

Subjective Perception of Individuals with Physical Disabilities Regarding Exercise Equipment Use

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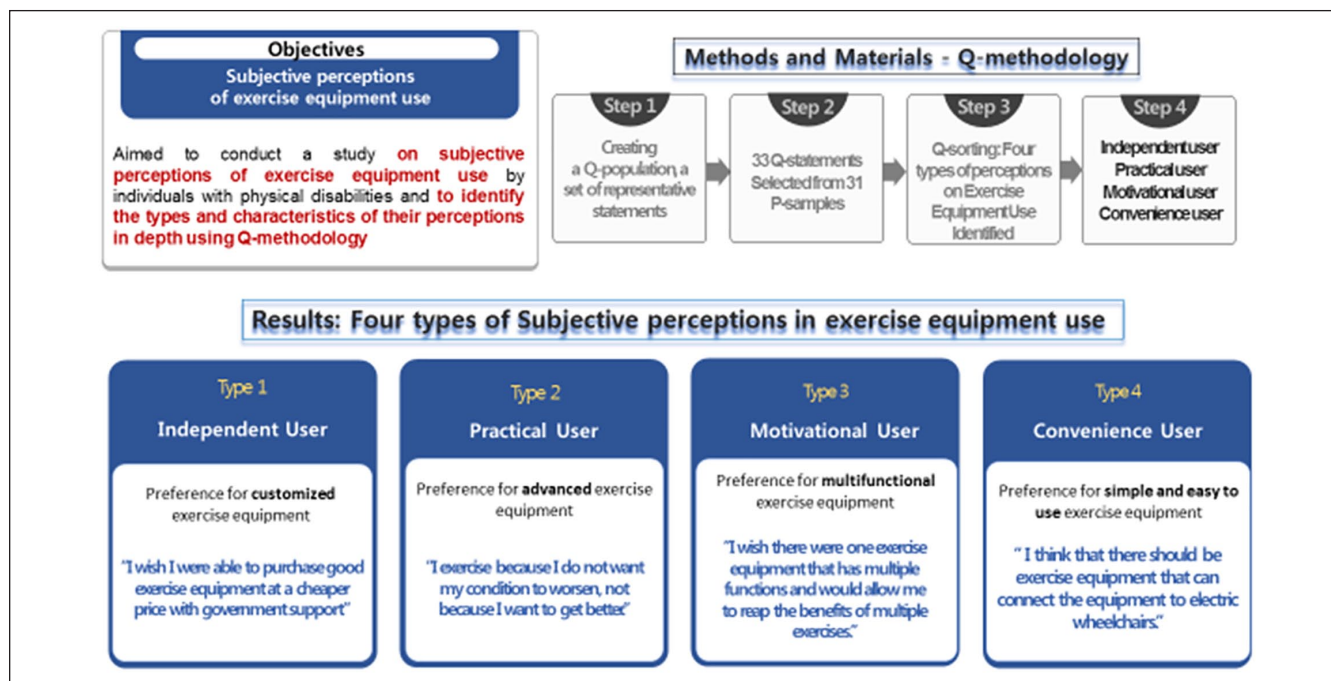


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Abstract

Rehabilitation exercise is effective for improving the health of persons with physical disabilities. However, there are limited studies on their perception of exercise equipment use. The purpose of this study was to investigate the subjectivity to understand the types of perceptions of individuals with physical disabilities regarding the use of exercise equipment in South Korea. This study used Q-methodology. A literature review and focus group interviews with individuals with physical disabilities were conducted to construct Q-Population. Q-statements were selected from the Q-population, after which Q-sorting was executed by P-sample. The results indicated 4 perception types: (1) “Independent user,” (2) “Practical user,” (3) “Motivational user,” and (4) “Convenience user.” Recommendations were provided for developing exercise equipment for use by individuals with physical disabilities. This study revealed 4 perception categories and the findings have strong potential to contribute to the development of proper services and the effective utilization of exercise equipment for individuals with physical disabilities.

