Development of the Exercise Rehabilitation Algorithm for the Children with Disabilities: With focus on the children with encephalopathy, intellectual disabilities and autism

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Abstract. The purpose of this study is to develop the algorithm for planning the exercise rehabilitation services for the children with encephalopathy, intellectual disabilities and autism in an effective way and provide field practitioners with the basic data required for consulting exercise rehabilitation services and establishing plans. To achieve the purpose of this study, the authors have reviewed relevant literatures and then selected 27 literatures for the study on the exercise rehabilitation for the children with disabilities. For a decision tree analysis, data was collected from 208 participants with encephalopathy, intellectual disabilities and autism in Seoul, Incheon and other areas through convenient sampling. The authors analyzed the collected data statistically using SAS Enterprise Miner 13.1 program and developed. On the basis of the results, the exercise rehabilitation algorithm for respective children with disabilities.

Keywords: exercise rehabilitation, algorithm, encephalopathy, intellectual disabilities, autism

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1 Introduction

The development rehabilitation service aim at improving the functions (e.g. cognition, adaptive behaviors, sense and exercise) and developing the behaviors of the children with mental and sensory disabilities (Graham & Reid, 2000; Rimmer & Kelly, 1991). It is a type of social service, including psychology and exercise rehabilitation. The registered children with disabilities (i.e. vision, hearing, language, encephalopathy, intelligence, autism, etc.) below 18 are entitled to the development rehabilitation services. The requirements were loosened up from ‘below 100% of the national average household income’ to ‘below 150% of the national average household income’ and the national budget increased to KRW57.8bil, 20.1% increase compared to 2012. So a total of 42,000 children with disabilities can benefit from such programs.

The interventional strategies, such as exercise, prevents the further damage resulting from the primary disorder and reduces the risk of the secondary disorder which may occur in future. (Blalock, DeVellis, Patterson, Campbell, Orenstein & Dooley, 2002; Dallow & Anderson, 2003; Kirk, Mutrie, Macintyre & Fisher, 2004). Therefore, if the disabled participate in adequate exercise, it will reduce KRW1.7 trillion. Furthermore, 80.9% of persons with disabilities participating in sports for the purpose of rehabilitation treatment, indicating their high demand for exercise rehabilitation (Choi, Mi Ri, and Lee, Eun Seok, 2012).

So, this study was conducted with the aim to develop the algorithm for planning the exercise rehabilitation services for the children with encephalopathy, intellectual disabilities and autism in an effective way and provide field practitioners with the basic data needed for consulting exercise rehabilitation services and establishing plans.

2 Study Methods

2.1 Systematic Literary Review

The participants involved in the systematic literary review included 1 professor in Exercise Rehabilitation Welfare Major, 2, 2 professors in Special Physical Education Major, 1PhD Sports Welfare, and 1 PhD in Special Physical Education Major-a total of 5 participants. The above 5 participants reviewed the literatures in the initial state and participated in the final screening process.

2.2 Subjects for Survey

A survey was conducted for 240 participants with encephalopathy, intellectual disabilities and autism in Seoul, Incheon and other areas. The institutions in the corresponding regions were selected through convenient sampling. Phone calls were
made to these institutions asking for their cooperation and the questionnaires were posted to the institutions that agreed to the survey. The questionnaire survey was conducted under the supervision of the persons in charge at respective institution. In case the participants had difficulties replying to the questionnaire, their guardians replied on behalf of them. A total 208 questionnaires excluding the inadequate replies were collected finally for this study. Table 1 below shows the demographics of the respondents in the survey.

Table 1. Demographics of the subjects.

