Restrictions of physical activity participation in older adults with disability: employing keyword network analysis

Kyo-Man Koo¹, Chun-Jong Kim², Chae-Hee Park³, Jung-Kyun Byeun⁴, Geon-Woo Seo⁵, *

¹Department of Adapted Physical Education, Baekseok University, Cheonan, Korea
²Department of Special Physical Education, Yeungnam University, Kyongsan, Korea
³Department of Sport and Healthy Aging, Korea National Sport University, Seoul, Korea
⁴Department of Adapted Physical Education, Korea National Sport University, Seoul, Korea
⁵Department of Sport Industrial, Korea National University of Transportation, Chungju, Korea

Older adults with disability might have been increasing due to the rapid aging of society. Many studies showed that physical activity is an essential part for improving quality of life in later lives. Regular physical activity is an efficient means that has roles of primary prevention and secondary prevention. However, there were few studies regarding older adults with disability and physical activity participation. The purpose of this current study was to investigate restriction factors to regularly participate older adults with disability in physical activity by employing keyword network analysis. Two hundred twenty-nine older adults with disability who were over 65 including aging with disability and disability with aging in type of physical disability and brain lesions defined by disabled person welfare law partook in the open questionnaire assessing barriers to participate in physical activity. The results showed that the keyword the most often used was ‘Traffic’ which was total of 21 times (3.47%) and the same proportion as in the ‘personal’ and ‘economical’. Exercise was considered the most central keyword for participating in physical activity and keywords such as facility, physical activity, disabled, program, transportation, gym, discomfort, opportunity, and leisure activity were associated with exercise. In conclusion, it is necessary to educate older persons with disability about a true meaning of physical activity and providing more physical activity opportunities and decreasing inconvenience should be systematically structured in Korea.

Keywords: Older people with disability, Physical activity, Keyword network analysis

INTRODUCTION

The National Statistical Office (2015) anticipates the elderly population to reach 15.7% (8.08 million) in 2020 and 40% or more in 2060. Considering current state compared to statistical change, this country was rapidly moving on to super-aged society. This tendency might affect a trend of increased disability among the older adult population. The disabled older person showed symptoms of high level of dependence, anxiety, phobia, depression, and deterioration of health, low level of satisfaction towards living, and insufficient economic standard of living (Kim, 1996; Lee, 2010; Song, 2011). In addition, older persons with disability had problems with maintaining activities of daily living as well as instrumental activities of daily living.

Many studies showed that physical activity is an essential part for improving quality of life in later lives. Regular physical activity is an efficient means that has roles of primary prevention and secondary prevention which diminish manifestation of chronic disease such as diabetes, cardiovascular disease, cancer, osteoporosis. This also has functional ability improvement, elevation of muscular strength, alleviation of depression, and stress for physically challenged people. Physical activity is prominent for enhanc-
Developing ability in daily lives, personal health-promotion and affects psychological aspects positively such as improvement of self-esteem and self-efficacy (Fernandez and Petetti, 1993; Graham and Reid, 2000; Hicks et al., 2003; Sherrill, 2004).

People with disabilities are living longer as they typically have better health care and support than in earlier years. However, many studies showed that people with disabilities are less likely to engage in regular moderate physical activity than people without disabilities, yet they have similar needs to promote their health and prevent unnecessary disease. In the United States, only 25% of physically disabled older adults participate in recommended physical activities. Likewise, practical participation rate of physical activities is trivial compared to its beneficial effects. Under consideration of current state, physical activity facilities should be provided for the inactive disabled elderly.

In Korea, there was few research regarding older adults with disability and restrictions of physical activity participation. However, there were a few studies discussing about adults with disability and barriers for participating physical activity. For example, Ku and Kim (2011) found that weather, tiredness, physical condition, lack of information, accessibility, convenience, lack of information were reasons not to participate in physical activity. In addition, Koo and Oh (2012) reported that shortage of facilities, economical difficulty, lack of time, inconvenience of getting transportation were main factors that put limits on the disabled adults participating in physical activities.

Older people with disabilities have problems from aging process as well as disability conditions. These complicated conditions make worsened to regularly participate in any form of physical activity and there are not many studies looking at factors related to physical activities. Therefore, it was very necessary to find out barriers and difficult factors affecting physical activity participation in older persons with disability to promote the physical activities for in their lives.

In particular, not only looking at how many a particular concept appears in the text but also examining the relationship between each concept using the structural analysis might be necessary. Therefore, the purpose of this study was to find out factors to hinder older adults with disability to participate in physical activity by analyzing keywords based on barriers of physical activity participation as well as their connected patterns employing keyword network analysis. The study results would help us to grasp the real meaning of the messages from older adults with disability and to visually understand the relationship between the important concepts. Additionally, results from the study will utilize to develop strategies for promoting physical activity participation for older adults with disability.