Graphical Abstract



Keywords

disabilities, exercise equipment, Q-methodology, subjective perceptions



Introduction

Physical activities and exercises among people with physical challenges not only enhance their independence and body functions but also prevent secondary health conditions that stem from the disability.¹⁻³ With the recent rise in the interest of health of individuals with physical disabilities, and the increasing desire to lead a healthy life, exercise is expanding to more diverse areas including daily exercise activities, elite sports, and school sports, which were initiated as a branch of rehabilitative exercise.⁴ A multifaceted study of people engaging in diverse exercises also demonstrated that active physical exercise is required to maintain functional independence and to advance psychological well-being.⁵⁻¹⁰ However, individuals with physical challenges experience strict barriers when considering the types of exercise equipment available, primarily due to the limitations related to their disabilities, safety-related incidents, financial situation, lack of facilities, and lack of coaches.¹¹⁻¹³

There are increasing demands for health and medical services tailored for individuals with physical impairments in South Korea. Among the registered individuals with disabilities (about 5% of the total population, or 2.59 million of 51.8 million South Korean people from 2018 census data in South Korea), 83% were individuals with physical disabilities in 2018.¹⁴ The rate of daily participation in life sports of individuals with physical disabilities has increased from 4.4% in 2006 to 23.8% in 2018. However, the accessibility to exercise equipment is inherently dependent on the places where the equipment is located. Regarding the preferred places for exercise, statistics showed that they tended to choose nearby nature trail or parks had the highest proportion (61.5%), followed by indoor (31.8%), welfare center for the people with disabilities (12.1%), and public sports facilities (9.6%).¹⁵ With regard to the preferable places for the use of exercise equipment, people with physical challenges choose nearby places or their home.

The psychological or self-promoted interests in exercises depend on the choice of appropriate exercises types and exercise equipment. The ability to use a diversely accommodating exercise equipment not only improves the general health levels, but is also critical in raising exercise-induced body satisfaction in people with disabilities.¹⁶ However, individuals with physical challenges often experience glaring barriers in real-world situations when they decide to engage in exercise.¹⁷ It is therefore important to consider the

hurdles, that is, the lack of accessible equipment and information, and warnings from physicians that exercise may worsen the disability, besides economic, emotional and psychological factors.¹³ As equipment-related barriers, professionals have identified 3 main reasons: (1) space between equipment for wheelchair access, (2) poor equipment maintenance, and (3) lack of disability adaptations. To facilitate the usability of exercise equipment it is important to understand the perceptions related to the exercise equipment so that relevant challenges can be introduced into the equipment to facilitate the independent exercise by people with disabilities. Recently, efforts have been made to resolve the barriers to physical exercise equipment usage in people with physical disabilities. For example, adapted exercise equipment has been developed to improve the cost effectiveness, weight, portability, safety, adaptability, ease of production, and functionality of equipment. Examples of these adapted exercise equipment include a portable wheelchair training roller, a motor-assisted elliptical machine, adaptive rower and arm crank ergometer, among others.^{13,18-20}

To date, multiple studies have addressed the importance of exercise for individuals with physical disabilities including stroke and spinal cord injuries by examining their physical and psychological needs, exploring the constructs of exercise programs, and analyzing their beneficial effects.^{11,21-27} However, there are limitations in observing the subjective values and perceptions of these individuals regarding their use of exercise equipment necessary for treatment or rehabilitation and health exercises. All individuals have different perceptions regarding the expression and objects of a given situation or a topic and judge them based on their own criteria.²⁸

Therefore, this study aimed to investigate a study on subjective perceptions of exercise equipment use by individuals with physical disabilities and to identify the types and characteristics of their perceptions in depth. To identify the subjective structure of the perceptions of individuals with physical impairments as they use the exercise equipment, we conducted interviews using a Q-methodological approach. Q-methodology is a method that studies the individuals' subjectivity by dealing with perceptions obtained from human experiences it comprises a series of statistical, philosophical, psychological, and psychometric concepts.^{29,30} This method is commonly used to "of self-reference," which allows a better understanding of intra- and inter-individual differences.³¹ "Exercise equipment for individuals with disabilities"