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of Case (N)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>208</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Exercise Phase</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Before planning</td>
<td>65</td>
<td>31.2</td>
</tr>
<tr>
<td>Implementation</td>
<td>143</td>
<td>68.8</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>131</td>
<td>63.0</td>
</tr>
<tr>
<td>Female</td>
<td>77</td>
<td>37.0</td>
</tr>
<tr>
<td><strong>Region</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seoul</td>
<td>58</td>
<td>26.9</td>
</tr>
<tr>
<td>Incheon</td>
<td>42</td>
<td>20.1</td>
</tr>
<tr>
<td>Other regions</td>
<td>108</td>
<td>53.0</td>
</tr>
<tr>
<td><strong>Disability Rating</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class 1</td>
<td>68</td>
<td>32.7</td>
</tr>
<tr>
<td>Class 2</td>
<td>91</td>
<td>43.8</td>
</tr>
<tr>
<td>Class 3</td>
<td>49</td>
<td>23.6</td>
</tr>
<tr>
<td><strong>Income</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Below KRW3mil</td>
<td>76</td>
<td>36.5</td>
</tr>
<tr>
<td>KRW3-4 mil</td>
<td>42</td>
<td>20.2</td>
</tr>
<tr>
<td>Above KRW4mil</td>
<td>90</td>
<td>43.3</td>
</tr>
</tbody>
</table>

2.3 Survey Details

In this study, the author used questionnaires for a survey. The questionnaire consisted of 6 questions for background variables (e.g. exercise phase, gender, age, region, disability rating, income and respondents), 1 question for exercise phase and ICF related questions (encephalopathy-physical functions: 46 question, participation in activities: 30 questions, environmental factors: 26 questions, autism-physical functions: 46 15question, participation in activities: 47 questions, environmental factors: 53 questions)

2.4 Survey Procedure and Data Analysis Method

The authors or their assistants themselves visited the corresponding institutions or the questionnaires were posted. The survey was conducted under the supervision of the
persons in charge at respective institutions. In case the respondents had difficulties replying to the questionnaire, their guardians, who knew them best, replied on behalf of them. The authors analyzed the collected data using SAS Enterprise Miner 13.1 program. To determine the exercise rehabilitation change phase of the children with disabilities, the authors used a decision tree analysis and used CART (classification and regression tree) to grow the decision tree.

3 Results of Study

3.1 Systematic Literary Review

A total of 27 literatures relating to the study of the exercise rehabilitation of the children with disabilities were selected as final. The subjects for analysis were categorized into 3 areas: ‘intellectual disability’, ‘autism’ and ‘encephalopathy’ and the variables were categorized into 3 areas: ‘physical’, ‘psychological’ and ‘social’. The method of studying the literatures was categorized into 5 areas: ‘experiment’, ‘cases’, ‘single-subject’, ‘literatures’ and ‘quantitative research’.

For the intellectual disabilities, the authors addressed various study variables, whereas for autism and encephalopathy, the authors addressed physical variables only. Horse riding accounted for the largest part of programs, followed by balance exercise. For the study method, the experiment accounted for the largest part in ‘intellectual disabilities’, ‘autism’ and ‘encephalopathy’, followed by case studies and single-subject study. Relatively less literary study and quantitative studies were conducted.

3.2 Analysis of the decision tree model analysis for the respective exercise rehabilitation change stages of the children with encephalopathy

Looking at the decision tree model from the right, the most influential factor in the exercise rehabilitation change stage of the children with encephalopathy is ‘general mental function’, followed by ‘cardiovascular function’, ‘home life’ and ‘sensory function and pain’. When looking at it from the left, the second the most influential factor in the group that replied ‘not impaired’ to ‘general mental function’ is ‘cardiovascular function’.

3.3 Analysis of the decision tree model for the respective exercise rehabilitation change stages of the children with intellectual disabilities

The most influential factor in the exercise rehabilitation change stage of the children with intellectual disabilities is ‘product and technology’, followed by ‘movement’, ‘support and relationship’, ‘attitude’, ‘general mental function’, ‘self-management’ and ‘service, system and policies.'
The exercise rehabilitation change stage of the children with intellectual disabilities is 26.79% after integrating ‘Before planning’, ‘Planning’ and ‘Preparation’ stage (named “1” in the respective nodes), and is 73.21% after integrating ‘Implementation’ and ‘Maintenance’ stage (named “2” in the respective nodes).

