dimensions underlying the set of items of ESES. Eigenvalues greater than 1 and screen-test were considered to address the numbers of factor. Criterion-related validity was analyzed by using Spearman's rank correlation to examine the relationship between the scores of ESES and sports/exercise sub-scale of PAQ.

RESULTS

Phase 1: Development of the ESES

Construct and content of exercise self-efficacy were identified from literature review and in-depth interviews with Chinese older adults. From the comprehensive literature review, exercise self-efficacy was defined as the judgment of an individual's capability to perform exercise. Exercise self-efficacy for Chinese older adults means the judgment of the Chinese older adults' capability to exercise with moderate intensity three or more times a week regularly in the face of identified obstacles to participation. The in-depth interview of 15 Chinese older adults provided more specific information from the perspective of Chinese older adults on factors influencing exercise participation. Seven factors influencing participation in exercise were identified, including time conflict, health condition, environmental barriers, lack of support, lack of facilities, lack of motivation and economic constraint. The first draft of ESES comprised 40 items, 5-point Likert-type scale ranging from "not at all confident" to "completely confident".

Phase 2: Testing Psychometric Properties

The content validity of the ESES yielded the CVI of .87. According to item analysis guideline, 5 items were deleted, 2 items were added and some items were combined. Thus, the revised ESES scale comprised of 36 items.

To ascertain the clarity and readability, the English version of 36-item ESES was translated into Chinese version and back translation technique was performed. The researcher translated the original English version of 36-item ESES into Chinese, and then a bilingual person who is an English language teacher in a Foreign Language Department of Shenyang Medical College back translated the Chinese version into English version. The two English versions were compared by both the researchers and the back translator to identify the flaws in the Chinese version. Then, the Chinese version of ESES was tested for clarity and readability with 15 Chinese older adults and the readability and clarity were confirmed. However, 2 items were added from the comments of the participants. In addition, 5-point scale structure was too difficult to differentiate the answer. Then, 38-item ESES scale with 4-point rating scale was tested for reliability.

Reliability of the ESES was tested. The Cronbach's alpha of the total scale was determined. The item-item correlation ranged from 0.533-0.752 and 8

items with inter-item correlation higher than .70 were deleted. Then the internal consistency reliability was tested with the 30-item ESES. The overall Cronbach's alpha coefficient was .97.

To determine the construct validity of ESES, explanatory factor analysis with principle component was conducted. The Kaiser-Meyer-Olkin (KMO) and the Bartlett's test of sphericity were conducted to test the sampling adequacy and identity matrix, respectively. The KMO measure of sampling adequacy was .97, and the Bartlett's test of sphericity was large and significant ($\chi^2=.8787.94$, $p=.000$). This means that the variables were correlated high enough to provide a reasonable basis for factor analysis. The results of explanatory factor analysis indicated that all of the 31 items loaded in six components together accounted for 69.61% of the total variance. Factor pattern and factor loading for the ESES are presented in Table 1.

Factor 1 consisted of six items of confidence in conducting exercise regularly even when lacking in motivation: under lots of stress, feel gloomy or depressed or anxious, goal is not achieved, recovering from an injury, exercise is too heavy, and recovering from chronic illness. Factor 2 contained eight items of confidence in conducting exercise regularly although there was no support from family members, friends and others. Those 8 items included: no exercise instructor, no one to give encouragement, someone made fun of them, discontinuation of partner, dislike of family members, cannot access to exercise equipment, have to pay for exercise fee, and exercise on your own. Factor 3 comprised of seven items: have chronic illness, exercise causes pain or muscle ache, recovering from injury, get sick, exhaustion, recovering from chronic illness, and exercise is too heavy. These items presented the perception of Chinese older adults on their ability to perform exercise even though they had some health problems or chronic illnesses. Factor 4 consisted of five items, namely, time conflicts: could not fit between exercise schedule and free time, lots of work, someone visit at home, busy with house work, and more interesting activities of appointments. This factor was the perception of Chinese older adults on their ability to do exercise even if there were time conflicts. Factor 5 included three items: no sport suits or shoes, closed gymnasium, and inaccessibility to exercise equipment. These items represented facilities to promote exercise behavior of Chinese older adults. Factor 6, environmental barriers, contained two items which represented the feeling of Chinese older adults on their capability to act on exercise without environmental support, i.e., no spacious place and bad weather.

