

# Reliability of Physical Activity Pattern Questionnaire for Elders

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## Research article

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# Abstract

**Background** Since it is important for elders to do physical activity regularly, many countries including South Korea have followed physical activity recommendations on the dose-response relationship between the frequency, duration, intensity, and type of physical activity for health. Although many studies have focused on the dose-response relationship of physical activity with health benefits for older adults, there is little information available and practical to measure physical active lifestyle whether they meet the recommendations of physical activity. **Objective** The purpose of this study is to assess the test-retest reliability of the newly developed physical activity pattern questionnaire in repeated assessments performed by older adults aged 65 years and above. **Methods** Of the 200 questionnaires, 117 residents aged over 65 who were participating in recreational programs provided by the community centers (senior center, residential culture center, and sport center) completed the survey. The test-retest repeatability was assessed using the Cohen's kappa statistics. **Results** The reliability coefficient showed good to high internal consistency throughout. The alpha statistic was 0.658 for questions on flexibility activity participation, 0.666 for questions on aerobic activity participation, and 0.935 for questions on muscular activity participation. **Conclusions** This paper made an important methodological contribution to the assessment of physical activity by showing that when creating a more accurate and comfortable tool for measuring physical activity it is necessary to take into account the global physical activity recommendations. In conclusion, the author found excellent or good reproducibility at a four week interval for all questions that survey physical activity pattern among elders and know whether they meet the global physical activity recommendations.

## Background

Research has repeatedly shown that exposure to regular physical activity for elders reduces the risk for a variety of illnesses, including cardiovascular disease, Type 2 diabetes, hypertension, certain types of cancers, such as breast cancer and colon cancer, certain types of musculoskeletal disorders, and obesity [1, 2]. There is also strong evidence that regular physical activity can help reduce and prevent some common mental health disorders, including anxiety, depression, and stress [3, 4].

To gain these health benefits of physical activity, the public health organizations such as the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) suggest the global recommendations on physical activity for health [5, 6]. The recommendations address three age groups: 5–17 year olds; 18–64 year olds; and 65 year olds and above. For example, adults aged 65 and over should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate and vigorous-intensity activity. In addition, muscle-strengthening activities should be done involving major muscle groups on 2 or more days a week. Since it is important for elders to do physical activity regularly, many countries including South Korea have followed physical activity recommendations on the dose-response relationship between the frequency, duration, intensity, and type of physical activity for health. Although many studies have focused on the dose-response relationship of

physical activity with health benefits for older adults, there is little information available and practical to measure physical active lifestyle whether they meet the recommendations of physical activity [7].

In past decades, many physical activity questionnaires have been developed for different populations in various countries. However, physical activity questionnaires still remain limited in reliability and validity [8-10]. Many self-reported physical activity questionnaires have been created to evaluate frequency, duration, and intensity of physical activity [11, 12]. The content of these measures differs widely and has limited reliability and validity relative to an objective measure of physical activity. Some questionnaires focus on a single type of activity such as occupation, leisure, sports, or aerobic exercise [13]. Several other questionnaires either provide a too narrow description of an individual's physical activity or offer a continuous total or subscale score although items used are often not comparable across measures [14, 15]. The physical activity questionnaires are not enough to distinguish occupational activity from leisure activity during leisure time [16]. Another deficiency in the questionnaires is the lack of the relative importance of aerobic, resistance, and flexibility activity that is performed.

Considering the fact that many countries estimate physical activity levels using questionnaires and analyze this information to identify health promotion strategies, there is a greater need than ever to assess more accurately the daily physical activity and to monitor comprehensive trends in habitual physical activity to meet the recommendations on physical activity from the public health organizations. Furthermore, as the health benefits of a regular physical active lifestyle are well documented, the more accurate and practical physical activity questionnaire to consider elders has become an interesting and important topic of study around the world.

Therefore, physical activity pattern questionnaires should consider the multiple mode of physical activity by reporting type and dimensions of duration, intensity, frequency, and the period of time from first engaging in the habitual physical activity. The purpose of this study is to assess the test-retest reliability of the newly developed physical activity pattern questionnaire in repeated assessments performed by older adults aged 65 years and above.

## **Methods**

### **Samples**

The assessment of the reliability of physical activity questionnaires was obtained from four samples, collected at different times and locations. The author used a quota sampling technique to select samples. First, the author randomly selected one senior center, one residential culture center, one sports center, and one community park in Samcheok city, South Korea. Second, the author randomly selected 50 samples from each of the centers. The samples included in Samcheok residents aged over 65 who were participating in recreational programs provided by the community centers (senior center, residential culture center, and sport center). At the centers, four research staff members conducted face to face interview surveys between the survey period (6:30 am to 11:30 am and 2:00 pm to 9:00 pm). The retest was scheduled to be administered four weeks after the first face to face interview. The retest period was

May 1 to May 30, 2019. Of the 200 questionnaires, 117 residents completed the survey. 44 (37.6%) were males while 73 (62.4%) were females. Participants ranged in age from 65 to 88 years old.

