Participant and caregiver experience of the Nintendo Wii Sports™ after stroke: qualitative study of the trial of Wii™ in stroke (TWIST)

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Abstract
Objective: To understand stroke survivors and their caregivers' experience and acceptability of using the Nintendo Wii Sports™ games (Wii™) as a home-based arm rehabilitation tool.
Design: A qualitative study within a randomized controlled trial investigating the effectiveness of using the Wii™ for arm rehabilitation. Data were analysed using thematic analysis.
Settings: Participants and carers were interviewed in their homes.
Subjects: Eleven male and seven female participants and 10 caregivers who were taking part in the randomized controlled trial within six months of stroke. Median age 65.
Intervention: All participants were using the Wii™ for arm rehabilitation.
Main Measures: Semi-structured interviews.
Results: Five themes were identified: diligence of play, perceived effectiveness, acceptability, caregiver and social support, and the set-up and administration of the Wii™. Participants appreciated the ability to maintain a social role and manage other comorbidities around the use of the Wii™. A small number of participants found the Mii characters too childlike for adult rehabilitation. The most popular game to start the rehabilitation programme was bowling. As confidence grew, tennis was the most popular, with baseball and boxing being the least popular games. Caregivers provided some practical support and encouragement to play the Wii™.
Conclusions: The Wii™ may provide an engaging and flexible form of rehabilitation with relatively high reported usage rates in a home setting. The Wii™ was acceptable to this sample of patients and their caregivers in home-based rehabilitation of the arm following stroke.

Keywords
Rehabilitation, stroke, qualitative study, arm, assistive electronic technologies

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Introduction

Up to 70% of stroke survivors have impaired arm function. There has been an increased interest in using computer-based systems to improve uptake of upper limb rehabilitation in patients following stroke. The main predictor of success in physical therapy is the amount of therapy undertaken and, therefore, guidelines for patients recommend high intensity repetitive motions. Several small case-control or pilot randomized studies have investigated Nintendo Wii Sports™ games (Wii™) in institution-based rehabilitation. A recent Cochrane review on the effect of virtual reality on arm function found limited evidence that it may be beneficial in improving arm function and activities of daily living when compared with the same dose of conventional therapy, however, present studies were too small and too few to draw firm conclusions, and more randomized controlled trials (RCTs) are needed. Despite the limited clinical evidence, Wii™ is being used by some therapists in stroke rehabilitation.

A qualitative study that explored the experience of nine Danish stroke survivors who used Wii™ in a hospital setting for up to nine sessions lasting for 30 minutes over three weeks, found that participants thought the Wii™ was an engaging, beneficial and challenging occupation for both rehabilitation and leisure. They also reported challenges including fatigue and frustration at their reduced skills.

A clinical Trial of Wii™ in Stroke (TWIST) is underway in the UK to investigate the effectiveness of using the Wii™ for six weeks as a home-based rehabilitation tool for improving arm function after stroke (ISRCTN: 06807619). This is the first major RCT in the UK using Wii™ as a home-based arm rehabilitation tool. The results of the RCT will be published in due course. Before any new intervention can be introduced, clinicians and people living with arm disability following stroke need to know if an intervention is acceptable in practice. There is a lack of qualitative studies using the Wii™ in home-based setting in patients following stroke. We therefore aimed to explore the perceptions of people and their caregivers following stroke in using this programme of rehabilitation. This study was conducted alongside the above trial.

Methods

TWIST was a pragmatic multi-centre RCT with blinded outcome assessment, incorporating a qualitative study and health economics analysis. The primary outcome of the RCT was change in affected arm function at six weeks follow-up in the intervention and control groups using the Action Research Arm Test (ARAT). Secondary outcomes included occupation performance and quality of life. Following baseline assessments 240 participants were randomized to either the intervention group, who were instructed in use of Wii™, or the control group, who were instructed in tailored arm exercises. The Wii™ games for the intervention group included bowling, tennis, golf, boxing and baseball. All participants in the intervention group had to be able to independently manipulate the Wii™ remote control to be included in the RCT. Caregivers could provide support with set up of the television, Wii™ console and navigation of the menus. Both groups were encouraged to exercise at home in a seated position for up to 45 minutes daily for six weeks in addition to usual therapy. All participants were encouraged to record the duration of daily exercise. The participants were followed up at six weeks and six months.

The experiences and perceptions of people using the Wii™ after stroke, and their caregivers, was explored in the qualitative study. This approach allowed more in-depth exploration of the subject area than through a quantitative approach and methods of the qualitative study are detailed below.