Table 1. Factor pattern and factor loading for the exercise self-efficacy scale (n=402).

No.	ESES items	Factors					
		1	2	3	4	5	6
Lack of motivation							
1	under lots of stress	.76					
2	feel gloomy or depressed or anxious	.73					
3	goal is not achieved	.67					
4	recover from an injury	.54					
5	exercise is too heavy	.51					
6	recover from chronic illness	.43					
Lack of support							
7	no exercise instructor		.65				
8	no one to encourage		.64				
9	someone made fun of		.64				
10	discontinuation of partner		.62				
11	dislike of family members		.59				
12	cannot access to exercise equipment		.56				
13	have to pay for exercise fee		.49				
14	exercise on your own		.43				
Health condition							
15	have chronic illness			.70			
16	exercise causes pain or muscle ache			.67			
17	recover from injury			.60			
18	get sick			.59			
19	exhausted			.57			
20	recover from chronic illness			.54			
21	too heavy			.48			
Time conflict							
22	could not fit between exercise schedule and free time				.67		
23	lots of work				.65		
24	someone visit at home				.61		
25	busy with house work				.54		
26	more interesting activities of appointment				.47		
Lack of facility							
27	no sport suits or shoes					.80	
28	closed gymnasium					.58	
29	cannot access to exercise equipment					.48	
Environmental barriers							
30	no spacious place						.56
31	bad weather						.51
	Eigenvalue	5.88	4.56	4.23	2.68	2.36	1.19
	% of variance	19.56	15.20	14.09	8.94	7.86	3.96
	Cumulative % of variance	19.56	34.76	48.85	57.79	65.65	69.61

The criterion-related validity was tested and is shown in Table 2. According to the magnitude of correlation suggested by Cohen, the ESES strongly correlated with the sports/exercise sub-scale of the Physical Activity Questionnaire (PAQ) ($\rho=.59$).

Table 2. Spearman's rank correlation coefficient of the 30-item exercise self-efficacy and sport/exercise sub-scale of PAQ.

	New scale	Concurrent validity measure
		Sport/exercise sub-scale of PAQ
ESES		.59**
** p<.01		

DISCUSSION

The ESES was developed to capture the judgment of the Chinese older adults' ability to exercise with moderate intensity three or more times a week regularly in the face of identified obstacles to participate. The scale addressed impediments and challenges of exercise perceived by Chinese older adults which were derived from in-depth interview. Those obstacles included lack of motivation, lack of support, health conditions, time conflict, lack of facilities and environmental barriers. It was found that obstacles found in the newly-developed scale were similar to the existing measures. However, the differences between the existing scales and the newly-developed scale were the obstacles of lack of facilities from community and lack of supports. Since this study was conducted with Chinese older adults residing in an urban area where there were not enough public facilities and more crowded than rural areas, lack of facilities provided by the public community might be considered as a significant factor to promote exercise. Additionally, support from significant others such as family, friend or neighbors was considered as a factor encouraging Chinese older adults to participate in exercise since they are more likely to depend on others, especially their family members. In terms of the format of ESES, 5-Likert-type scale was modified to 4-point responses because it was easier and more practical for Chinese older adults due to the difficulty to differentiate between very confident and completely confident.

Compared to other exercise self-efficacy scales developed based on self-efficacy theory of Bandura, the Exercise Self-efficacy Scale of Bandura (Bandura, 2005), the Exercise Self-efficacy Scale of Resnick and Jenkin (Resnick and Jenkins, 2000), the proposed ESES may be more suitable for Chinese older adults since it focuses on obstacles of exercise in the context of Chinese older adults.

