**FINAL REPORT**

**Title:** A feasibility study of exergaming to increase physical activity for mental health service users in a community mental health care setting

**Authors:**
Seren Haf Roberts
Jois Bailey

**Corresponding author:**
Dr Seren Haf Roberts

Address:
School of Healthcare Sciences
Bangor University
Cambrian House, Archimedes
Wrexham Technology Park
Wrexham
Ll13 7YP

Email: Seren.roberts@bangor.ac.uk
Tel: 01248383929

**Abstract**

**Background**: people with severe and enduring mental illness have an increased risk of obesity, developing metabolic syndrome and diabetes, attributed mainly to lifestyle issues. Interventions that target lifestyle have been tried and tested to offset some of these risk with mixed results. Exercise is an important part of keeping healthy and facilitating activity to help maintain or improve health for those using psychotropic medication is an area of considerable research.

**Aim/s**: This observational study explored whether access to gaming technology' referred to as exergaming', in community mental health care setting enable mental health service users to increase their physically active thereby improving their overall health and wellbeing.

**Methods**: An observational study was carried. An XBox Kinect with a variety of games were made available to mental health service users, their carers (including support workers), in a community Mental Health Team. Usage was monitored and field notes were recorded. In addition, 5 participants agreed to take part in a specific sub-study which involved taking anthropomorphic measurements (weight, height, waist circumference, and blood pressure), fitness test (1 minute fitness test and short walking test), and complete short questionnaires about their physical activity and mood at baseline and after 6 months of using the XBox Kinect. One =participant agreed to a semi-structured interview to explore their experiences of using the Xbox Kinect and about whether this type of exergaming would be useful to mental health service users.

**Results:**

Twenty one mental health service users engaged with intervention at least once, with 14 (66.7%) using the console more than once. Six participants agreed to take part the sub-study and completed the baseline measures. However, only 1 participant completed the 6 month follow-up and the semi-structured interview.

Key themes emerging from the observational field notes were around support (peer and staff support); opportunity and accessibility; self-monitoring of progress; perceived benefits. Themes emerging from interview data were related including the benefits; motivators; barriers; delivery of the intervention.

**Conclusion:**

The study highlights the value, acceptability and feasibility of open access exergaming in the context of community mental health services. Providing such an intervention has the potential to increase physical activity for mental health service users leading to additional physical health benefits such as reduce weight and BMI.

**Introduction/Background**

People with mental health problems, especially people with severe and enduring mental illness are disadvantaged in terms of their physical health than the general population with higher rates of morbidity and mortality (2000, Harris and Barraclough, 1998). This has partially been attributed to unhealthy lifestyles such as poor diets (McCreadie, 2003), lack of physical activity (Brown et al., 1999), higher rates of smoking (Ziedonis et al., 2003), and substance use (Kamali et al., 2000, Frisher et al., 2004) are observed in this population. Much research examines behavioural interventions (Happell et al., 2012), psychoeducation/health promotion interventions (Bonfioli et al. 2012) and exercise interventions (Rosenbaum et al., 2014) to improve the physical health of people with mental illness.

Exergaming, where new generation gaming consoles for health benefit (Laikari, 2009; Sween et al., 2014) have become an increasingly popular method to increase physical activity in both children and adults (Daley, 2009, Graf et al., 2009, Barkley and Penko, 2009, Lanningham-Foster et al., 2009). Energy expenditure is shown to increase with exergaming (Bailey and McInnis, 2011). Gaming consoles are also acceptable for older adults with improved quality of life, reduced depressive symptoms and empowerment (Klompstra et al., 2014) as well as increased social interaction, happiness and health (Theng et al., 2009) as potential benefits for this population. Clinical applications of these consoles have also been explored for example for rehabilitation after stoke (Leder et al., 2008, Brown et al., 2009), improved cognition (Anderson-Hanley et al., 2012), Parkinson's Disease rehabilitation (Barry et al., 2014), balance training (van Diest et al., 2013), repetitive behaviours in autism (Anderson-Hanley, et al., 2011), and for clinical assessments (Clark et al., 2010). Mental health benefits have also been explored across the lifespan (Jenssen, 2016; Li et al, 2016). There is growing evidence of gaming for health and its utility within healthcare (Kato, 2010). Few studies have explored the physical and mental health benefits of exergaming with mental health service users.

Identified barriers to physical activity in community-based patients with schizophrenia include limited experience of physical activity engagement, impact of the illness and effects of medication, effects of anxiety, and the influence of support networks (Johnstone et al., 2009). Similar findings are reported by Roberts and Bailey (2011; 2014) looking at the incentives and barriers to lifestyle intervention for people with severe mental illness.