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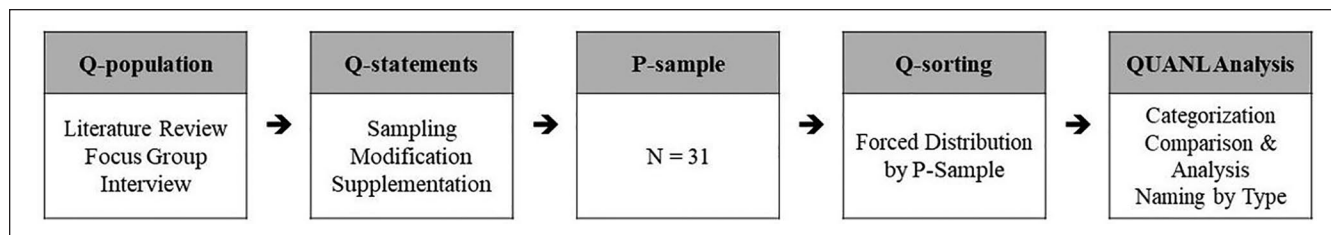


Figure 1. Study process using Q-methodology.

conceptually encompasses all exercise equipment used by such individuals. It includes the treatment that studies the feelings, opinions, preferences, advantages, ideals, and tastes to analyze the disabled individuals' perception of exercise equipment for providing basic data for the development of exercise equipment for such individuals.

Methods

Q-methodology is a combination of qualitative and quantitative research methods that is used to explore subjectivity about a specific topic.³² Using this method, this study understands the perceptions related to subjective experiences of individuals with physical disabilities. Figure 1 describes the study process that included creating a Q-population (a set of related statements of the perceptions), followed by the selection of Q-statements (representative statements) and the P-sample (participants), Q-sorting (classification of representative statements by the participants), and finally, analysis and interpretation of the collected data.

Q-Population

A Q-population, a set of related statements, comprises a wide range of ideas, comments, and conversations on a specific topic that can be collected in several ways; these include interviewing people, reviewing existing scientific literature, and participant observation.^{30,33,34} For this study, we created the representative statements from a review of the relevant literature as well as focus group interviews (FGI).

First, we performed a comprehensive literature review of articles related to exercise equipment use among people with physical disabilities. Then, FGIs were conducted with 5 individuals with physical disabilities participating in the exercise rehabilitation program at the National Rehabilitation Center. The 5 participants consisted of 2 females and 3 males selected through purposive sampling. Two of the participants were in their 40s, 2 in their 60s, and 1 in their 70s. All the participants were given written informed consent forms that were in accordance with the principles of the Declaration of Helsinki.

FGI is one of the most frequently used methods of setting up the related statements (Q-population). Various perceptions on exercise equipment usage in persons with physical

disabilities can be studied via FGI. Semi-structured questions were prepared by literature reviews for FGI and then Q-population was structured based on the answers to those FGI questions.

The semi-structured questions for the FGI included the following: (1) What do you think about the current use of exercise equipment (advantages, disadvantages, things to be improved)? (2) Where would you want to use the exercise equipment (home, public space, rehabilitation center, welfare center, rationale)? (3) Do you think exercise equipment are necessary? (necessary, unnecessary, rationale)? (4) If you were asked to pay to use exercise equipment, how much would you be willing to pay? (5) What is your biggest objective of using exercise equipment, if you do use them? (6) Who would you like to use the exercise equipment with? (7) What should be the functions of the exercise equipment? (8) What kind of help do you want when you use exercise equipment? (9) If you were to make your own exercise equipment, what would you make? (10) What are your thoughts about exercise equipment for individuals with physical disabilities?

Q-Statements

Q-statements is a set of representative statements selected from the pre-selected related statements by employing a comprehensive review and revision process. This process involves ensuring that the statements are relevant, self-referential, clear, simplified, and not repetitive.²⁸ For this study, a total of 33 statements were selected to be used for further analysis.