**MATERIALS AND METHODS**

**Subjects**

Two hundred twenty-nine older adults with disability who were over 65 including aging with disability and disability with aging in type of physical disability and brain lesions defined by disabled person welfare law partook in the open questionnaire assessing barriers to participate in physical activity. The respondents lived in Seoul, Gyeong-gi, and Incheon region. Demographic characteristic of the participants represented 129 males, 100 females by gender and 76 people of 65–69 years old, 72 people of 70–74 years old, 48 people of 75–79 years old, and 33 people of 80 years old or more by age. By types of disability, it demonstrated 48 people for brain lesions, 171 people for physical disability, and 10 for other disability. The study was conducted from September 1, 2013 to October 31, 2014.

**Procedure**

An open questionnaire was used to acquire barriers to participate in physical activities in older adults with disability. The researchers conducted questionnaire configurations literature analysis (Kasser and Lytle, 2005; Korean Paralympic Committee, 2011; Rimmer et al., 2004) and the questionnaire was modified and fabricated through the inter-meeting-related two professionals in the area of adapted physical activity and physical activity with older adults.

Next, it confirmed the primary keyword based on the questionnaire in order to carry out the purposes of this study, duplicate or means were reanalyzed the same word. Keywords summarized 49 pieces. In order to analyze the frequency of text, ‘KrKwic’ software was used. And the appearance was analyzed simultaneously by utilizing software ‘KrTitle’ (co-occurrence) frequency to the text analyzed by the network matrix. Also it was used to visualize and analyze the connections centrality by ‘NodeXL (ver. 1.0.1.113)’ program. The process of the study is shown below Fig. 1.

Network analysis is a method for a visual representation to identify the relationship between structure and properties of the connection centered on the interaction of the object for communication as one of the social analysis methodology interstate quantitatively (Kim and Ko, 2004). In recent years, it was gradually increasing its scope, ranging from the social sciences, applied sciences, and management. Techniques to interpret the phenomena dis-
played by a network of relationships between words appearing in the text; analyze the network (Choi and Park, 2011; Sim, 2011).

And the language and knowledge made through each word is a methodology that the network configuration between the networks (Sowa, 1984) is based on the perception that the relationship between language and the language encoding (Popping, 2000). In the sociological part has adopted a text link analysis and network analysis techniques, widely used in promoting understanding of such phenomena and research about him (Cho, 2011).

Network analysis was carried out more about the keywords network analysis, detailed areas. The keywords of the data collected in the network analysis appeared in the form of a matrix, it was used if there was a relationship between the objects shown as 1, otherwise, the analysis method shown to zero. The term node refers to keywords, relationship between the criteria used with the paper, it meant a topic. It calculated as the number of links connected to a node degree, was connected to the central high means that the relationship with other nodes were high. Centrality parameter was intended to mean the extent to which the position on a shortest path between the node and the node. Parameters on the central role were represented as a mediator or arbitrator.

**RESULTS**

The keyword the most often used was ‘Traffic’ which was total of 21 times (3.47%) and the same proportion as in the ‘personal’ and ‘economical.’ Looking at the top ten item showed ‘high price,’ ‘state policy,’ ‘cost,’ ‘feeling,’ ‘chance,’ ‘weather,’ ‘helper’ in order. It was the total keyword More than eight times shown, in 49 items, it had been used 605 times (Table 1).

Focusing on the upper network analysis was performed keyword. The results thereof are as follows. It was the same and represented an illustration of the central node and related thereto, and represented the degree used with both keywords. In the connectivity analysis, according to the various terms it had been made around the ‘exercise,’ and represented the degree of the distance between the center keywords. In addition, it was confirmed that the two groups formed in each area (Fig. 2). Any keyword could be represented as a network. At a basic level, the keywords,
Table 1. Frequency of the keywords

