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Facilitators and Challenges to Exergaming:

Perspectives of Patients With Heart Failure

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Abstract

Background: Few investigators have explored challenges and facilitators to exergaming, essential factors to exergaming adherence, among patients with heart failure.

Objectives: In this qualitative study, we explored facilitators and challenges using a home-based exergame platform, the Nintendo Wii Sports, in patients with heart failure.

Methods: Semistructured face-to-face interviews were conducted in 13 participants given a diagnosis of heart failure (age range, 34–69 years). Participants were asked about their experiences with exergaming. Transcribed interviews were analyzed with content analysis.

Results: The following 4 facilitators were identified: (1) enjoyment and competition motivated gaming, (2) accessibility at home gave freedom and lowered participants' barriers to exercise, (3) physical benefits when decreasing sedentary lifestyle, and (4) psychosocial benefits on stress,

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mood, and family interactions. Challenges included (1) diminished engagement over time due to boredom playing similar games and (2) frustrations due to game difficulty and lack of improvement.

Conclusion: Exergaming can increase individuals' physical activity because of easy accessibility and the fun and motivating factors the games offer. Participants initially found exergaming enjoyable and challenging. However, engagement diminished over time because of boredom from playing the same games for a period of time. Participants' preferences and capacities, participants' past experiences, and social support must be considered to avoid boredom and frustrations. Future studies are warranted to determine adherence to exergaming among patients with heart failure and, ultimately, increased overall well-being and healthcare delivery in this patient population.

Keywords

challenges; exergaming; facilitators; heart failure; perspectives; qualitative

Exercise training has been associated with an individual's improvement in cardiovascular health. The American Heart Association has recommended an exercise regimen in adults to improve cardiovascular well-being and health-related quality of life.¹ Engagement in exercise has also been promoted as an important modality in treating individuals with chronic heart failure (HF) to improve functional status and quality of life and reduce clinical events and healthcare utilization.²⁻⁴ However, despite the beneficial effects of exercise, most patients with HF report a low level of daily exercise.⁵ Specifically, engaging patients with HF to perform daily exercise has been a challenge. Research has shown that some of the reasons patients are less likely to engage in exercise include physical limitations such as difficulty breathing, shortness of breath, discomfort, fatigue, or psychological impediments (eg, lack of motivation, depression).^{6,7} Environmental factors such as heat and cold, space, and safety also play vital roles in patients' motivation and engagement to exercise.^{8,9}

Exergaming, a form of exercise using video games or virtual reality, has gained acceptance as a healthcare intervention among older adults.^{5,10-12} There is an increasing body of research addressing the effect of exergaming on the physical and psychosocial well-being in older adults, such as improving physical capacity,^{8,13} balance,¹⁴⁻¹⁹ muscle strength,^{20,21} mobility,¹⁵ and cognitive functions^{22,23}; reducing depressive symptoms^{24,25}; and improving health-related quality of life.²⁶⁻²⁸ Researchers and clinicians reported that exergaming might overcome the traditional challenges to exercise that patients encounter, including environmental elements, safety, time restriction, service access cost, and boredom.⁸ It was surmised that exergaming can deter boredom among individuals because of the fun factor and may foster engagement and adherence to exercise. Competition and camaraderie while exergaming can promote socialization through group play,^{8,12,29} thus making exercise more enjoyable and engaging.

Whereas most previous investigators have focused on improving adults' physical activity and psychosocial well-being, few have explored older adults' experiences and perspectives related to facilitators and challenges to exergaming, important factors that may also determine engagement and adherence to this form of exercise program. A study conducted among older adults with impaired balance demonstrated that participants

experienced enjoyment and high motivation with exergaming, especially when playing with grandchildren.¹⁹ Similarly, older women living in the community expressed an improved sense of physical, social, and psychological well-being after 6 weeks of exergaming.³⁰

Whereas the positive benefits of exergaming have been described, most studies on various groups of older adults reflected on both the positive and negative effects of exergaming occurring concurrently. In an assisted living facility, residents cited health and mobility, increased alertness, social interactions, and program structure as facilitators to exergaming. At the same time, age- or health-related impairments and unpleasant experiences to exercise were identified as challenges.³¹ Furthermore, in a study conducted in Sweden by Klompstra and colleagues,³² they reported that patients with HF experienced exergaming as enjoyable, easy to use, convenient, and having improved physical fitness but less appealing over time.