Access

The first 19 participants allocated to the RCT intervention group were identified by the RCT therapist from seven participating centres in the Southwest of the UK. The intervention arm required participants to use the Wii™ for six weeks, as well as usual care. When the participants were first recruited to the trial, the Participant Information
Sheet contained information about the qualitative study. At the end of the intervention the trial therapists gave participants and caregivers a new information sheet describing the qualitative study. Inclusion criteria were: ability to take part in semi-structured interviews, aged 18 or over and have the ability to give informed consent. Owing to slow recruitment and, therefore, time constraints, consecutive convenience sampling was used in this study. Participants were contacted by the qualitative researcher (DT) up to three weeks after the Wii™ had been removed from their home. Following any questions they were invited to take part in the study. Participants were offered the choice of being interviewed either at home or in a research clinic within four weeks and were all interviewed by DT.

**Procedures**

After informed consent procedures, participants and their partners/caregivers took part in a face-to-face semi-structured interview using a topic guide. Topics included the experience of the stroke, expectations of the Wii™ on recovery, experience of the Wii™, barriers and facilitators of using the Wii™, and the experience of home-based rehabilitation (see Table 1). The guide was used flexibly to allow the participants to express their own thoughts about the Wii™ intervention. All interviews were conducted in the home and lasted between 27 and 90 minutes, mean duration of 46 minutes.

**Data analysis**

All interview recordings were transcribed verbatim and analysed using NVivo 9 computer software informed by thematic analysis by DT. Thematic analysis is a six-step process, allows flexibility and can potentially provide a rich and detailed, yet complex, account of data. Transcripts were read several times to familiarise the researcher with the data. Using QRS NVivo 9, the researcher developed ‘codes’, which are words or short phrases that served as descriptive or interpretive labels for sections of data. From the codes, the researcher searched for themes, which showed patterns across the data and were related to the research questions. The themes were refined as data was compared across the transcripts and an explanation sought for the experiences of the participants.

The study was led by an experienced qualitative researcher (JW) who was previously a nurse in a stroke rehabilitation setting. The qualitative researcher who conducted the interviews and the primary analysis had a non-healthcare background. Both were educated to higher degree level, including qualitative research. Both were independent of the clinical team caring for the participants. Both were familiar with the Wii™, but open minded about the effect on this study population.

The qualitative researcher (DT) undertook the primary analysis, however for trustworthiness and to ensure no key themes were missed, the qualitative study lead researcher (JW) independently analysed a sub-set of six transcripts. Both researchers kept a reflexive diary to account for methodical decisions and/or to reflect on their own values and how they were influencing the data collection and analysis. The researchers met regularly to refine the themes through regular discussions. Initial emerging themes indicated that the feedback from the Wii™ may be a significant facilitator and that some games were more popular than others. These were explored in subsequent interviews and further discussion of the data. There were no major differences between the researchers, and both qualitative researchers agreed the final themes.

At the end of the study, participants were informed of the results, but were not approached to comment on the analysis as there was already a considerable burden on them to take part in the ongoing trial as well as the qualitative study.

**Ethics**

The study was approved by the South Central Portsmouth NHS Research Ethics Committee (REC11/SC/0405).

**Results**

A total of 19 trial participants were invited to take part in the study. One participant was excluded as the interview could not be arranged within the
protocol of interviewing within a three-week period. Participants commenced the Wii-based intervention within six months following their stroke. The mean time across the participant group for starting the Wii™ intervention after the date of their stroke was ten weeks. A total of 18 participants were interviewed between April and August 2012 from all participating centres.

The participants ranged from age 35 to 84 years, with a median age of 65 years. Seven were female and 11 were male; all participants and caregivers were Caucasian (see Table 2 for sample characteristics). Stroke severity was measured using the modified Rankin Scale (MRS)\(^2\), arm strength was measured using the Medical Research Council Scale (MRC)\(^2\) and arm function was measured using the ARAT (see Table 2 for results). These measures indicate that most participants had slight or moderate impairment following their stroke, and participants had some functional use of their arm at the time of enrolment into the study. The 10 caregivers who were present at the interviews were two females and eight males. Most caregivers were the spouses of
the participants, apart from two participants; one was supported by a neighbour, while the other was supported by parents. Half of the caregivers were retired.

Over the course of the qualitative study, participants and their caregivers shared many experiences of stroke and subsequent treatment including their hospital stay. These experiences provided us with context to assist understanding their experience and acceptability of using the Wii™. For the purposes of this article, we only present themes relating to the experience and acceptability of using the Wii™.

Five key themes emerged as being integral to the use of the Wii™ computer game as a rehabilitation tool in a home setting. We discuss the themes below, with supporting participant and caregiver quotes. The order of themes does not imply prioritisation in terms of importance. The themes were selected for relevance to the study.