Thus, whilst physical activity can maintain and even improve health, engaging people with mental health problems in physical activity can be challenging. A qualitative study (Roberts and Bailey, 2014) which explored the views of participants about an educational intervention found that services users wanted to do more physical activity within the intervention and group context. With these findings in mind, this study was designed to explore the application and acceptability of exergaming to increase physical activity for mental health service users and their carers or support workers within the community mental health setting.

**Aim**

This study aims to demonstrate the feasibility of open access exergaming for mental health services users in a community mental health care setting to increase physical activity.

**Objectives**

The key objectives are:

- To determine the uptake of exergaming amongst users of mental health services, their carers and support workers
- To explore possible health and social benefits of exergaming for this mental health services, their carers and support workers
- To qualitatively explore user's experience and acceptability of accessing exergaming within community mental health care setting

**Design**

This study was an observational prospective feasibility study. Qualitative and quantitative methods were used.

An X-Box Kinect gaming console was used for this study. The console was available within a community mental health care setting with open access for two full days per week to service users and their carers or support workers. This console requires no controllers minimising likely injury or damage and the gaming sensor detects full body movement without the need for any equipment. A range of physically interactive games were available to suit a range of abilities and fitness levels. Clear warm up and cool down instructions were provided as well as advice on overexertion and injury.

Observation

As a feasibility study, use of the console was monitored and the physical and social activity around the console were observed and recorded. All individuals who use the console were invited to participate in a sub-study to record more detailed quantitative and qualitative data. Use of the console was not restricted to those participating in the study.

An ethnographic approach (Hammersley and Atkinson, 1995) underpinned the qualitative elements. Observation and, with consenting participants, semi-structured interviews were undertaken. A trained research assistant facilitated access to the console, observed and monitored activities in and around the console and kept field notes for a period of 12 months. The nine dimensions of observation (Spradley, 1990) underpinned the observation. Observation was overt and made known to all console users. Consent was not required for this aspect of the study.

Sub-study- Quantitative measures and qualitative interviews

A sub-study was undertaken with consenting participants. This involved 30 minute one-to-one semi structured interviews and quantitative data collection at a convenient time and location.  In addition to demographic data, physical health measurements including: weight, blood pressure, heart rate, Body Mass Index (BMI), and waist circumference were recorded at baseline and 6 months to identify changes in health status. Four self-rated questionnaires were also administered. These are the Hospital Anxiety and Depression Scale (HADS), Short Form 12v2, Rosenberg Self-Esteem Scale (RSES – Rosenberg, 1965) and International Physical Activity Questionnaire (short form) together with a specifically designed satisfaction questionnaire. The latter was administered at 6 months only to establish participants' overall satisfaction and to identify the most and least liked aspect of the intervention.

A 1-minute fitness test (Strassman et al., 2013) and an 8 feet walking test (Jette et al., 1999) were also undertaken at each time point.

*Recruitment*
Posters about the console availability were disseminated to all community and inpatient mental health teams in the area along with an invitation letter to inform them of the study and ask if they would bring the study to the attention of their service users, carers and support workers. The poster invited interested service users, carers or support workers to contact the research team. Distribution was staggered over time to gauge likely response and allow management of the demand if required. A study information sheets was sent and an induction meeting arranged with anyone making contact with the team. At the induction meeting a member of the research team oriented the individual to the equipment, give a demonstration of the console, and provided safety information about the equipment, safe exercising and injury prevention. The study and sub-study was discussed at this meeting with an open discussion about the observation which will be undertaken regardless of whether they consent to participant in the sub-study. Written consent was for those wishing to take part in the sub-study.

*Sample*
The console was open to all mental health service users and their carers (including support workers) in the local area.

*Data management*
Participant identifying information was only be accessible to the research team. All data were link-anonymised so that no patient identifying information was kept with raw research data. Qualitative interview data was digitally audio recorded and transcribed. Recordings and notes were kept confidential and held securely by the research team. All data about the console users who do not consent to participate in the sub-study were anonymised.

*Analysis*
As a feasibility study, the uptake of the resource was of primary interest. Qualitative and quantitative analysis of the observational field notes were undertaken. Quantitative analysis related to attendance and use of the console. Qualitative analysis related to observed changes in behaviour over the period of use of the console, undertaken jointly by both authors.

Quantitative data analysis of health measurements were limited with only 1 participant completing the 6 month follow up as part of the sub study. Thus, descriptive analysis only was carried out on quantitative data.

