

Exergaming for stroke rehabilitation: Lessons learned for future implementation strategies

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Abstract— This study aimed to understand the perspectives of clinicians regarding an exergaming program to supplement stroke rehabilitation care, one year after its implementation. Semi-structured interviews were conducted with occupational and physical therapists who had referred their clients to an exergaming program. Transcribed verbatims were analyzed using inductive content analysis. Individual, organizational and technological factors influencing implementation and sustained use of an exergaming program were identified. The results stressed the need to target the key implementation factors.

Keywords— Stroke; rehabilitation; exergames; serious games

I. INTRODUCTION

Virtual reality interventions can offer rich, multi-modal and stimulating environments shown to be important for rehabilitation [1,2]. Despite the increasing evidence supporting virtual reality interventions, the adoption and implementation of virtual reality is not yet commonplace in hospital settings. In a survey of over 1000 Canadian occupational and physical therapists, 46% had experience using virtual reality or active video games for rehabilitation purposes. Of this percentage, only 12% of respondents used this modality at the time of the study [3], suggesting that some factors may hinder the sustained use of virtual rehabilitation. Globally, translating research evidence into clinical practice is a major concern in healthcare, but the dissemination of research evidence to clinicians is not sufficient to ensure knowledge uptake and adoption in clinical settings [4]. Previous studies have identified factors influencing the adoption of virtual reality in neurological practice. Lack of time, education, space, and equipment were often cited as barriers to implementation, whereas client motivation and engagement were common facilitators [5-8]. However, these studies focused mainly on the quantification of facilitators and barriers to knowledge use through questionnaires.

To facilitate the transfer of knowledge and sustain knowledge use, there is a need for greater insight on the perspectives of clinicians about the use of low-cost exergames specifically designed for stroke rehabilitation. Understanding these perspectives in a setting where efforts are made to address the main barriers to the adoption of this technology can help inform future implementation strategies. The aim of this study was to understand the perspectives of occupational and

physical therapists regarding an exergaming program to supplement stroke rehabilitation care, one year after its implementation. This knowledge will serve to identify factors influencing the sustainability of an exergaming program specifically tailored to individuals receiving rehabilitation services in a hospital setting following a stroke.

II. METHODS

A. Exergaming program and implementation

An exergaming program was established at the Jewish Rehabilitation Hospital, Centre Intégré de Santé et de Services Sociaux de Laval (Laval, Canada) to supplement stroke care. The implementation of the exergaming program took place over nine months. Implementation steps included obtaining a dedicated room, approval from the hospital administration, purchasing the equipment, establishing the referral process and hiring the personnel. The design of the exergaming program considered the main barriers to implementation cited in the literature [5-8]. The program included two different systems: the Jintronix (Montreal, Canada) and the Meditouch HandTutor (Netanya, Israel). Occupational and physical therapists of the Stroke Program referred potential participants to the exergaming program and indicated their overall treatment goals. An expert clinician designed and progressed the treatment program using the exergames, while a trained assistant provided the treatment.

B. Participants

Occupational and physical therapists working in the Stroke program at the Jewish Rehabilitation Hospital were included in this study, using a convenience sampling strategy. There were no exclusion criteria. The project was approved by the local ethics review board and written consent was obtained.

C. Data collection and analysis

Using an interpretive research paradigm, semi-structured interviews (10-20 min) were conducted with each occupational and physical therapist. The interview was composed of open-ended questions and developed using the Unified Theory of Acceptance and Use of Technology [9]. The interviews were audio-recorded and transcribed verbatim. Two members of the research team independently performed an inductive content analysis to identify codes emerging from the data. First, a codebook was developed with the list of

codes and their definitions. Then, the codes were aggregated into meaningful units to form the themes and subthemes, inspired by the Organizational Behaviour Framework [10]. The themes were refined collaboratively throughout the data analysis process as further insight was gained to generate an optimal representation.

III. RESULTS

A total of 10 clinicians from the Stroke Program were recruited (6 occupational therapists, all females, and 4 physical therapists, 1 male and 3 female). On average, participants had 8.1 years of clinical experience (range 1–25 years) and 90% of participants worked in the Stroke Program since the implementation of the exergaming program. Three main themes referring to the factors influencing the implementation and sustained use of the exergaming program were identified: individual, organization and technological factors.

A. Individual factors

Among the individual factors identified, clinicians had personal positive experiences with the exergaming program. The presence of the expert clinician highly facilitated the sustainability of the program, as this person was considered knowledgeable and trustworthy. While it was perceived that client motivation greatly influenced participation, client-related factors such as difficulty with transportation, lack of familiarity with technologies and client functional limitations (e.g. pain, fatigue, communication, physical limitations or cognitive limitations) represented barriers to sustained use. This suggested that not everyone can benefit from using virtual reality interventions.

B. Organizational factors

Processes for referring and scheduling clients to the program, training sessions and reinforcement from the management to refer clients to the program facilitated the implementation. The short average length of the intervention sessions (10-15 minutes) and the need for additional resources, such as a larger variety of exergame systems, larger space, more staffing and better staff training were identified as important barriers.

C. Technological factors

The exergames were perceived as being easy to use for the therapists and clients as they were seen to target a large range of physical impairments. The exergames allowed the opportunity for clients to practice physical activity outside of their regular therapy sessions. Important limitations of the exergames were the lack of precision in movement detection and the lack of task specificity, allowing clients to use maladaptive compensatory movements. The limited cognitive challenge of the games was also highlighted.

IV. DISCUSSION

Individual, organizational and technological factors influencing implementation and the sustained use of an exergaming program were identified. Overall, clinicians who referred individuals with stroke to the exergames program over a 1-year period expressed a high level of satisfaction with the program, as it offered adjunctive treatment interventions

addressing rehabilitation goals. The support from the organization, as often cited in the literature [11], was crucial for the implementation and sustainability of the program. Unlike other studies that cited the lack of familiarity or knowledge of the technology as important barriers [5,6], this was not perceived by the participants, probably due to the presence of an expert clinician and the delivery of training about the exergames. An important limitation reported with the systems used were the inaccuracy of the motion tracking system, potentially encouraging maladaptive movement strategies. With the advancement and development in technology, this limitation will likely be addressed in the near future.

V. PRACTICAL IMPLICATIONS

Targeting key barriers to the use of virtual reality interventions greatly facilitated the implementation and sustainability of an exergaming program to supplement stroke care. Despite these efforts, barriers remain such as limited resources, lack of accurate motion tracking, need for more training and client factors. An ideal exergames program should offer a wide variety of games to address the heterogeneous impairments following a stroke. In an effort to address these factors, the exergames room has now moved to a larger space and more hours of treatment are offered due to the hiring of a kinesiologist.

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