**Diligence of play**

Most participants reported using the Wii™ for at least five weeks in total, while only two participants played it for less than three weeks. The participants appreciated the opportunity of home-based rehabilitation as the flexibility of when to complete their exercises enabled continuation of social activities or attendance at health-related appointments. Some participants preferred the privacy of their own home, as it was more relaxing and they did not want to use the Wii™ in front of other people.

A few of the participants reported that sometimes they did not feel able to use the Wii™ at certain times of the day, perhaps because they felt too tired or owing to the effects of medication.

Well, I suppose in a way, it’s easier to do it at home, cos, one, you can do it when it suits you and, obviously, two, because I can’t drive at the moment, it’s getting to wherever if you had to go into hospital to do it. (Female participant, 54)

Social factors influenced the use of the Wii™, such as friends visiting or staying over, but a few participants carried on playing even if they did have visitors. Some participants were not able to play as they were away from home, although one participant did circumvent this by taking the Wii™ with them.

The set period of time (six weeks) appeared to motivate participants to play the Wii™ regularly. Most participants viewed the Wii™ intervention as a specific stage in the rehabilitation process, and once the six weeks had finished felt it was time to move onto other activities.

Cos you (caregiver) said, ‘I’ll go & buy you one (a Wii™)’, and I said, ‘No, no, no’. It was awful in one way it was going but, in another way, because I was getting better, um, it didn’t make me go and sit in a chair ...I kept trying do little bits round the house, didn’t I? (Female participant, 54)
A few participants were affected by physical difficulties caused by stroke or comorbidities and weighted up the benefits of playing Wii™, against the perceived costs to health.

I would measure my blood pressure before and after [playing the Wii™] and it would go up…I just thought it was too, too high…and I just thought, ‘Well, it’s just not worth it’. (Male participant, 40)

A small minority of participants were more enthusiastic about doing other more functional activities for their rehabilitation.

Doing my dusting and my polishing and things like that, I am, probably look around now and see a cobweb! (Laughs)…is giving me more satisfaction than sitting down playing that [Wii™]. (Female participant, 66)

**Perceived effectiveness of the Wii™**

Most participants and their caregivers expected that the Wii™ would improve their arm function. The majority of participants perceived that by the end of the intervention period their physical and/or mental condition had improved.

[The Wii™] helped hand-to-eye co-ordination…and, improved the strength on this side so it’s a lot better than it was. (Female participant, 53)

A few participants had difficulty operating and manipulating the hand-held remote control. Until they mastered the control, there was frustration at a relative lack of success. There were also times when the Wii™ did not appear to respond as expected, they thought that the game was ‘rigged’.

But I found that, with the golf, sometimes the computer [Wii™] would decide that you were going into the sand or going out and there’s nothing you can do about it. (Male participant, 73)

In contrast, many participants liked the fact that they received instant feedback in scores and used them to gauge their improvement.

I knew when I got higher [scores], ‘I am getting better’, cos I’m getting better at that, so I must be getting better movement. (Female participant, 54)

Playing the Wii™ was felt to also help improve mental well-being. This seemed especially true of participants who lived more isolated lives.

…I was feeling emotional after the…stroke, um, because I wasn’t well enough to do anything round the house… but that [the Wii™] just perked me up and made me feel useful. I think I would’ve gone quite down in the dumps, actually, just sitting in a chair. (Female participant, 54)

**Acceptability of the Wii™**

Most participants had no previous experience of the Wii™. The novelty factor of using the Wii™ influenced the acceptability and appeal of this form of rehabilitation. Often, traditional exercises were associated with more negative connotations.

…but I think the fact that being something different and being interactive is the main motivator with it actually, than just exercising. (Female caregiver, 60s)

Many of the participants seemed motivated to play the Wii™, as they liked the competitive element of the games. Participants wanted to exceed a previous score or ‘beat the machine’, as some participants described it, and this spurred them on. A minority of participants felt they had become obsessed in this way and played longer than the allotted 45 minutes per day. Most participants also felt the audio and visual aspects of the Wii™ provided positive feedback and encouragement, and made playing the games more fun.

… It was nice because you had the sound effects when you hit the golf ball, you know, ‘whack’, when you hit the thing…when you got onto the fairway, whatever, and the crowd would go, ‘Ooh, nice hole’ or, ‘Nice approach’ (laughs). (Female participant, 53)

It’s one of these things I’ve got to do, my Wii, so I did it, …, I enjoyed it. (Male participant, 80).
Some thought the visuals of the Wii™ made it look more like a child’s game and less appealing and/or they just found them generally annoying. A small minority did have more negative views of computer games throughout the whole six weeks.