Only one participant completed the interview. The qualitative interview data were analysed using a thematic analysis approach which involved a series of reading the interview transcript to get a sense of the data and an initial coding undertaken. Repeated reading and coding were undertaken by the lead author and verified by the second author. Once the key themes were agreed, the themes were described and summarized and quotes selected.

Ethical approval
Ethical approval was obtained from an NHS Ethics Committee and approval was granted by the Local Health Board Research and Development Board.

**Result**
Twenty one individuals engaged with Xbox at least once. Six mental health service users agreed to take part the sub-study and completed the baseline measures. However, only 1 participant completed the 6 month follow-up and the semi-structured interview. The remaining 5 were lost to follow up: One participant moved out of area, one withdrew and three did not attend repeated appointments. No carers participated in the sub-study.  All participants of the sub-study were aged 18 years or over, able to consent to participate and able to complete the research assessments. Baseline demographics and health measurements are seen in table 1.

Table 1 Baseline demographics and health measurements

| Demographic characteristics | N |
|---|---|
| *Diagnosis* | |
|     Schizophrenia | *4* |
|     Bipolar affective disorder | *1* |
|     Personality disorder | *1* |
| *Gender* | |
|     Female | 4 |
|     Male | 2 |
| *Marital status* | |
| Single | 6 |
| *Ethnicity* | |
| White British | 6 |
| *Smoking status* | |
|     Non smoker | *3* |
|     Smoker | *3* |
| *Alcohol Consumption* | |
|     No alcohol | 5 |
|     1-7 units per week | 1 |
| | |
| *Employment status* | |
|     permanently sick /disabled | 5 |
|     temporarily sick /disabled | 1 |
| **Health measurements (Mean)** | |
| *Weight* | |
|     Kgs (range) | 115.4 (68.6 - 156) |
|     Lbs (range) | 254.4 (151.2 - 344) |
| *Mean BMI* (range) | *37.6 (25.2 – 46.8)* |
| *BP* (range) | |
| Systolic | 121 (111 – 134) |
| Diastolic | 85   (77 – 98) |
| *Waist cm* (range) | 46.8   (32-65) |
| *Heart rate* (range) | 100 (89 – 115) |
| *Baseline HADS (range)* | *24 (13 – 29)** |

*Missing data for 1 participant*

Follow up data were recorded for one participant and over the time frame recorded a weight loss of 9.3kg (22lbs); reduced BMI from 41.7 to 38.5; reduced BP of 121/89 to 113/81; reduced heart rate of 89 to 74. No follow up waist measurement was recorded. This service user accessed the console most with 42 sessions attended.

The HADS score increased from 13 to 16; more physical activity is reported in some of the IPQA questions with some missing data. The self-esteem measure and fitness measures were introduced after completion of the follow up for this participant and thus no data are available on these measures.

A specifically designed satisfaction form was completed by the participant at the end of the sub study and indicated a good degree of satisfaction overall. The participant agreed with all the statements except 1 in which the statement 'I prefer to use the Xbox Kinect by myself than with others' was rated 'neither agree/disagree' and reported 'playing on my own' as the thing s/he least liked about the intervention. In response to the three things most liked about the intervention, the participant reported 'it was free to use; I was guided throughout; I feel fitter'. The participant also reported 'choosing your own day and time' as a way to improve the intervention and suggested walking was a way to increase physical activity for mental health service users.

Observational field notes
Observational field notes were analysed. Fourteen (66.7%) of the 21 service users who used the console attended two or more times. Of these, 6 (43%) attended more often by themselves than with another person (μ=11 visits; range 2 – 36 visits); 2 (14%) service users attended twice by themselves and twice with another person; and the remaining 6 (43%) attended more often with another person (μ=6 visits; range 3 -8). Almost half of the services users (N=9; 43%) attended 5 sessions or more. Two service users were highly regular console users with one attending 42 sessions and another attending 22 sessions across the time frame.

For 14 prearranged sessions, 11 were DNAs, 1 cancelled with no reason given, 1 cancelled owing to repair contractors at home, and 1 was unwell.

The field notes highlight that a bowling game was the most popular game (recorded use = 40times) with a dancing game second (recorded use 17times). With more exposure, users became more confident to try other games, which would be introduced during the sessions.

Key themes emerged from the qualitative thematic analysis of the field notes shown in table 2.

