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Original Article

The feasibility of using exergames as a rehabilitation tool: the attitudes, awareness, opinions and experiences of physiotherapists, and older people towards exergames

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Abstract. [Purpose] The aim of this study was to investigate the feasibility of using exergames as a rehabilitation tool by determining the attitudes, awareness, opinions and experiences of physiotherapists, and older people towards exergames. [Subjects and Methods] A cross-sectional study was conducted and two short self-developed questionnaires (for physiotherapists and older people) were distributed in three hospitals in Cork (Ireland) to assess the attitudes towards and familiarity with exergames among physiotherapists and older people. The data were analysed using Microsoft Excel version 2013. [Results] The results show that a lot of older people have seen exergames devices but have not attempted to play them. This may indicate a lack of interest in or information about these devices and how to use them. With regard to the second group, physiotherapists underestimate older people's knowledge about exergames. [Conclusion] Older people were not very familiar with exergames but they were willing to try them. In addition, despite physiotherapists being familiar with exergames, they see them as an additional tool that will not replace or change any traditional exercise methods.

Key words: Exergames, Physiotherapist, Older people

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INTRODUCTION

In recent times, life expectancy and the number of people living to old age have increased for many reasons, such as an advanced medical care system and good economic circumstances. These factors have dramatically increased the elderly population around the world. According to the World Health Organization (WHO), the size of the world's elderly population, those aged over 60 years, will increase from 11% to 22% between 2000 and 2050[1]. For example, in the UK alone in mid-2015, there were 11.6 million people aged 65 and over, representing 17.8% of the population, whilst the 1.5 million people aged 85 and over represented 2.3%. These figures were estimated in mid-2015 by the United Kingdom Office for National Statistics[2]. Furthermore, the Republic of Ireland has seen a significant increase in the aged population of 65 years old and over[2]. According to the Central Statistics Office (CSO) of Ireland in 2016, the segment of the population aged 65 years and over increased by 19.1% from 102,174 (2011) to 637,567, with the highest concentrations in Fingal (36.1%) followed by South of Dublin (34.1%)[3].

As people get older, they develop age-related diseases. Many diseases are related to older people, such as stroke[4] and

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Parkinson's disease[5, 6]. For example, the prevalence of stroke was 25.7 million cases globally in 2013[7]. What is more, according to Chen et al. [4], "Over 80% of strokes occur in the elderly (people aged ≥65 years), and patient outcomes after stroke are highly influenced by age." In addition, among elderly people in the community, around 30 to 35% of them experience at least one fall a year[8]. Having a balance impairment is one of the issues most reported to physicians and experienced by older people[9]. Throughout the last decade, much research has been done regarding the combined use of the concept of visual biofeedback (VBF) and games. VBF can be defined as a type of rehabilitation treatment tool that provides an individual with visual information about their centre of gravity within the limits of stability whilst they stand on a pressure plate. The person can see where their centre of gravity is relative to the support base shown on a screen[10]. Simply, the individual stands above the force plate in front of a screen that allows him to see his performance whilst he is doing the task.

The effects of doing exercise to decrease falls or the risk of falls and improve balance have been well documented in clinical practice guidelines for fall prevention, such as those from the American Geriatrics Society and British Geriatrics Society (AGS/BGS)[11] and the National Institute for Clinical Excellence (NICE)[12]. Exercise games (exergames) have started to appear in training and health fields. They are video games that include doing some physical exercise and are mainly used to improve health and physical function, and to increase the physical activity of older people[13]. This idea of using exergames is supported by research by Lange et al.[14], Primack et al.[15] and van Diest et al[16]. Furthermore, it seems that older people enjoy doing their exercise with exergames (Nintendo Wii), especially when they practice it with their grandchildren[17]. Clark et al.[18] claim that the "WBB (Wii Balance Board) is a valid tool for assessing standing balance." In terms of intervention, Larsen et al.[19] conducted a systematic review about the physical effects of doing exergames in healthy elderly patients. This review concluded that exergames appear to have an improvement effect on older people. Another study found a significant improvement in both balance and fatigue when using exergames in older people with Parkinson's disease[20].