P-Sample

A P-sample generally consists of participants who are theoretically relevant to the issue.²⁹ According to Herrington and Coogan,³² the general standard stating that larger sample sizes are better does not apply to Q-methodology; even a small sample can produce powerful results. In this study, 31 individuals with physical disabilities, who were expected to be the most relevant group based on their experience level with the equipment at the National Rehabilitation Center, were selected for the participants. The purpose and process of this study was sufficiently explained for them to

Table 1. Q-Statements.

Number	Statements
Q1	Utilizing the exercise equipment is burdensome as it takes longer to get prepared to use it than the actual duration of use.
Q2	I need an expert to help me when using the exercise equipment.
Q3	There should be customized exercise equipment for different types of disabilities.
Q4	I wish I were able to purchase good exercise equipment at a cheaper price with government support.
Q5	It would be convenient to use the exercise equipment at home.
Q6	I would exercise more if there were someone that could help me or if the equipment were easier to use.
Q7	The trips to and from external institutions for exercise take too long.
Q8	I wish there were one exercise equipment that has multiple functions and would allow me to reap the benefits of multiple exercises.
Q9	It costs too much to repair exercise equipment when they break.
Q10	It is difficult to measure the effectiveness of the exercises after using the exercise equipment.
Q11	Using the exercise equipment in public places is difficult for me when it is hard to access or the weather is bad.
Q12	If there were good exercise equipment for individuals with disabilities in regular fitness centers, I would like to go there and use the equipment.
Q13	I think that there should be exercise equipment that will allow me to exercise on my own.
Q14	I think that there should be exercise equipment that can connect the equipment to electric wheelchairs.
Q15	I wish there were exercise equipment that I could use while watching TV or reading books.
Q16	I exercise because I do not want my condition to worsen, not because I want to get better.
Q17	I don't feel motivated when I exercise by myself at home. So, I usually prefer to exercise in public spaces where there are other people exercising as well.
Q18	I like having a help screen that tells me how to exercise so I can do it by myself.
Q19	I have a fear of getting hurt while using the exercise equipment.
Q20	I end up not using exercise equipment if they are difficult to use.
Q21	While there is a need for exercise equipment for individuals with disabilities, I feel that they should be in welfare centers for better management and to prevent risk of injuries.
Q22	There should be exercise equipment for individuals with disabilities in public spaces.
Q23	I think that there only needs to be 1 or 2 equipment for each type of disability.
Q24	I developed a positive mindset because of achieving good health from using exercise equipment.
Q25	There should be a cutting-edge exercise equipment that utilizes VR.
Q26	I feel bad asking for help when I use exercise equipment.
Q27	There are no channels for support regarding the use of exercise equipment.
Q28	I feel that the exercise equipment available in public spaces are for non-disabled individuals, and not for individuals with disabilities.
Q29	I hope that there would be more equipment that focuses on specific areas of body.
Q30	The place to exercise or type of exercise equipment should change depending on how long the person had the disability.
Q31	A total of 100,000 won per month is a good rental price for exercise equipment, if they can be rented any time.
Q32	I feel that the standard exercise equipment usually in public institutions are useless.
Q33	It would be preferable to have exercise equipment for individuals with disabilities in public places, but I am concerned that non-disabled individuals would frown upon it.

understand the research purpose. The participants also signed and returned the informed consent forms (Table 1).

Q-Sorting and Data Analysis

The process of classifying representative statements by participants is called Q-sorting; this is a forced distribution method instructing the participants to read the 33 Q-statements and classify them according to their level of agreement. The Q-sorting in this study was completed on a 9-point rating scale, from the most agreeable (+4) to the most disagreeable (-4; Supplemental Table 1). After classifying the data

through Q-sorting, the respondents were asked to provide their reasoning for selecting the 2 subjective statements at each end in detail.