### **Physical activity pattern questionnaire**

Because the main document of WHO's physical activity recommendation emphasizes the combination of aerobic, resistance, and flexibility exercise, the questionnaire was developed to capture WHO's physical activity recommendations and different types of physical activity. 17 items of 23 items were selected based on Cho's study [17] and the public health organizations' physical activity recommendations [5, 6]. Items were discarded from the following criteria such as items with learning effects, response rate close to 0%, and high semantic similarity. The questionnaire was divided into two parts, a demographic factor and physical activity pattern factor (aerobic activity, muscular strength activity, and flexibility activity).

An expert panel in the field of sports & leisure and recreation was invited to classify the activities into three different types of physical activities. The categorizations of physical activities were aerobic exercise & sports (walking, biking, jogging, swimming, aerobic, basketball, softball, soccer, golf, table tennis, badminton, football, etc.), flexibility exercises (stretching, yoga, Pilates, calisthenics, etc.), muscular exercises (weight training, free weight training, etc.). An expert panel in this study determined items to assess aerobic, muscular, and flexibility activity behaviors. To assess aerobic activity patterns, four items (frequency, intensity, duration, and overall length of physical activity during their leisure time) with usage of a five-point Likert-type scale were included. For example, "how often do you participate in the activity in your free time?" The frequency of physical activity was categorized as "almost every day (5)", "4-5 days/week", "3 days/week", "1-2 days/week", and "very infrequently (1)."

Regarding the assessment of muscular activity patterns, again four items (frequency, intensity, duration, and overall length of physical activity during their leisure time) with usage of a five-point Likert-type scale were included. For example, "how intensely do you participate in the activity?" The intensity of activity participation was categorized as "very hard (5)", "hard", "moderate", "light", and "very light (1)."

To assess flexibility activity patterns, four items (frequency, intensity, duration, and overall length of physical activity during their leisure time) with usage of a five-point Likert-type scale were included. For example, "how long do you do the activity in your free time?" The duration of physical activity participation was categorized as "less than 20 minutes (1)", "30 - 50 minutes", "60 - 80 minutes", "90 - 110 minutes", and "more than 120 minutes (5)."

### **Procedure and analysis**

After obtaining an ethical clearance by the authentic ethical committee of Daegu University, copies of the survey questionnaires were distributed to each of the 200 participants in the community centers from the

four different places in Samcheok, South Korea. The written consent forms and questionnaires were distributed to participants by the research staff. The participants were informed that participation in the study was voluntary and they were free to withdraw from the study at any time. At retesting, four trained survey interviewers conducted one-on-one interviews with 117 respondents. Of 200 respondents, 83 respondents did not participate in the study owing to a change in shift pattern or a summer holiday in the survey period. Therefore, the study sample comprised 117 residents whom agreed to participate in the study.

The test-retest repeatability was assessed using the Cohen's kappa statistics. According to Fleiss and Cohen [18], an agreement of less than 0.40 was considered as poor, between 0.41 and 0.59 as fair, between 0.60 and 0.74 as good, and of 0.75 or more as excellent. Internal consistency was assessed by the Cronbach's alpha coefficient. According to Nunally and Bernstein [19], an alpha over 0.7 indicated a high reliability, over 0.5 a moderate reliability, and below 0.2 a low reliability. Data processing used the SPSS software version 24.

## Results

A total of 160 subjects participated in the first survey and 117 subjects participated in the follow-up questionnaire survey. The respondents ranged in age from 65 to 88 years old. 44 (37.6 %) respondents were males while 73 (62.4 %) respondents were females. 48 (41.0 %) respondents are living in urban areas and 69(59.0 %) are in rural areas.

For the sake of clarity, the repeatability of the responses was shown according to the questions with five-point Likert-type scale answers. The repeatability of questions pertaining to flexibility activity was excellent for three questions (frequency, time, intensity) with kappa values of greater than 0.75. One question (overall length) showed a kappa value of 0.725, indicating substantial agreement (table 1).

To know the repeatability of the responses on the aerobic activity questions, Cohen's kappa statistic was used. The kappa values of four items with a five-point scale ranged from 0.878 to 0.852, indicating almost perfect agreement (table 1).

For the sake of clarity, the repeatability of the responses on the frequency, time, intensity, and overall length of muscular activity participation are presented in table 1. The repeatability of questions pertaining to frequency, time and overall length of muscular activity participation was excellent with kappa values of 0.795 to 0.751. The repeatability of response on intensity of muscular activity participation was good with kappa value of 0.679.