The most popular game in the early stages was bowling, as participants found it was one of the easiest of the five games to understand and play.

To start with, the bowling was my favourite, I think, because it was fairly straightforward and it wasn’t too arduous. (Female participant, 53)

After a while, bowling was seen as bit ‘easy’ and less of a ‘challenge’ and so it became a bit ‘boring’. A small minority also reported pain in their arm and/or shoulder after bowling. The participants reported their hand would make contact with the side of the chair while bowling. No injuries however were reported using the game.

Most participants played tennis and it was the single favourite game in later weeks as they liked the ‘reactive’ nature of the game and the challenge of responding to a ball. It was seen as a more vigorous game and those participants who played tennis perceived that it improved effective movement, reflexes and co-ordination in their arm and shoulder.

…best score in tennis, when I thrashed the pants off all three games, thought, ‘blinking heck’, you know. That was when I noticed that the hand-to-eye thing was getting’ much better. (Female participant, 53)

Golf was the second or third choice game. Participants appreciated the mental ‘thinking’ aspect of the game, for example taking account of factors such as the wind direction and speed. Also, playing at one’s own pace and the lack of stress was appealing.

I actually enjoyed the golf, actually…almost Zen like, I would say, sort of, therapeutic, you know (laughs). (Female participant, 53)

The least popular games of the Wii™ were baseball and boxing. Baseball was very hard to play as it required precise hand-to-eye co-ordination, which could lead to frustration. Boxing’s lack of popularity seemed to rest on participants’ dislike of boxing in general and may be a cultural phenomenon.

Caregiver and social support

The caregiver’s involvement with the Wii™ intervention varied and often they tended to be more actively engaged where the participant was physically less able to do things. The caregiving activities included, for example, putting a chair in the right place, preparing the television for play, monitoring the participant by staying in the room in which they were playing or coming in to check on them every so often and offering encouragement. As the six weeks progressed, the caregiver became less involved and completed other household or personal activities.

It was good, really good because he was busy and I was watching and especially from the beginning because everything was no good. But when he was getting better and better, it was like, ‘I don’t need you anymore’ (laughs). (Female caregiver, 50s)

The degree of involvement of the caregiver depended on whether they were ‘allowed’, intentionally or otherwise, to be included in the intervention by the participant. Some participants seem to have taken ownership and responsibility for the rehabilitation and did not want support.

I was quite adamant that I did it on my [own], I did it when I wanted to do it…So no; there was no prompting or nothing like that. (Male participant, 84)

A minority of caregivers were simply not interested in computer games or knew little about them and so left using the Wii™ to the participant.

Setting up and administration of the Nintendo Wii™ intervention

Overall, most of the participants felt that the set-up visit had been instructive and the therapist had been helpful and friendly.
...good to have a demonstration on how to use it as well, so I said to (name of therapist), ‘Ooh, once you’ve gone…I won’t remember how to do this tomorrow’, but he repeated it enough times while I was there for me to get the grasp of it, so I didn’t have to go reading the instructions. (Female participant, 53)

However, a minority of participants reported that they felt some practical issues regarding the Wii™ had not been covered sufficiently. During this study, many of the therapists themselves were also learning about the Wii™ for the first time and were inexperienced regarding the set-up and instruction.

The weekly phone call by the administrator provided reassurance and advice to the participant and caregiver. The phone call seemed to play a bigger role in the intervention period for those who were house-bound or spent a significant proportion of the time on their own. It provided a form of company and a link with the ‘outside world’.

…it’s nice that, to know that people are interested. That is terribly important, cos, you know, we’re sort of like on an island here…you don’t go out, you can’t go out. (Female caregiver, 80s)

Discussion

This qualitative study investigated unsupervised use of the Wii™ in a home setting and suggests that it is acceptable to stroke survivors and their caregivers in our study population. This is the first qualitative study that we are aware of that reports experiences of using Wii™ in a home-based setting for patients following stroke in the UK.

The perceived benefits to participants were enjoyment, improved arm function, flexibility of the intervention and being able to play the Wii™ at home, enjoyment of this rehabilitation tool and for some there was an added degree of competitiveness, even though they were playing the game alone. Barriers identified included a preference for functional rehabilitation tasks, belief that the games were more childish and belief that the risk to blood pressure outweighed any perceived benefits.