These studies have provided an understanding of motivators, difficulties, attitudes, abilities, and preferences to exergaming in older adults who are healthy or with varying chronic conditions and disabilities. However, there is a lack of studies on perceived facilitators and challenges to exergaming in patients with HF. The purpose of this study was to explore facilitators and challenges to exergaming in patients with HF.

Methods

This is a qualitative study nested within the US site of the randomized HF-Wii study in which the effect of exergaming using the Nintendo Wii Sports was examined in improving the physical and psychosocial well-being of patients with HF with extended collection. A complete description of the study design and methods of the parent study describing the effects of exergaming on exercise capacity in patients with HF has been published elsewhere.^{5,33} The current study is grounded in an exploratory, descriptive design using content analysis of data gathered from participants' interviews.^{34,35} The design was appropriate because it facilitated rich contextual data related to the experiences on exergaming of patients with HF.

In the US study site, 30 adults (>18 years old) given a diagnosis of HF were randomly assigned using computer-generated blocking to the standard of care (eg, motivational support where patients get exercise advice from the HF team) versus standard care plus structured access to Nintendo Wii video game for 12 weeks (exergaming group). Because only patients in the exergaming group could describe their experiences with exergaming, the 16 participants randomized to the exergaming group were invited to participate in interviews; 13 agreed to participate in a face-to-face interview and describe their experiences with exergaming.

Participants were recruited from a university-based HF program in Southern California. Eligibility criteria for the study included individuals 18 years or older; a diagnosis of HF (New York Heart Association classes I–III) independent of ejection fraction; ability to speak, read, and understand the English language; absence of mobility or balance problems, communication deficits (vision, speech, or hearing), severe cognitive impairments, or

psychiatric illness; and being in a stable condition. Stability was defined as the absence of hospital admissions and emergency department visits in the last month.

In the study exergaming arm, the first author (M.C.) trained the participants on using the Nintendo Wii Sports installed in their homes. Games included in the Nintendo Wii Sports package are bowling, baseball, golf, tennis, and boxing. Participants were taught to move the remote control in a way similar to the way games were played in real life, for example, holding and swinging the remote control as a bowling ball, tennis racket, baseball bat, golf club, and boxing gloves. They were advised to play all games and exergame for 30 minutes per day for 12 weeks. If needed, they were instructed to adapt to their capacity, for example, to play more often for shorter periods during the day or play longer if able. Participants received written safety guidelines and information on how to use the Nintendo Wii Sports after installation. The first author also assessed participants' home surroundings for safety issues. Participants were contacted by the first author using a structured telephone script to discuss their experiences with the Nintendo Wii games, given motivational support, and, if needed, provided with assistance to resolve unexpected problems at 2, 4, 8, and 12 weeks. Technical assistance was provided during the intervention period.

The university institutional review board approved the study, and informed consent was obtained from all study participants. Semistructured face-to-face interviews were conducted by the first author (M.C.) at the end of the 12-week study. All interviews were audio recorded, and field notes and impressions of the interview were written to capture nonverbal data. The interviews were conducted during the 12-week follow-up visit, which was completed at a university-affiliated HF clinic in a quiet, private room. Using an interview guide questionnaire prepared by the research team, participants were asked: "Can you describe your experience with the Nintendo Wii Sports games?" Participants were asked to elaborate on their responses to understand their perspectives better. Finally, participants were asked to share their ideas of what they would recommend to improve the exergaming experience. Interviews lasted between 12 and 20 minutes.

Data Analysis

The audio files were transcribed verbatim, and transcriptions were checked against the research team's audio recordings upon completing the interviews. Transcribed interviews were analyzed through content analysis using inductive code generation.³⁶ Each transcript was independently coded by 2 coders (M.C. and L.E.) with the guidance of an expert in qualitative research (A.S.) to ensure that the identified themes reflected the actual participants' statements. Coding disagreements were resolved through discussion. This comparative analysis was used to validate the data to ensure credibility and dependability. Codes were condensed into higher-level themes structured around 2 related topics: facilitators and challenges to exergaming.