We used the QUANL software's Q Principal Component Factor Analysis to analyze the data from Q-sorting by categorizing the P-sample into different types of perception and then loading Z-scores for all the statements. Z-scores with an eigenvalue of ± 1.000 or more within each type were considered significant. The statements with significant Z-scores were thoroughly reviewed, along with the written reasonings from the participants, for an in-depth and meaningful interpretation of the resulting types.

Table 2. P-Samples of Individuals with Physical Disabilities.

Number	Sex	Age	Name of diagnosis	Onset duration (years)
P1	Male	68	Stroke	26.8
P2	Male	78	Stroke	18.2
P3	Male	33	Spinal cord injury	16.0
P4	Male	65	Spinal cord injury	27.0
P5	Male	72	Spinal cord injury	6.6
P6	Male	76	Spinal cord injury	18.9
P7	Male	51	Spinal cord injury	17.4
P8	Male	49	Spinal cord injury	25.0
P9	Male	55	Spinal cord injury	22.0
P10	Male	61	Stroke	2.6
P11	Male	57	Stroke	2.4
P12	Male	66	Stroke	10.4
P13	Male	48	Spinal cord injury	17.0
P14	Female	58	Spinal cord injury	12.8
P15	Male	52	Stroke	2.7
P16	Male	63	Stroke	16.0
P17	Male	66	Stroke	11.1
P18	Male	52	Cerebral palsy	52.0
P19	Female	78	Stroke	24.6
P20	Male	78	Spinal cord injury	6.0
P21	Male	52	Stroke	2.6
P22	Male	79	Stroke	16.3
P23	Female	64	Stroke	15.0
P24	Male	58	Stroke	2.7
P25	Male	42	Stroke	2.7
P26	Male	60	Stroke	10.3
P27	Male	70	Stroke	27.3
P28	Male	66	Stroke	15.0
P29	Male	83	Stroke	37.0
P30	Male	61	Stroke	2.7
P31	Male	33	Stroke	12.0
	F: 3, M: 28	61.1 ± 12.8 years	Stroke: 20, SCI: 10 Cerebral palsy: 1	15.5 ± 11.3 years

Table 3. Eigenvalues and Explained Variance of the 4 Classification Types.

Content/type	I	II	III	IV
Chosen Eigenvalue	6.691	2.8922	2.5720	2.1544
Percentages of Total Variance	0.215	0.0933	0.0830	0.0695
Cumulative	0.215	0.3092	0.3921	0.4616
Percentages of Variance within 4 factor solution	0.467	0.2021	0.1797	0.1505
Cumulative	0.467	0.6697	0.8495	1.0000

Results

Q-Statements

A set of related statements was created and 33 representative statements (Table 1) were selected from 31 participants (Table 2), after which a Q-sorting of collected data was conducted for analysis of results. A total of 4 types of exercise equipment use were identified and the eigenvalues of each

type are shown in Table 3 (Type I: 6.69; Type II: 2.89; Type III: 2.57; Type IV: 2.15). The 4 types of exercise equipment use by individuals with physical disabilities are as follows: (1) independent user, (2) practical user, (3) motivational user, (4) convenience user (Type I: Supplemental Tables 4 and 5; Type II: Supplemental Tables 6 and 7; Type III: Supplemental Tables 8 and 9; Type IV: Supplemental Tables 10 and 11). The correlation between each type shows the level of

similarity between each type (Types I and II: 0.219; Type I and III: 0.394; Type I and IV: 0.384; Type II and III: 0.189; Type III and IV: 0.264, Supplemental Table 2). Among the factor weights of perception types, according to the questions in this study, the highest values were Type I with $P=30$ of 1.87, Type II with $P=9$ of 1.29, Type III with $P=16$ of 0.85, and Type IV with $P=7$ of 1.40 (Supplemental Table 3). Consensus items refer to the items that each type has agreed on (Supplemental Table 4).