Limitations of the study include using consecutive convenience sampling rather than purposive sampling as originally planned owing to slow recruitment to the RCT and the resulting time constraint on the qualitative study. This means that the participants in the qualitative study may not reflect those of the main trial and limits generalisability. In addition, the trial criteria at the time of the qualitative study included only participants with dominant arm weakness, this also limits generalisability as participants with non-dominant arm weakness may report different experiences not identified in this study. Further research is required to investigate use of Wii™ in stroke survivors with non-dominant arm weakness and those from ethnic minority groups. A further limitation is that within the trial there was no reliable method of measuring adherence of using the Wii™ in a home-based setting and, therefore, we are suggesting rather than proving acceptability. Participants of the RCT reported the use of Wii™ in their daily diary. Preliminary results of the diary show the daily median time participants exercised in the intervention group was 37 minutes (range 4–108 minutes) and in the control group 32 minutes (range 4–63 minutes).

Interviewing participants and caregivers together provided some useful insights into the participant–caregiver relationship. However, it may have been of further value to have interviewed the caregivers separately, as they may have been more forthcoming regarding negative experiences and caregiver burden.

This study found that, overall, the most popular games were bowling and tennis, and the least favoured were baseball and boxing. Some of the Wii™ games are more challenging as they require accurate and fast responses (e.g. baseball). Other researchers are addressing this problem by tailoring Wii™-based rehabilitation for each participant depending on their skills level 25 and developing computer-based rehabilitation tailored to stroke patients’ needs (Wii STAR ISRCTN42229581). Future research should investigate whether more intensive support in home settings, e.g. therapist present or observing the patient through a secure audio-visual web-based system, improves participant’s satisfaction.

Our results support findings of previous studies of positive engagement and motivation using
the Wii™ in rehabilitation. Similar to other studies, we found that, for the majority of our participants, the auditory and visual feedback was engaging and fun. Contrary to a previous study, Laver et al., who aimed to determine the acceptability of Wii Fit™ as a therapy tool for hospitalised older people, found that older participants preferred using more traditional approaches to therapy; our study enjoyed the Wii Sports™ games. One explanation may be that our study population was playing at home and used a different game set aimed at arm rather than leg rehabilitation. Similar to the Danish qualitative study by Celinder et al., we found our participants enjoyed using the Wii™ and engaged with this rehabilitation tool. They found that Wii™ broke up the boredom of hospitalisation, was challenging and most participants wanted to play again. Similar to Joo et al., we found that some participants had difficulties manipulating the control owing to distal limb weakness.

Most participants commented that the Wii™ not only improved their physical wellbeing, but also had a positive effect on their mental wellbeing. This seemed particularly evident in participants who were socially more isolated. This finding warrants further research in stroke as part of the rehabilitation process; this was not studied in the RCT.

The study found that caregivers had a role in offering support and encouragement to the stroke survivor in using the Wii™ and no caregiver reported that this role was onerous during the rehabilitation period. This may be because the study population included mildly to moderately impaired stroke survivors. Social support has, however, previously been identified as important in post-stroke recovery and community-based exercise programmes.

All the participants and their caregivers were unanimous in their preference for carrying out this type of rehabilitation in their homes. This was perceived to have provided a more flexible and less stressful environment, and enabled the participants to fit their rehabilitation in with their day-to-day lives and they were able to accommodate their responsibilities, social activities and other medical appointments. Furthermore, stroke survivors and their caregivers took ownership of their rehabilitation, especially where the Wii™ was perceived as improving arm function.

This study was nested within the clinical trial, because in the UK use of the Wii™ is not part of NICE recommended routine clinical practice for stroke patients. Participants, therefore, could only be recruited who are taking part in a clinical trial using the Wii™.

In conclusion, we found in this group of participants that the Wii™ was an acceptable and enjoyable form of arm rehabilitation requiring little caregiver support. As computer games were new to most of the participants, the instruction and guidance provided by the therapists and administrators was essential. Stroke survivors want responsive services enabling them to continue to work towards independence and to improve self-management. RCTs are required to establish the effectiveness of the Wii™ as a rehabilitation tool.

Clinical messages
- People with arm weakness after stroke who use a Wii™ at home reported wanting to use it owing to: perceived effectiveness due to instant feedback; interest in and acceptability of most games; and caregiver engagement.
- Negative features mentioned included perceived child-like nature of games and lack of interest in some games.

Supplementary information
Anonymised transcripts can be made available from the corresponding author.

Contributors
KA initiated the study. JW, CP, CS and KA designed the study. KA and JW monitored study progress. DT and JW completed data collection. DT and JW undertook the analysis. All authors contributed to writing the article. KA is
the guarantor taking responsibility for the accuracy and honesty of the report and the morality of the study.

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Conflict of interest

None declared.

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