Exergames technology has been around for decade now, during which time trials have been done on different aspects of rehabilitation older people with different needs. Exergames have been repeatedly proved to have a promising future in the rehabilitation of the elderly. Despite the fact many studies have been conducted on using exergames, like the Nintendo Wii fit, and visual reality, such as Kinect, monitoring their reliability and validity as a tool in rehabilitation, inadequate research has been published about the feasibility of exergames among the older population. Some researchers have looked at the feasibility but all of their studies have limitations such as sample size and the differences between populations. Meanwhile, none of them have looked at the views of physiotherapists and older people towards using exergames as a tool in rehabilitation. For the reasons outlined above, this study aimed to investigate the feasibility of using exergames as a rehabilitation tool, specifically looking at the attitudes, awareness, opinions and experiences of physiotherapist and older people regarding exergames. The aims of this study are (1) to explore if physiotherapists have used exergames in rehabilitation, along with their perceptions of the potential risks and the potential benefits, (2) to explore what physiotherapists perceive would be the reaction of older people to exergames in rehabilitation, and to compare these against older people's actual views, and (3) to explore if older people are familiar with exergames in general, and outline their views on using them in rehabilitation.

SUBJECTS AND METHODS

This is an observational (cross-sectional) study design using a survey with some free text boxes to capture qualitative data. Two populations were included in this study. The first population was physiotherapists working in three hospitals in Cork, Ireland: Saint Finbarr's Hospital (SFH), Marcy University Hospital (MUH) and Cork University Hospital (CUH). Physiotherapists who did not have experience in treating older patients were excluded. The second population was older people who attended the Assessment Treatment Centre and rehabilitation wards in in SFH in Cork, Ireland. The inclusion criteria were: (1) aged 60 years old and over, (2) good cognitive ability to read and understand the questions, (3) undergoing in-patient (non-acute), or out-patient attending sessions with or without a relative, (4) not suffering from a critical condition or disease, for example, cancer and (5) had attended a physiotherapy session at least once in the hospital. Study approval was granted by the Clinical Research Ethics Committee of the Cork Teaching Hospitals to approach and conduct participants (older people and physiotherapists) from three hospitals in Cork MCH, SFH and CUH (Approval Number: ECM 4 (e) 04/04/17). All participants were given informed consent and all data have been kept anonymous.

There are no studies in the literature looking at physiotherapists' beliefs or attitudes towards exergames. Therefore, the researchers developed a novel short questionnaire to look at physiotherapist's attitude, awareness, opinions and experiences towards exergames. The physiotherapist questionnaire starts with introductory questions on the first page followed by 11 questions about exergames in rehabilitation. The first part of the survey included questions regarding age, gender, years of experience as a physiotherapist and their current work setting. The second part focused on exergames in rehabilitation, questioning the participants' thoughts, opinions and experiences towards the use of exergames. Regarding older people survey, the first part of the questionnaire contained simple introductory questions about the participants, such as age, gender, mobility and balance level, how much they can walk nonstop and how often they had fallen in the last six months. The next seven questions were about the older people's experience with exergames. The subsequent four questions related to whether any healthcare professional had given them advice about doing normal exercise or exercise using exergames. The last section included four questions to examine their opinions towards exergames, for example, if they are just for fun or are good for doing more exercise, and whether exergames are as good as exercising with or without physiotherapy.

Two questionnaires were used; one for older people and one for physiotherapists. The older people questionnaire was piloted with four older people in SFH whilst the physiotherapist questionnaire was piloted with six physiotherapists. The feedback was used to improve the quality of the questionnaires and to correct any mistakes or misinterpreted questions. Paper questionnaires were used in this study rather than online questionnaires because some older participants might find accessing and completing surveys on a website difficult. The surveys for the physiotherapist participants were distributed by other therapists, who agreed to distribute and collect the surveys for the researchers. Those therapists were not involved in this study, so there was no direct contact between the researchers and the participants. For the older people, some of them were sent their questionnaire by post, another group was given the survey by a therapist who agreed to distribute and collect the surveys from the patients, and some of them were given the survey directly by the researchers.

The data in this study was extracted manually from the questionnaires completed by the physiotherapists and older people and entered into Microsoft Excel version 2013 for analysis. Some participants did not answer all of the survey questions. The researchers decided to include these results in the study because they contained some valuable answers for other questions.

RESULTS

The total number of participants was 44; 17 of them were physiotherapists and 27 were older people. Table 1 shows the ages of the participants. Most of the physiotherapists were under 40 years old, whilst most of the older people were aged between 75 and 84 (55%; Table 1).