| No. | Item             | Frequency (%) |
|-----|------------------|---------------|
| 1   | Traffic          | 21 (3.47)     |
| 2   | Personal         | 21 (3.47)     |
| 3   | Economical       | 21 (3.47)     |
| 4   | High price       | 18 (2.98)     |
| 5   | State policy     | 18 (2.98)     |
| 6   | Cost             | 17 (2.81)     |
| 7   | Feeling          | 17 (2.81)     |
| 8   | Chance           | 16 (2.64)     |
| 9   | Weather          | 16 (2.64)     |
| 10  | Helper           | 16 (2.64)     |
| 11  | Money            | 15 (2.48)     |
| 12  | Prepared         | 15 (2.48)     |
| 13  | Mental attitude  | 15 (2.48)     |
| 14  | Body             | 15 (2.48)     |
| 15  | Free             | 14 (2.31)     |
| 16  | Hospital         | 14 (2.31)     |
| 17  | Paralegal        | 13 (2.15)     |
| 18  | Shortage         | 13 (2.15)     |
| 19  | Inconvenience    | 13 (2.15)     |
| 20  | Person           | 13 (2.15)     |
| 21  | Social life      | 12 (1.98)     |
| 22  | Leisure sports   | 12 (1.98)     |
| 23  | Stress           | 12 (1.98)     |
| 24  | Facility         | 12 (1.98)     |
| 25  | Body             | 12 (1.98)     |
| 26  | Hard             | 11 (1.82)     |
| 27  | Exercise         | 11 (1.82)     |
| 28  | Weight           | 11 (1.82)     |
| 29  | Equipment        | 11 (1.82)     |
| 30  | Disabled         | 10 (1.65)     |
| 31  | Disabled sports  | 10 (1.65)     |
| 32  | Rehabilitation   | 10 (1.65)     |
| 33  | Private          | 10 (1.65)     |
| 34  | Accessibility    | 10 (1.65)     |
| 35  | Policy           | 10 (1.65)     |
| 36  | Restrictions     | 10 (1.65)     |
| 37  | Leader           | 9 (1.49)      |
| 38  | Disability       | 9 (1.49)      |
| 39  | Fitness room     | 9 (1.49)      |
| 40  | Athletic         | 9 (1.49)      |
| 41  | Gym              | 9 (1.49)      |
| 42  | Training         | 9 (1.49)      |
| 43  | Special sports   | 8 (1.32)      |
| 44  | Prejudice        | 8 (1.32)      |
| 45  | Program          | 8 (1.32)      |
| 46  | Health           | 8 (1.32)      |
| 47  | Environment      | 8 (1.32)      |
| 48  | Activity         | 8 (1.32)      |
| 49  | Wheelchair       | 8 (1.32)      |
| Total|                 | 605 (100)     |

Table 2. Centrality measurement for restrictions of physical activity participation in older people with disability

| Vertex          | In-degree | Out-degree | Betweenness centrality | Closeness centrality |
|-----------------|-----------|------------|------------------------|----------------------|
| Exercise        | 29        | 28         | 1.000                  | 1.378                |
| Facility        | 23        | 23         | 0.415                  | 1.533                |
| Athletic        | 23        | 23         | 0.390                  | 1.556                |
| Disabled        | 22        | 21         | 0.390                  | 1.556                |
| Program         | 15        | 15         | 0.106                  | 1.822                |
| Traffic         | 14        | 19         | 0.468                  | 1.600                |
| Gym             | 14        | 14         | 0.079                  | 1.822                |
| Inconvenience   | 12        | 11         | 0.062                  | 1.889                |
| Chance          | 12        | 12         | 0.023                  | 1.867                |
| Leisure sports  | 11        | 11         | 0.030                  | 1.911                |
| Person          | 10        | 10         | 0.048                  | 1.899                |
| Wheelchair      | 9         | 8          | 0.299                  | 1.933                |
| Equipment       | 8         | 8          | 0.055                  | 1.933                |
| Prepared        | 8         | 7          | 0.526                  | 1.911                |
| Shortage        | 8         | 7          | 0.011                  | 1.978                |
| Body            | 8         | 7          | 0.000                  | 1.978                |
| Policy          | 7         | 7          | 0.151                  | 2.178                |
| Money           | 7         | 6          | 0.134                  | 2.000                |
| Money           | 7         | 6          | 0.134                  | 2.000                |
| Leader          | 7         | 7          | 0.001                  | 2.000                |
| Human body      | 6         | 6          | 0.153                  | 2.067                |
| Restrictions    | 6         | 6          | 0.086                  | 2.067                |
| Private         | 6         | 6          | 0.009                  | 2.089                |
| Disabled sports | 6         | 6          | 0.008                  | 2.133                |
| Prejudice       | 6         | 6          | 0.004                  | 2.044                |
| Hard            | 5         | 5          | 0.000                  | 2.156                |
| Hospital        | 4         | 4          | 0.000                  | 2.733                |
| State policy    | 4         | 4          | 0.000                  | 2.733                |
| Weight          | 4         | 4          | 0.000                  | 2.244                |
| Rehabilitation  | 4         | 4          | 0.000                  | 2.156                |
| Free            | 4         | 4          | 0.000                  | 2.133                |
| Environment     | 3         | 3          | 0.055                  | 2.200                |
| Personal        | 3         | 4          | 0.036                  | 2.267                |
| Economical      | 3         | 4          | 0.003                  | 2.222                |
| Activity        | 3         | 3          | 0.001                  | 2.378                |
| High price      | 3         | 4          | 0.000                  | 2.733                |
| Stress          | 3         | 3          | 0.000                  | 2.422                |
| Price           | 3         | 3          | 0.000                  | 2.267                |
| Health          | 3         | 3          | 0.000                  | 2.222                |
| Accessibility   | 2         | 2          | 0.153                  | 2.533                |
| Weather         | 2         | 2          | 0.002                  | 2.956                |
| Training        | 2         | 2          | 0.000                  | 2.933                |
| Feeding         | 2         | 2          | 0.000                  | 2.333                |
| Fitness room    | 2         | 2          | 0.000                  | 2.311                |
| Disability      | 2         | 2          | 0.000                  | 2.289                |
| Helper          | 1         | 1          | 0.000                  | 3.511                |
| Social life     | 1         | 1          | 0.000                  | 3.044                |
or the concepts were the nodes, and their relations were the edges of the network. Once a keyword was represented as a network, a wide range of tools from network and graph analysis could be used to perform quantitative analysis.