Results

Characteristics of the Sample

Sixteen individuals were invited, and 13 agreed to participate in a face-to-face interview (mean age, 57.3 ± 10.1 years; range, 34–69 years; 62% male); 39% were White, 23% were Black, 23% were Hispanic, and 15% were Asian. Less than half (46%) were married with children and/or grandchildren, and 54% were employed. Participants were given a diagnosis of HF by an echocardiogram or radionuclide ventriculography within the past 6 months and mainly classified as New York Heart Association class II with a mean ejection fraction of 32%. Comorbidities included diabetes, hypertension, renal failure, myocardial infarction, and cancer.

Participants were advised to participate in exergaming for 30 minutes per day for 12 weeks. Adherence is defined as meeting 80% of the recommended time in exergaming, which was initially high, with participants reporting exergaming 5 to 7 days a week for 20 to 45 minutes at the third and fourth week, then 1 to 3 times a week for 15 to 20 minutes at 8 weeks, and less than 2 times per week at 12 weeks. Adherence to exergaming was entered in the diary as self-report. Before exergaming ($n = 9$), participants reported low levels of physical activity and lack of motivation. Unstructured activities included walking around the neighborhood, grocery store, or mall; yard work; and doing household chores. The rest of the participants did not report any form of exercise.

Overview of Findings

Four themes emerged as facilitators to exergaming: (1) enjoyment and competition motivated gaming, (2) accessibility at home gave freedom and lowered barriers to exercise, (3) experienced physical benefits when decreasing sedentary lifestyle, and (4) experienced psychosocial benefits on stress, mood, and family interactions. Challenges included (1) engagement diminished over time because of boredom playing similar games and (2) frustrations due to game difficulty and lack of improvement. The Table presents some examples of quotes provided by participants in each category.

Facilitators to Exergaming

Enjoyment and Competition Motivated Exergaming—All participants stated that the exergaming device was overall user-friendly after the initial familiarization with the technology. They stated that the Wii Sports games were enjoyable initially, specifically the first 4 weeks that kept them interested and motivated with exergaming. They enjoyed competing against themselves or the computer, and that inspired them to play more. They wanted to get better scores or beat their best game every time they played. Others expressed that, as gameplay difficulty increased, the games became more engaging because of the new challenges, especially when game goals were attained. The novelty and game challenges were cited reasons for continued play.

Accessibility at Home Gave Freedom and Lowered Barriers to Exercise—The accessibility of the Nintendo Wii device at home emerged as a motivating factor to engage in exercise. All participants claimed that being able to play at times convenient to them

provided a sense of control. They stated that the convenience of a home-based exercise such as exergaming provided a good alternative when unable to go to the gym or exercise outdoors.

Experienced Physical Benefits When Decreasing the Sedentary Lifestyle—

Participants described a surge of energy when they played, and this energy is what kept them moving. They reported that the platform provided an outlet to be active and fit instead of being sedentary and physically exhausted. Specifically, several participants (>50 years old) stated that exergaming helped improve their stamina, whereas 1 participant younger than 50 years said it kept his blood pumping. Participants reported spending a lot of time watching television (TV) before they had the Nintendo Wii, but exergaming allowed them to use arm movements even while sitting down and helped boost their confidence in being active.

Experienced Psychosocial Benefits on Stress, Mood, and Family Interactions

—Most of our study participants reported that exergaming made them feel more active and that being more active made them feel good. Some participants described that exergaming helped relieve stress, most notably when playing boxing. Other participants claimed that exergaming helped reduce their feelings of depression by filling a void. Spending family time with exergaming was another perceived benefit that participants reported.

Challenges to Exergaming

Engagement Diminished Over Time Because of Boredom Playing Similar

Games—Initial impressions of exergaming were mostly positive at the beginning of the study. All participants expressed enjoyment when they first started exergaming. However, 4 weeks into exergaming, participants, especially those in solitary play, reported getting bored playing the same game repeatedly. Having played the same games for more than a month made the games predictable, diminishing the fun factor. For some participants, achieving mastery of the games or “beat the games” did not provide further motivation to keep exergaming. Some participants stated that, when the weather was nice, they prefer the outdoors to playing in the room in front of a TV screen. All participants suggested that adding various games would be beneficial and would enhance their desire to play more.