Physiotherapists were asked about where they felt exergames could provide the most value in terms of the patient group, a particular disease, setting (place) and exercise domain. The participants could write as much as they wanted to. Physiotherapists in this study thought that exergames could give most value with paediatrics, balance issues and young adult (general) groups, and stroke (old and young) groups. Then was traumatic brain injury, neuro (general), orthopaedic (musculoskeletal), and cardiac and pulmonary groups. Moreover, when asked about which particular disease exergames could be useful for, stroke (CVA) disease was most commonly mentioned by the participants followed by age-related disease, including balance disorders (impairments) and fractures (Table 2). The hospital was considered to be the best setting for exergames; the physiotherapists chose many places inside the hospital, such as the in- and out-patient departments, rehab and children wards. The home was the second setting considered to be acceptable for using exergames, and then the community. Surprisingly, the gym and special rehab clinics were rarely felt to be good settings for exergames (Table 3). When asked about the exercise domain in which exergames can have more value, only 47% of the participants answered this question. Balance and weight shifting activities were the exercise domain that could be best trained by exergames from the physiotherapists' point of view, then mental (executive function) training. Other domains included resistance, lower limb, coordination, proprioception and gait, which were given the same importance (Table 4).

From the physiotherapists' perspective, the top of benefits of exergames were increased patient motivation and participation (23%), variety of exercise options (19%), can increase intensity and difficulty, and give readable data and feedback (visual and auditory), which both have a similar percentage (14%) (Table 5). The physiotherapists thought that the top risks were falling (42%) and inappropriate and low-quality movements (21%). Around 6% of physiotherapists stated visual problems and another 6% said more pressure on staff to supervise the patients (Table 5).

Table 6 shows the older people's answers to the five questions about their awareness of exergames. Around 68% of older people had seen their children or grandchildren playing exergames whilst just 92% of them had tried to play with someone else's games. Most of the older people (77%) said they had received advice about exercise from health care professionals. Furthermore, around 73% of them had been given an exercise sheet or exercise program to do at home. The majority of them (88%) did not recall being given any suggestions about using exergames (Table 6). Around 22% of older people responded that they were familiar with exergames compared with only 13% of physiotherapists who perceived that older people were

Table 1. The age of the participants

Participants	Age range	Percentage
Physiotherapist	30 or less	35%
	30–40	53%
	41–50	12%
Older people	60–64	8%
	65–69	14%
	70–74	11%
	75–79	33%
	80–84	22%
	85–89	7%
	90 or more	0%

Table 2. The most value of using exergames in terms of patients group and specific disease

Category	Items	Percentage
Patient group	Stroke (old and young)	11%
	Pediatric	14%
	Traumatic brain injury (TBI)	7%
	Neuro (General)	7%
	Balance issue	14%
	Young adult (General)	14%
	Cardiac	7%
	Pulmonary	7%
	Orthopedic (Musculoskeletal)	7%
	Geriatric (General)	4%
	Lower limb (Rehab)	4%
	Community dwelling older adult	4%
Disease	Stroke (CVA)	33%
	Parkinson's disease (PD)	15%
	Traumatic brain injury (TBI)	7%
	Multiple Sclerosis (MS)	11%
	Chronic obstructive pulmonary disease (COPD)	4%
	Contralateral C7 (Peripheral nerve disorders)	4%
	Age related disease: balance disorder and fractures	26%

Table 3. The most value of exergames in terms of setting place

Setting place	Frequency
Home	6
Gym	3
Special rehab clinic	2
• Hospital:	14
• Hospital (General)	3
• Outpatients departments	5
• Inpatients departments	2
• Rehab ward	2
• Children ward	1
• Long term rehab	1
Gym community	4
Public health center	1
Nursing home	1

Table 4. The most value of exergames in term of exercise domain

Exercise domain	Frequency
Balance and weight shifting	8
Resistance	1
Lower limb	1
Mental (executive function)	2
Co-ordination	1
Proprioception	1
Gait	1

familiar with exergames (Table 7). Of the 22 responders, 15 would use exergames if it was suggested to them. Most participants would prefer to have their training program in written paper format (Table 8).

DISCUSSION

The aim of this study was to investigate the feasibility of using exergames as a rehabilitation tool by determining the attitudes, awareness, opinions and experiences of physiotherapists, and older people towards exergames. This study showed that the majority of the physiotherapists surveyed were familiar with exergames while older people were not familiar with using exergames as a lot of them had seen them but had not used them.