As we could see, “exercise” was the central term in this text and it was also adjacent to the most words in the network. The term “disabled, facility, athletic, and traffic” had a high degree. And lower betweenness centrality words “helper, weather, feeling,” which had a lower degree measure. This indicated that the words “disabled, athletic, gym, leisure sports, chance, program, facility, traffic, and inconvenience” are an important local hub that binded together a cluster of terms. The term “exercise, traffic, facility, athletic, disabled, and wheelchair” had a relatively high in and out degree for its high betweenness centrality. That could indicate that the term “exercise” it is used more to connect contextual clusters together than define a certain context within the text (Table 2).

Average degree was obtained by dividing the total number of edges by the number of nodes (Newman, 2010), showing how many connections (on average) each word had to other unique words in the keyword.

A lower number could also be obtained if the algorithm used for keyword scanning did not make connections between the paragraphs and the paragraphs were short (thus indicating dispersed paragraph structure within a keyword). So it could be safely said that this keyword’s connectivity was relatively medium and a few but significant number of concepts function as the central, more frequently used ones.

**DISCUSSION**

The purpose of this study was to find out restriction factors for participating physical activities in older adults with disability and to provide basic data for developing physical activity participation strategies for them. Data were collected through the open questionnaire and were analyzed utilizing the keyword network analysis. Based on the analysis, exercise was considered the most central keyword for participating in physical activity and keywords such as facility, physical activity, disability, program, transportation, gym, discomfort, opportunity, and leisure activity were associated with exercise.

These results demonstrated that older adults with disability did understand physical activity as exercise which was very closely related to health instead of understanding a concept of physical activity as all movements including everyday activities such as washing dishes, cleaning, etc. In other words, older adults with disability had more difficulties when they tried to regularly participate in physical activity which was more planned and it could not be revealed in the previous studies (Koo and Oh, 2012; Ku and Kim, 2011).

The study showed that exercise, the central keyword, was very closely related to the words such as gym, program, inconvenience, leisure sports, and chances. If we looked at this a little more closely,
older adults with disability had difficulties to participate in physical activity in the context of social and physical environment such as lack of opportunities and inconvenience using facilities, programs, etc due to individual’s physical function and abnormalities.

Ultimately, older people with physical disability recognized exercise as a physical activity instead of a true meaning of physical activity. That led older adults with disability perceived their personal physical and environmental problems were barriers to participate in physical activity. Therefore, in order to promote the appropriate physical activity, education and public relations about physical activity should be delivered to older persons with disability and it was very necessary to develop a system that was providing more opportunities for physical activity participation and decreasing inconvenience in facilities, programs, and transportation.

It is very helpful to understand to promote physical activity for older adults with disability if a future study employs theoretical model because older persons with disability have their own stage of physical activity awareness and readiness of physical activity. In addition, to draw continuous physical activity participation, there is need to make promoted exercise environment from the physical activity planning stages and systemized the management is also needed.

Proposals for future researches are as follows. First, studies of motivation related to physical activity will be needed based on elderly with physical disabilities’ exercise constraints. Second, employing a more realistic and effective measures in the area of the policy research for older adults with disabilities should be conducted.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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