Frustrations Due to Game Difficulty and Lack of Improvement—Feelings of frustration were expressed when playing some of the Wii game components that were fast-paced and required visual acuity and hand-eye coordination (eg, tennis, baseball), especially among older participants (>55 years old). Most of the frustrations arose from a fast-moving ball and inability to hit it at the right moment, a problem with hand-eye coordination. Reports of inability to hit the ball due to difficulty with hand and eye coordination and inability to advance to the next game level resulted in annoyances and defeat. In contrast, bowling, a slow-paced game that did not require hand-eye coordination, was a favorite. Some participants voiced that they avoided playing some games because of difficulty and feelings of disdain toward the game and self-failure. These frustrations led to a decreased engagement in exergaming and sporadic play, whereas others stopped playing the games altogether.

Discussion

Exercise is an essential part of the management and treatment of patients with HF. However, adherence to exercise among this patient population is low. The use of technology such as exergaming, a strategy for encouraging and adhering to exercise and other forms of physical activity among older adults, is novel and might lessen the traditional challenges to exercise (ie, environmental elements, safety, time restriction, service access cost, and boredom).⁸ Technology-driven and home-based exercises such as exergaming can improve physical activity in this patient population.

Facilitators to Exergaming

Our study findings demonstrated that all participants were initially engaged in exergaming using the Nintendo Wii Sports games. The fun factor and competitive nature the games offer seemed to play critical roles in motivating and engaging participants to exergame. Our findings were consistent with earlier research that showed the Nintendo Wii platform was highly usable in terms of fun, enjoyment, and satisfaction,^{30,32,37,38} and engagement was strongly associated with the competitiveness the games foster.³⁹

In this study, participants reported that fun and enjoyment was associated with a sense of accomplishment, pride, and joy as their game mastery increased by moving up to the next level or achieving high scores. Finding pleasurable and sustainable physical activities such as exergaming that may motivate and engage individuals to exercise consistently and frequently is crucial. Accessibility was also identified as a facilitator to exergaming. This console-based platform is portable and can be set up in any setting, especially at home. A home-based exercise program that is accessible at all times makes it very convenient.³⁸ The accessibility of the Nintendo Wii games may address time- and resource-related challenges, such as transportation to rehabilitation centers or gym membership, and potential benefit to individuals with physical limitations or who are unable to leave their homes (eg, immunocompromised). In addition, allowing participants to decide when and how much to exercise provided motivation for continued play. However, Nintendo Wii games may pose challenges such as patient safety,⁴⁰ home distractions (ie, competing desire to complete household chores), TV accessibility (ie, only 1 TV in the home), and lack of accountability and social support (no family members).³⁸ Thus, it is important for clinicians to consider the physical and social environment that allows for engagement in such programs while improving physical function.

Increased physical and psychosocial benefits emerged as another facilitator to exergaming among our study participants, which is consistent with findings in recent research involving older women living in the community³⁰ who claimed that playing the Nintendo Wii games kept them active regardless of age or health condition. Our findings showed that exergaming could provide an outlet to be active regardless of mobility factors, as stated by participants who played the games in a sitting position or standing up. Participants also attributed exergaming to relief of stress, making them feel good, managing depression, and increased interactions with family members. These perceived psychosocial benefits were similar to findings reported among older adults that credited exergaming to reducing depressive symptoms^{24,25} and stress,⁴⁰ which are essential motivating factors to engagement and

exergaming adherence. Increased family interactions with exergaming were also reported among study participants. The use of a novel technology that was initially marketed to younger generations for entertainment value allowed older persons to be more connected to their family members, especially grandchildren.^{19,31,32} These intergenerational connections and shared experiences with younger family members promoted social support and may lead to improved psychosocial well-being among patients with HF.