Table 1. Repeatability of answers on aerobic, muscular strength, and flexibility activity questionnaire

Physical activity types	Items	Questions	Cohen's kappa	p
Aerobic activity	Frequency	How often do you participate in the activity?	0.856	.001
	Time	How long do you do the activity?	0.871	.001
	Intensity	How intensely do you participate in the activity?	0.852	.001
	Overall length	How long have you been performing the activity?	0.878	.001
Muscular strength	Frequency	How often do you participate in the activity?	0.795	.001
	Time	How long do you do the activity?	0.785	.001
	Intensity	How intensely do you participate in the activity?	0.679	.001
	Overall length	How long have you been performing the activity?	0.751	.001
Flexibility activity	Frequency	How often do you participate in the activity?	0.762	.001
	Time	How long do you do the activity?	0.807	.001
	Intensity	How intensely do you participate in the activity?	0.783	.001
	Overall length	How long have you been performing the activity?	0.725	.001

The reliability coefficient showed good to high internal consistency throughout. The alpha statistic was 0.658 for questions on flexibility activity participation, 0.666 for questions on aerobic activity participation, and 0.935 for questions on muscular activity participation.

## Discussion

The Test-retest method is used to estimate components of measurement error by repeating the measurement process on the same subjects under conditions as similar as possible [20]. The kappa scores were observed in items assessing physical activity patterns on frequency, intensity, time, and overall length of aerobic activity, muscular and flexibility exercise. The author obtained good agreement for all items of the questions on aerobic activity patterns: “how often do you participate in the activity”; “how intensely do you participate in the activity”; “how long do you do the activity”; “how long have you been performing the activity”. The questions on the muscular strength activity pattern scored excellent or good agreement. The kappa values were in the good range for one question (intensity) and excellent for three questions (frequency, time, overall length). The questions of the flexibility activity behavior were

repeatable. The kappa values were in the good range for one question (overall length) and excellent for three questions (intensity, time, frequency).

The alpha coefficient was used to test internal consistency. A Chronbach's alpha coefficient of  $< 0.40$  indicates that the measurement instrument is not reliable, whereas values of  $0.60 - 0.80$  indicate substantial reliability [19]. The alpha statistic was 0.658 for questions on flexibility activity participation, 0.666 for questions on aerobic activity participation, and 0.935 for questions on muscular activity participation. None of the alpha statistics were classified in the poor or fair categories. In terms of the public health organizations' physical activity types, items relating to aerobic exercise, muscular activity, and flexibility exercise showed to be reliable. Therefore, the internal consistency of the physical activity behavior questionnaire proved to be satisfactory. A high Chronbach's alpha coefficient, in this case, is the reflection of the degree of coherence of items within one domain in exploring the concept that is assessing physical activity patterns. The items being considered are complementary of each other so it is a general reflection of all the aspects of this domain.

## **Conclusion And Future Study**

This is the first known study to survey physical activity patterns among elders using questionnaire based on the global physical activity recommendations in terms of test-retest reliabilities for physical activity patterns, although many questionnaires exist to examine physical activity. This paper made an important methodological contribution to the assessment of physical activity by showing that when creating a more accurate and comfortable tool for measuring physical activity it is necessary to take into account the public health organizations' physical activity recommendations. In conclusion, in this sample of subjects aged from 65 to 88 of residents of the Samcheok community in South Korea, the author found excellent or good reproducibility at a four week interval for all questions that survey physical activity pattern among elders and know whether they meet the global physical activity recommendations.

This study is limited by the lack of a parallel form reliability analysis. Therefore, the parallel forms test should be used to test the reliability of a questionnaire. The reliability of this questionnaire should be tested in samples with a different demographic range. Also, future study should focus on the development of physical activity index using this questionnaire. Although many countries are responding to the public health organizations' physical activity recommendations, it has been difficult for countries to bridge the know-do gap from recommendation to implementation. Therefore, it is encouraging to see the concerted effort of countries around the world as elders strive to meet the public health organizations' physical activity recommendations.

## **Declarations**

### **Ethics approval and consent to participate**

Ethical approval has been given by Ethical Committee of Daegu University. Written informed consent was obtained from all the participants. All research procedures followed were in accordance with the ethical standards of the committee and with the Helsinki Declaration of 1975, as revised in 2013.

### **Consent for publication**

This manuscript does not contain any individual person's data that needing a consent for publication.

### **Availability of data and material**

The data used and analyzed during the current study are available from the author on reasonable request.

### **Competing interests**

The author declares that he has no competing interests.

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### **Authors' contributions**

Dr. Cho designed the study and was responsible for the collection, analysis, and writing the manuscript.

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## Supplementary Files

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- [Physicalactivitypatternquestionnaire.pdf](#)