Characteristics of Perception Types of Exercise Equipment Use by Individuals with Physical Disabilities

Type 1: Independent User. Type 1 was titled “independent user,” who prefers customized exercise equipment. This type showed the strongest agreement with Q4 ($Z=2.23$): “I wish I were able to purchase good exercise equipment at a cheaper price with government support,” and a strong agreement with Q3 ($Z=2.00$): “There should be customized exercise equipment for different types of disabilities.” The statement with the most disagreement was Q31 ($Z=-2.40$): “A total of \$100 per month is a good rental price for exercise equipment, if they can be rented any time.” It also showed a strong disagreement with Q12 ($Z=-1.64$): “If there were good exercise equipment for individuals with disabilities in regular fitness centers, I would like to go there and use the equipment.” The most significant statement of agreement for Type 1 that differs from the averages of other types was Q3 ($d=1.56$): “There should be customized exercise equipment for different types of disabilities.” The most significant statement of disagreement that differs from the averages of other types was Q31 ($d=-1.93$): “A total of \$100 per month is a good rental price for exercise equipment, if they can be rented any time.” $P=30$, who had the highest factor weight among Type 1, stated that “I feel that it is necessary to have exercise equipment that befits disability types. I also prefer to exercise at home because I can use it any time and I don’t have to travel back and forth to use the equipment.” (Supplemental Tables 5 and 6).

Type 2: Practical user. Type 2 was titled “practical user,” who prefers advanced exercise equipment. This type showed the strongest agreement with Q16 ($Z=2.10$): “I exercise because I do not want my condition to worsen, not because I want to get better,” and the meaningful statement with Q25 ($Z=1.44$): “There should be cutting-edge exercise equipment that utilize VR.” The statement with strongest disagreement was Q20 ($Z=-1.81$): “I end up not using exercise equipment if they are difficult to use.” It also revealed a strong disagreement with Q33 ($Z=-1.28$): “It would be preferable to have exercise equipment for individuals with disabilities in public places, but I am concerned that non-disabled individuals would frown upon it.” (Supplemental Tables 6 and 7).

For Type 2, the statement with the strongest agreement compared to the averages of other types was Q16 ($d=2.14$): “I exercise because I do not want my condition to worsen, not because I want to get better,” and the statement with the strongest disagreement compared to the averages of other types was Q15 ($d=-2.08$): “I wish there were exercise equipment that I could use while watching TV or reading books.” $P=9$, who had the highest factor weight among Type 2, stated that “I work out so as not to worsen my condition, but it takes too long to prepare for exercise.”

Type 3: Motivational user. Type 3 was titled “motivational user,” who prefers multifunctional exercise equipment. This type showed the strongest agreement with Q8 ($Z=2.30$): “I wish there were 1 exercise equipment that has multiple functions, and would allow me to reap the benefits of multiple exercises.” and a strong agreement with Q17 ($Z=1.36$): “I don’t feel motivated when I exercise by myself at home. So, I usually prefer to exercise in public spaces where there are other people exercising as well.” (Supplemental Tables 9 and 10).

The statement with the strongest disagreement was Q1 ($Z=-2.40$): “Utilizing the exercise equipment is burdensome as it takes longer to get prepared to use it than the actual duration of use.” It also showed a strong disagreement with Q19 ($Z=-1.88$): “I have a fear of getting hurt while using the exercise equipment.” For Type 3, the statement with the strongest agreement compared to the averages of other types was Q17 ($d=2.00$): “I don’t feel motivated when I exercise by myself at home. So, I usually prefer to exercise in public spaces where there are other people exercising as well.” The statement with the strongest disagreement compared to the averages of other types was Q1 ($d=-2.53$): “Utilizing the exercise equipment is burdensome as it takes longer to get prepared to use it than the actual duration of use.” $P=16$, who had the highest factor weight in Type 3, stated that “There are many exercise equipment that I have purchased, but I do not use them because I feel that they are not effective.”