Challenges to Exergaming

At the beginning of the study, participants found exergaming enjoyable and motivating. However, after 4 weeks of playing similar games and when game mastery was achieved, they reported boredom and exergaming was reduced over time. This finding is supported by a study in older adults with multiple sclerosis³⁸ and a similar study among patients with HF conducted in Sweden.³² However, cultural differences need to be taken into consideration. Perceptions among study participants in Sweden may be different from the US participants. The difference in perceptions may be influenced by culture, norms, beliefs, and different ethnic backgrounds. Likewise, findings from a systematic review showed that exergaming declined over time, with the highest use occurring upon receiving the exergaming consoles and games.⁴¹ Boredom in our study was also strongly associated with a lack of game variety. This finding is similar to a study conducted among obese adolescents on the motivating effects of cooperative exergaming, where participants reported boredom after playing repetitive games and such boredom led to study dropouts.⁴² It is evident that “one size does not fit all”³²; thus, game variety must be considered when starting a home-based exergaming program to ensure that games are tailored to individuals’ interests and capacities. Providing individuals with a variety of games is important to generate and sustain exergaming at home.

Interestingly, in exergaming involving group play such as those conducted at assisted living facilities,^{31,37} community health service centers,³⁰ and retirement centers,³⁹ participants did not report boredom. These findings suggest that exergaming may be more beneficial when integrated into group activities such as those occurring at rehabilitation centers where individuals exercise with other people over the solitary play at home. One can also argue that boredom was perhaps not due to exergaming itself but rather due to lack or absence of interaction between the participants and other players. Group play involves social interaction and connectedness, a motivating factor to engage in exercise.^{8,39} Likewise, support from friends and family and playing with others may facilitate long-term exergame play.⁴¹ These findings suggest that exergaming is most effective in improving and sustaining physical activity among people who exercise together.

Another challenge to exergaming was game disdain and self-frustration. Participants verbalized frustrations over games that require hand-eye coordination and precision of movements, such as baseball and tennis games. For instance, the tennis game needed players to align their arms at a certain angle and use precise timing to hit a virtual ball at a target, or small rapidly moving features such as baseball that required both skill and hand-eye coordination.³⁰ Such failures to properly execute movements could itself become a challenge to exergaming. These challenges seemed to reduce enjoyment,

mainly because participants had to complete many successful hits to progress to the next game.⁴² Developing an understanding of participants' perceived challenges and how these can be mitigated is vital for ensuring adherence and persistence with exergaming. This is particularly important in home-based interventions where family or clinician support may be lacking, and participants may feel less motivated to exergame. These findings suggest that proper instructions, training, support, and encouragement are needed to help individuals overcome their lack of confidence in technology and gameplay when starting a home-based exergaming program. Additional training and encouragement may potentially reduce or avert feelings of frustration related to exergaming in our sample.

Strengths and Limitations

A strength of this study lies in the diversity among participants from different ethnic backgrounds and socioeconomic status. Diversity in the cultural context might garner different perspectives of exergaming because of one's beliefs and norms. Another strength is the inclusion of a wide age range (34–69 years) among participants. Game preference was strongly associated with age. Participants older than 50 years avoided games that required hand-eye coordination and precision of movements such as baseball and tennis, thus creating potential game bias. Gender also influenced game selection. Male participants preferred boxing and golf, whereas female participants preferred bowling. Game preference may have had influenced participants' perspective of exergaming. Female participants comprised 38% of study participants, a limitation that was related to recruitment challenges in the study setting. Most patients where study recruitment occurred were male. Notably, female patients showed less interest in study participation when exercise using videogames was introduced. This phenomenon is akin to a similar research in Sweden where fewer women participated in the study.⁸ Findings from this study must be interpreted with caution because the study sample is small and the participants' experiences with exergaming might not be transferable to all patients with HF, especially older adults over 85 years of age. Other limitations include cost or accessibility to gaming devices. The Nintendo Wii games and consoles cost money and some patients may lack the resources to purchase the exergaming device. Furthermore, lack of space may be a challenge. Individuals may not have the living space for device set up and exergaming. Most of all, our findings are unique to this patient population and influenced by the researchers' beliefs and perceptions about exergaming. Future research is warranted to explore the perspectives of individuals with chronic disease on exergaming, especially on older adults where the use of technology may pose a challenge. The insights gained from this study will contribute to the body of knowledge in integrating technology, specifically devices like the Nintendo™ Wii, to improve physical activity and adherence to exergaming in patients with HF and other chronic illnesses.