We asked physiotherapy participants where exergames might be useful in terms of the patient group, a particular disease, the setting and the exercise domain. First, the majority of participants chose either balance issues, paediatrics, young adults (general) or stroke (old and young) groups. They may have chosen these groups because there are many research studies conducted about exergames with these groups. Rehabilitation patients with balance issues have been the main subjects of using exergames, and there are many research studies relating to exergames in rehabilitation of the balance focus with older

Table 5. The potential benefits and risks of exergames from physiotherapists prospective

Category	Items	Percentage
Benefits	Enjoyment for patients	9%
	Increase patient's motivation and participation	23%
	Variety of exercise option	19%
	Can increase intensity and difficulty	14%
	Give readable data and feedback (visual and auditory)	14%
	Novel	5%
	Challenges multiple senses	2%
	Dual technique can rehab balance and upper limb	5%
	Use as patient device home exercise program	2%
	Can increase strength fitness and practice time	7%
Risks	Falling	42%
	More pressure on staff to supervise the patients	6%
	Visual problem	6%
	Incorrect use	5%
	Injury	5%
	Increase the bad competition between patients	5%
	Inappropriate and low quality of movements	21%
	Waste time to set up	5%
	Put pressure on patients	5%

Table 6. Questions about the awareness of exergames among older people

Questions	Percentage	
	Yes	No
Have the old people seen their children or grandchildren play?	68%	32%
Did you try to play with someone else's games?	8%	92%
Have you advised about exercise from healthcare professional?	77%	23%
Have given exercise sheet or programme to follow at home?	73%	27%
Has a healthcare professional suggested you to use exergames?	12%	88%

Table 7. The familiarity with exergames (older people and physiotherapists)

Questions	Percentage	
	Yes	No
Older people response	22%	78%
Physiotherapists perception	13%	87%

Table 8. Openness to use exergames by older people and preferring teaching methods

Category	Items	Frequency
Suggested	Yes	15
	No	7
Preference witten down	Paper	15
	DVD	3
	Online	4

people, such as those by van Diest et al.[16] and Larsen et al.[19]. For young adults, there are studies by Vojciechowski et al.[21] and Huang et al[22]. Furthermore, in the paediatric group there are studies by Staiano et al.[23] and Bulea et al.[24], which used exergames in the rehabilitation of children with cerebral palsy. For stroke patients, Goble, Cone and Fling[25] who conducted a systematic review about using exergames with stroke patients. From the data collected regarding suitable patient groups, it is clear that the diseases that exergames are perceived to have the most value for were stroke and age-related diseases, including balance disorders (impairments) and fractures.

For the setting, many physiotherapists chose different locations inside the hospital, for example in- and out-patient departments, because they believed that the hospital was the best place for the use of exergames. 'Home' was chosen as the second most suitable setting for exergames. Agmon et al.[17] conducted a study on six older people using exergames in the home. They

explained that older people felt happy to play with their grandchildren and the authors concluded that "Use of Wii Fit for limited supervised balance training in the home was safe and feasible for a selected sample of older adults." In addition, van Diest et al.[26] agreed that training older people with exergames at home is feasible, but these participants would not benefit from the program equally. Most physiotherapists found that balance and weight shifting is the primary exercise type that could be provided by exergames. A device like a Nintendo Wii has a unique tool to assess the balance and weight shifting of the participants, called the WBB. In addition, many studies have shown that participants improve their balance after using exergames. For examples, in post-stroke patients[27, 28] and community-dwelling older people[29, 30], as well as Parkinson's disease patients[20, 31].

Comparing between exergames and other traditional methods of exercising might give exergames some advantages, as they have many different levels of difficulty and can focus on the particular task of training[13] as well as providing variety to the patient. This gives participants who engage with them different levels of challenges that are comfortable and suitable for individuals, where the participants can increase or decrease the task's difficulty depending on their performance[14]. The study results showed that a high percentage (23%) of physiotherapists thought that increased patient's motivation and participation were the benefits of using exergames, whilst 19% of them said that the benefit is the variety of exercise options. Around 14% believed the benefit is that there is readable data and feedback (visual and auditory) and the same proportion felt that the ability to increase the intensity and difficulty of the exercise is a potential benefit of exergames. These results fit well with other research, such as that by Chao, Scherer, and Montgomery[32], whose results also showed that Wii exergames interventions improved motivation and socialisation of the participants towards the exercise among older people. Those benefits can be attributed to the technology that is involved with exergames, such as the audio feedback and the eye-catching graphics, which make exercise more enjoyable and fun to do, so older people continue exercising for longer[33, 34]. Falling was reported by the physiotherapy participants (42%) in this study as the main potential risk caused by exergames. Taylor et al.[35] reported in his study that injuries occurred when playing Nintendo Wii. According to the authors: "The majority of these injuries were sustained from excessive gameplay, up to 10 hours in some cases, or resulting from a fall." However, there are no clear statistics about falling whilst using exergames among elderly. In addition, 21% of the physiotherapists stated that exergames provide inappropriate and low-quality movements.