Looking at the decision tree model from the left, the most influential factor in the rehabilitation change stage is ‘product and technology’ followed by ‘movement’. Looking at it from the right, the second most influential factor in the group that replied to ‘not influence’ to ‘product and technology’ is ‘support and relationship’.

3.4 Analysis of the decision tree model for the respective exercise rehabilitation change stages of the children with autism

The most influential factor in the exercise rehabilitation change stage of the children with autism is ‘product and technology’, followed by ‘service, system and policies’ and ‘self-management’.

The exercise rehabilitation change stage of the children with intellectual disabilities is 32.31% after integrating ‘before planning’, ‘planning’ and ‘preparation’ stage (named “1” in the respective nodes), and is 67.69% after integrating ‘implementation’ and ‘maintenance’ stage (named “2” in the respective nodes).

Looking at the decision tree model from the left, the most influential factor in the exercise rehabilitation change stage of the children with autism is ‘product and technology’.

4 Discussions and Conclusions

Based on the above results, the authors could sort out the variables for the children with encephalopathy, intellectual disabilities and autism to or not to participate the exercise rehabilitation program on a regular basis and the conditions. An understanding of the conditions of study variables is expected to enable it to predict the possibility children with encephalopathy, intellectual disabilities and autism will participate or will not the exercise rehabilitation program.

First, the participation of the children with encephalopathy in the exercise rehabilitation program is expected to be restricted when they complain about their inconveniences relation to ‘home life’ even if their mental and cardiovascular function is not impaired (i.e. normal memory and consciousness, normal heartbeat, heart function and breathing). Next, the children with encephalopathy are expected to be able to participate in the programs if they participate in the program on a regular basis while their mental function (i.e. memory and consciousness) is impaired and their sensory function and pain (i.e. sight, hearing and pain) is also impaired. The possibility that they may participate in the program can be predicted through consultation. On the contrary, in case the participation of the children with disabilities is expected to be restricted, the change and adjustment of the related variables may serve as situational conditions to induce them to participate on a regular basis.
Second, the participation of the children with intellectual disabilities in the exercise rehabilitation program is expected to be restricted, when they are under the influence of ‘product and technology’ variable such as supportive equipment in everyday life and they do not feel any inconveniences relating to ‘movement’ variable (i.e. maintaining a specific posture, moving objects using hands and using public transportation). The children with intellectual disabilities are expected to be able to participate in the programs if they are not influenced by ‘product and technology’ variable but influenced by ‘support and relationship’ variable (i.e. parents, brothers and sisters, and helpers. etc.) and their ‘general mental function’ (i.e. ability to think, intellectual function, etc.) is not impaired. In addition, if their ‘general mental function’ is impaired and they feel inconveniences relating to ‘self-management’ variable (i.e. washing and going to stool by themselves) under the same conditions, their participation increases significantly. The possibility that they may participate in the program can be predicted through consultation. On the contrary, in case the participation of the children with disabilities is expected to be restricted, the change and adjustment of the related variables may serve as situational conditions to induce them to participate on a regular basis.

Third, the participation of the children with autism in the exercise rehabilitation program is expected to be restricted, when they are under the influence of ‘product and technology’ variable such as supportive equipment in everyday life and ‘service, system and policies’ variable such as support system and education system, but they are not influenced by ‘attitude’ variable such as the values their parents, brothers and sisters and acquaintances under the same conditions. The children with autism are expected to be able to participate in the programs if they are not influenced by ‘product and technology’, and influenced by ‘attitude’, ‘service and policies’ and ‘self-management’. The possibility that they may participate in the program can be predicted through consultation. On the contrary, in case the participation of the children with disabilities is expected to be restricted, the change and adjustment of the related variables may serve as situational conditions to induce them to participate on a regular basis.

References