Type 4: Convenience user. Type 4 was titled “convenience user,” who prefers simple and easy-to-use exercise equipment. This type showed the strongest agreement with Q4 ($Z=1.87$): “I wish I were able to purchase good exercise equipment at a cheaper price with government support,” and a strong agreement with Q14 ($Z=1.32$): “I think there should be exercise equipment that can connect the equipment to electric wheelchairs.” (Supplemental Tables 11 and 12).

The statement with the strongest disagreement was Q32 ($Z=-2.18$): “I feel that the standard exercise equipment usually in public institutions are useless.” It also showed a strong disagreement with Q33 ($Z=-1.97$): “It would be preferable to have exercise equipment for individuals with disabilities in public places, but I am concerned that non-disabled individuals would frown upon it.” For Type 4, the statement with the strongest agreement compared to the averages of other

types was Q1 ($d=2.26$): “Utilizing the exercise equipment is burdensome as it takes longer to get prepared to use it than the actual duration of use.” The statement with the strongest disagreement compared to the averages of other types was Q28 ($d=-2.27$): “I feel that the exercise equipment available in public spaces are for non-disabled individuals, and not for individuals with disabilities.” P=7, who had the highest factor weight in Type 4, stated that “I feel that there isn’t any exercise equipment I can use.”

Discussion

The study revealed 4 perception types of exercise equipment use: “independent users” with a preference for customized exercise equipment, “practical users” with a predilection for advanced exercise equipment, “motivational users” with a propensity for multifunctional exercise equipment, and “convenience users” with a penchant for simple and easy to use exercise equipment.

Type 1—*independent users*—seem to know what types of exercise equipment they need and intend to utilize such customized exercise equipment at home. They have a very proactive attitude; Therefore, they have a high possibility of increased use of exercise equipment.

Type 2—*practical users*—would like to use innovative exercise equipment, such as equipment utilizing VR or a help screen. While they are similar to Type 1, in that they do not have much regard for what others may think, they were found to have a stronger desire to voluntarily engage in exercise, compared to Type 1.

Type 3—*motivational users*—have a strong desire to utilize exercise equipment in public spaces because they feel that exercising around many other people motivates them. Moreover, they do not deem the time spent on utilizing the exercise equipment as inconvenient. As long as this kind of an environment is provided and accessible, Type 3 is more than willing to actively exercise.

Type 4—*convenience users*—dislike complicated exercise equipment involving unnecessarily long preparation time; therefore, they would like equipment that can maximize the time spend on doing the actual exercise itself. In addition, they care about understanding how to use the exercise equipment through various support channels, such as a professional or a help screen, which makes it much easier for them to use the equipment. They also expressed their need for financial support from the government to be able to afford the equipment.

In summary, Type 1 prefers owning personalized exercise equipment that suits their physical disabilities, more so than the other types. Type 2 tended to emphasize practical function; in particular, they had stronger intention of sustaining their current health status, rather than aiming to improve. Similar results were shown for Type 3, the

emphasis on the functions of exercise equipment; however, they would utilize multifunctional exercise equipment and focus on group motivation when exercising with other people. Similar to Types 2 and 3, Type 4 also focused on equipment function. However, they perceived that systematic support would be more important to use those functions for exercise equipment usage.

With these classified types of exercise equipment use, health care providers or exercise coaches may identify corresponding exercise services or programs for individuals with physical disabilities. Participation in physical exercises by people with disabilities who have identified their preferred types of exercise equipment use, is easily affected by social situations. To determine the use of exercise equipment (of different classifications) by people with physical disabilities in South Korea, 1 study classified 6397 registered individuals with disabilities according to their disability type and analyzed their participation in daily exercise activities, depending on their lifestyle and level of disability.³⁵ Of the respondents, 26.9% reported not engaging in exercise as they did not have time, while another 26.3% responded that they did not engage in exercise because they had severe disabilities. To promote the health in people with disabilities, public health care institutes or related service providers may help to provide alternative information on exercise equipment use, that is, rental program or program using virtual wearable technology.