Conclusion

This research was conducted to examine facilitators and challenges to exergaming among patients with HF. Our findings support the idea that using exergaming can improve exercise among patients with HF. Exergame play, much like real sports, can promote fun, social interaction, and competition while increasing physical activity. However, clinicians must consider game variety, preferences, capacities, participants' past experiences, and social

support to achieve adherence to exergaming, especially when solitary play is expected. With interactive technologies being used as health interventions to promote physical activity, such as the Nintendo Wii games, clinicians must consider facilitators and challenges to exergaming as an integral part of a framework for improving knowledge about establishing exergaming programs at home.

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What's New and Important

- Game variety must be taken into consideration when establishing a home-based exergaming program to avoid boredom.
- Individuals' game preferences, capacities, past experiences, and social support must be taken into consideration to achieve adherence to exergaming.

TABLE

Themes With Representative Quotations

Theme	Quotations
Facilitators to exergaming	
• Enjoyment and competition motivated gaming	<ul style="list-style-type: none"> • “It’s easy that anyone can just practice and you can get better because I’ve gotten better since I started playing it” • “I love it, it’s fun, it’s competitive...it’s always fun to have games and things like that...it’s engaging” • “Fun! It soaks up a lot of time... Enjoyable as the games can get competitive, even if it’s against the computer... enjoyable playing the games, especially when I get to the next level”
• Accessibility at home gave freedom and lowered barriers to exercise	<ul style="list-style-type: none"> • “I can play the game whenever I want to... I feel in total control” • “The nice thing about the Wii was when I wasn’t working in the gym or did not feel like going out, then I can turn on the Wii and exercise” • “You can do it anytime you want...like 2:30 in the morning I’m up bowling...”
• Experienced physical benefits when decreasing the sedentary lifestyle	<ul style="list-style-type: none"> • “I feel that it keeps me moving, so I felt like I’m doing something... It got me to stand during the time where I would normally be sitting” • “It helped me with stamina, I can say that it motivated me to get up and do more things, ‘cuz I was lazy... Depending on the game, it gets my blood pumping” • “...doing something in front of the TV... It helps create an environment where you are more active even if I’m just using my arms”
• Experienced psychosocial benefits on stress, mood, and family interactions	<ul style="list-style-type: none"> • “It got me motivated a bit. It’s a good stress reliever.” • “...if I get stressed, I would come home and box a couple of rounds” • “It helped the boring time because you have too much time on your hands... You become bored and can lead to depression... With the Wii, you turn it on, play something, and all of a sudden next thing you know, half an hour’s gone...time goes by, and stuff it takes care of depression.” • “It was a good way for the family to get together”
Challenges to exergaming	
• Engagement diminished over time because of boredom from playing similar games	<ul style="list-style-type: none"> • “Wii was good, but it gets boring after a while...it’s the same game I play over and over again...you anticipate the moves... I already beat the game” • “...to keep my interest, I would play different games (other than Wii Sports) like the dance and do different things...add a Wii Zumba something that keeps you excited so you do not get bored I love to dance I love to move around... I think it just needs variety” • “It’s (the Wii games) cool, but it gets old playing after a while.... I am kind of getting tired of playing the same five games... I do not feel like playing the game when it’s nice and warm outside”
• Frustrations due to game difficulty and lack of improvement	<ul style="list-style-type: none"> • “...I could not figure out really the swing and the bat to really connect at the right place consistently (when playing baseball)... I lost interest...not playing the game as expected” • “Not being able to do it. Not being able to play the game. Not being able to return a serve. It’s so frustrating!” • “...tennis because I cannot return a service to save my life. Baseball is another one. I either swing too soon or too late. That was the other one that I get upset with. I stopped playing...when I better the score I had; that’s how I feel successful; otherwise, I feel mediocre. I feel like a failure.”