The psychometric properties of the ESES were well demonstrated in this study. The CVI and the Cohen's Kappa were acceptable due to the triangulation of data from literature review, in-depth interviews and expert review. Moreover, back translation technique was conducted to verify for content validity of the Chinese version of the ESES. The Chinese version was examined for clarity, readability and appropriateness of length of the scale by Chinese older adults.

Construct validity of the newly-developed scale was considered satisfactory. Regarding the components of each factor, Factor 1 “Lack of motivation” and Factor 3 “Health condition” addressed having chronic illness, negative emotional feelings and previous experiences of exercise impacting on confidence of Chinese older adults to do exercise; most Chinese older adults live with chronic illnesses (Spector, 1992). Unsurprisingly, physical and psychological health conditions were seen as major obstacles for Chinese older adults since the decline of health status affected the perception of strength of exercise of an individual.

Factor 2, “Lack of support” and Factor 5, “Lack of facility” reflected interpersonal relationship influencing perceived capability of Chinese older adults to perform exercise. Support and facilities provided by the community and family and all sources of support such as instrumental or economic, emotional and informational support were perceived by Chinese older adults as essential factors influencing exercise performance. It can be explained that the role of family and community is critically important in Chinese culture and the sense of self is much more interconnected with others, especially the significant family members (National Chronic Care Consortium, 2005).

Factor 4, “Time conflict” included conflicts among housework activities, other activities and exercise. This is partly due to Chinese older adults having more responsibilities even after their retirement, engaging in housework such as looking after grandchildren, cleaning house, cooking food. This makes them busy and with little or no time to participate in exercise.

Factor 6, “Environmental barrier” included bad weather and only few areas for exercise. During the winter time in China, it is very cold with lots of snow, therefore, older people have to keep themselves warm to prevent sickness. Moreover, some communities in China are overcrowded with buildings, and the public parks are far away from the communities. Furthermore, most older adults prefer to do exercise near their home or in their community. Therefore, it is difficult for Chinese older adults who would like to exercise to do so outdoor.

Reliability estimate of the ESES revealed the reliable scale. For the internal consistency reliability of the ESES, this was highly reliable for a new scale. However, all of the coefficient values were falling in the .90s, and this threatened redundancy of items in the scale (DeVillis, 1991). Further research is needed to test reliability of the ESES with different groups of sample. Additionally, the deletion of items is needed to be considered. Beside internal consistency, stability of the ESES was confirmed. This indicated that this scale is reliable enough to measure exercise self-efficacy of Chinese older adults in different time intervals.

The concurrent criterion-related validity of the new scale was supported in this study. The ESES was strongly correlated with the sports/exercise sub-scale of PAQ, suggesting that the ESES related to some degree of exercise performance among Chinese older adults. This may be because exercise self-efficacy can be enhanced by exercise participation (Li et al., 2001) and exercise self-efficacy is a significant predictor of exercise behavior (McAuley et al., 2002). Since about half of the participants (51.6%) in this study exercise regularly, the concurrent criterion-related validity was confirmed. However, the exercise behavior should

be considered to verify the evidence for predictive validity of ESES. Therefore, further study is needed to confirm the predictive validity of the ESES. Also, the more standard measure of exercise behavior will help to reinsure the criterion-related validity of ESES.

CONCLUSION

An appropriate instrument developed to measure exercise self-efficacy of Chinese older adults is needed before the educational intervention can be implemented to promote exercise behavior of this specific group of elders. The 30-item 4-point Likert Exercise Self-efficacy Scale for Chinese older adults was developed and tested for validity and reliability. It can be used by health care personnel to classify the Chinese older adults into low and high self-efficacy groups in order to establish the appropriate intervention program to enhance exercise self-efficacy. Additionally, it is useful for measuring effectiveness of an intervention program in terms of promoting exercise self-efficacy among Chinese older adults.

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