Among the individuals with disabilities who exercised to manage their health, 14.3% utilized exercise facilities; more than 80% of those in the young, middle-aged, and older generations engaged in exercises at home, hiking trails, parks, and school playgrounds.³⁵ These results were echoed by a report of the Ministry of Health and Welfare and the Korea Institute for Health and Social Affairs.³⁶ Major places for exercise utilized by the individuals with disabilities included parks near their homes (at 66.8%), followed by home (at 11.4%), commercial sports facilities (at 6.8%), and neighboring school playground (at 4.2%).¹² Thus, health administrators can perceive the types of exercise equipment preferred for better development of exercise equipment, and for more relevant formulation of policy on arrangement of equipment and providing preferred services such as medical service providers or social workers. Furthermore, expanded population, that is, older adults, may benefit from exercise equipment use when identifying types of the perception on exercise equipment utilization because exercise generally improves people’s health and therefore the quality of lives.

There are at least 2 possible suggestions from our results. First, exercise equipment should be designed to consider different perceptions of exercise equipment among individuals with physical disabilities who use them. Two people with an identical spinal cord injury, for example, may have different perceptions on exercise equipment use. The design of exercise equipment may also differ in terms of characteristics such as places (ie, indoor vs outdoor), type (ie, group vs

individual), or purpose (ie, clinics vs gym). Therefore, their preferences on places, types, and purpose would be different. Thus, properly designed exercise equipment is necessary to facilitate the habit of exercises in individuals with disabilities, largely to promote healthier lives.

Second, we understand that people with physical disabilities are actively engaged in exercise for various reasons, especially for improved health. They all try to find independent, practical, and motivational usage of exercise equipment searching for easier means. This study showed that when using exercise equipment, people with physical disabilities do not essentially depend on assistance, but become self-reliant and active users.

People with disabilities have their own right to seek optimal health care and protection services, to choose customized exercise equipment for themselves, and to maintain physical, mental, and social health in their lives. However, people with disabilities often face limitations on exercise locations, mobility for health management. In addition, there are not enough exercise equipment and facilities for people with disabilities to manage their health in their daily life. Therefore, health care rehabilitation experts may consider these factors when selecting the exercise equipment, locations, types, and purposes, in terms of their characteristics and perception of exercise equipment use. Moreover, various exercise programs need to be provided for health care services in rehabilitation along the corresponding types of exercise equipment use in people with disabilities. Prior to that, the rehabilitation experts should participate in implementing plan or strategy to develop various exercise equipment and service provisions. There needs another plan to provide the proper information on possible types of exercise equipment, related service providers, maintenances and so on, publicly to people with disabilities.

There are certain limitations to this study. This study applied Q-methodology to show the differences in perceptions on exercise equipment usage among persons with physical disabilities. The general objective of Q-methodology is to not generalize perceptions, but categorize the characteristics of various perceptions on a specific topic.³¹ Therefore, there are limitations to the generalizability of the current results. Future studies should therefore extend the research area to a quantitative study on the difference in the perceptions of exercise equipment to generalize current outcomes. Most of our participants were afflicted with either stroke or spinal cord injury, which represents a major portion of people with physical disabilities in South Korea. However, the age of the current population in P-sample was limited to older than 50 years and strokes commonly occur in people older than 50. Thus, the study population was too restricted to represent all generations of physical disabilities. Future study may include wider populations with various disabilities—such as developmental or neurological disorders and visual and auditory disorders—and various age groups, so that we could identify disability-specified or age-specific perceptions on exercise

equipment use for better health management. Lastly, a number of existing studies showed gender bias in exercise participation;^{37,38} therefore, further studies should investigate gender bias in perception on exercise equipment usage to contribute toward enhancing healthcare services for persons with physical disabilities.

Conclusion

The present study explored the types of perceptions of individuals with physical impairments regarding exercise equipment as well as the characteristics of each type. The findings have strong potential to contribute to the development of proper services and effective utilization of exercise equipment for the individuals with physical disabilities.

Declaration of Conflicting Interests

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Supplemental Material

Supplemental material for this article is available online.

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