In this study, there were some questions for older people about exergames. Our focus was not just older people who have prior experience of exergames but also for individuals who might not have any experience. The first question was about whether they had seen their children or grandchildren playing exergames. Surprisingly, more than half (68%) of them had seen their children or grandchildren playing exergames. Thus, the next question was if they had tried to play the games or others' games. Just 8% of them had decided to play exergames. That is a discrepancy between only 22% being familiar with exergames but 68% saying they had seen someone play the games in front of them. This indicates that they are not "familiar" with exergames as they did not personally use them; perhaps they were not interested in playing video games in the first place. Kari et al.[36] conducted a study in Finland about playing habits and the reasons for not playing exergames. Their results showed that for 649 participants aged 45 years and over, around 29.7% did not play exergames because they were not interested. The second most common reason was that they preferred other forms of exercise (18.2%) and the third reason was ownership (16.5%). Only 4.9% said they did not play because they were not familiar with exergames, and by "not familiar" they mean that the participant has not even heard of exergames. These results fit well with our results as the majority of them had seen someone play exergames but they did not try because they were not interested in playing. The high proportion of them who said they are "not familiar" with exergames may mean that they had not tried to play them or that they did not know the meaning of the word "exergames" itself. Herstad and Holone[37] stated that "what we are unfamiliar with is often things that we do not engage with, have no skill or understanding of and are foreign to."

The majority of physiotherapists in this study were familiar with exergames, but the majority of older people did not receive any suggestion to train with exergames. Thus, it could be that healthcare professional might not be aware of using exergames in general or they have another perspective regarding the use of exergames with older people. For this reason, the researcher asked if the physiotherapists thought that older people were familiar with exergames. Around 13% said they thought that older people would be familiar with exergames. When we asked older people if they were familiar with exergames, around 22% of respondents said they were familiar. When physiotherapists were asked for the reason, the common reason for those who believed that older people would be familiar with exergames was that they might have seen their children play. One physiotherapist stated that "Most of them witnessed children and grandchildren using them," and this agreed with what we found when we asked older people. The majority of individuals said older people would not be familiar. One of them reported that "Generation gap, generally system only 30 years old so older population has limited exposure." It was surprising that there was an underestimation by some physiotherapists of the familiarity of older people with exergames. This might mean that a lot of them had seen exergames but that does not mean that they are familiar with how to use them. Experience is the key to becoming familiar with something, so if older people gain experience of using exergames and enjoy it, they might become willing to consider it as a part of their rehabilitation. Zhang et al.[38] said that "Familiarity helps in encouraging the elderly to learn and understand how to interact with the new technology by using their existing knowledge learned in their everyday life." So, we asked older people if their physiotherapists ever suggested to them to use exergames as a part of their rehabilitation, would they be open to try and use them? More than half (68%) of older people who answered this question were happy to try it. Furthermore, we asked about their preferred way to receive their training program. Most

of them answered that they preferred it to be written down in paper format and a few of them preferred having their exercise program on a DVD or online. That gives a good indication that older people want to participate.

This study had some limitations; one of them is that both questionnaires were self-developed over a short time. To make them more robust, they should have been reviewed by more physiotherapists. In addition, the small sample size of the study makes it difficult to generalise the results because the physiotherapy results represent the physiotherapists in three hospitals in Cork city (MUH, SFH and CUH), whilst the older people just represent the older people in SFH.

In conclusion, the majority of the physiotherapists surveyed were familiar with exergames in terms of potential benefits and risks, and had opinions on suitable patients, diseases, settings and exercise domains for using exergames. However, they still saw it as an extra method in rehabilitation, and it would not change or replace any traditional methods of exercising. Older people in this study were not familiar with using exergames as a lot of them had seen them but had not used them. Lack of interest and not knowing the benefits of using exergames as their healthcare professional did not suggest to them to use it are the main reasons for this unfamiliarity with exergames among older people. In spite of this, older people showed a willingness to learn how to use them if it would progress and improve their rehabilitation. A larger sample including multiple centres and cities is recommended in future research. In addition, the awareness and familiarity of the different healthcare professionals towards exergames should be investigated.

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Conflict of Interest

None.

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