Table 2 Themes from observational field notes analysis

| Themes | Subthemes |
|--------|-----------|
| Support | Encouragement and peer support<br>Staff support and involvement<br>Motivation |

| | Social networks |
|---|---|
| Opportunity and accessibility | Arranging access |
| | Pursuing other physical activity |
| | Preparedness |
| Self-monitoring of progress | Previous scores |
| | Others' scores |
| Perceived benefits | Enjoyment |
| | Confidence |
| | Getting out of the house |

*Support*

Several service user seemed to prefer to play with others and would often ask staff to participant in the games. Service users would encourage each other when playing together. One service user "gave encouragement to the others when they had their turn at bowling and all three gave each other a 'high five' when they scored a strike." (Field note transcript 63).

They would often ask staff to help set up the games even after repeated use. One service user was asked if another could join in her session and reported that "it was a good idea and found it better if she played the game with someone else." With both later stating that "they had enjoyed the session and the company of the other" (Field note transcript 41).

Service users particular enjoyed playing with staff and in doing so seemed to "interact well with staff and laughed when they missed" (Field note transcript 39).

Service users were more motivated to participate with others and were often reported to encourage each other. However, the service users also enjoyed the social context and would happily chat instead of engaging with the game without prompting by the facilitator. "Staff did have to encourage them to continue with the game after they had finished their drinks. All three were happy to continue talking rather than be interested in bowling" (Field note transcript 45).

Service users did seem to like support from staff reporting that they "enjoyed more with staff" (Field note transcript 35) and found it "less boring with staff" (Field note transcript 34). It seems that the activity within the context of the CMHT enabled a continued connection with staff and perhaps services that the service user found helpful.

*Opportunity and accessibility*

Most sessions were arranged by the service user in advance typically arranging a regular slot; although occasionally service users would turn up opportunistically. With more frequent use, service users came more prepared for the physical activity in appropriate clothing (tracksuits and trainers) and bringing drinks along (sometimes energy drinks) with them, although water was available at all times.

Some service users for the equipment difficult to use. "[Initials] found using the hand senor difficult and was not able to use the voice activation as she did not know what

songs were available" (Field note transcript 40). Some service users would engage for a single taster session but with inappropriate attire such as "casual clothes with a large coat" (Field note transcript 72) and finding it difficult to operate the console, did not seem to enjoy the experience.  However, others, particularly with more frequent use, would only require verbal prompting to set up the game and in some cases became confident enough to set up the game entirely independently.

*Self-monitoring of progress*
As well as compete against others, service users seemed to enjoy monitoring their own progress and would try to better their own scores. There was clear motivation to achieve personal best scores which seemed to uplift mood and bolster self-confidence. After clarifying the high score of the day, one participant stated that she had 'broken that score today I have got 230 I've had four strikes in a row" (Field note transcript 39).

*Perceived benefits*
Service users seemed to enjoy using the console and particularly enjoyed playing with others. Laughter was a commonly reported observation in the field notes suggesting that the service users seemed to enjoy the camaraderie, social support and encouragement from others. One service user stated "I really enjoyed that session" (Field note transcript 13).

Weight loss
Sense of achievement and confidence
One service user "laughed all the way through the dance and stated that was really good I enjoyed that" later reporting wanting to attend "on a regular basis as she found it fun and thought it would help with weight loss." (Field note transcript 40).

There was also a sense that the activity provided a structure and purpose by getting the service user "out of the house and gives him something to do in the morning" (Field note transcript 61).

The activity appeared to provide a therapeutic benefit, providing an opportunity to talk to staff, which seemed to help improve mood. One service user "opened up to staff while bowling about how she was feeling, [initials]'s mood began to lift during the game as staff spoke about possible solutions to her current difficulties"; later reporting "I feel a lot better now" (Field note transcript 77).

Overall, the field notes suggest that there are both physical, social and emotional benefits to engaging with the gaming console. The camaraderie, peer support and social context seem to increase the enjoyment element. Mood and motivational improvements were also observed and it is possible the service users felt reassured with an indirect but continued contact with the CMHT.

Qualitative interviews
Only one person completed the interview. Four main themes were identified from thematic analysis of the interview data: Benefits, motivators, barriers, and delivery (see table 3 for summary)

Table 3 Summary of themes

| Key themes | Summary descriptor |
|---|---|
| **Benefits** | Positive experience with perceived and actual benefits reported |
| **Motivators** | Motivator for participant to engage and how to motivate others to participate |
| **Barriers** | Barrier to participants' own engagement with the activity and barrier to others' engagement |
| **Delivery** | General set of the activity within the CMHT setting, opportunities for drop-in, staff involvement and playing against someone. |

*Benefits*
The benefits theme related to both the perceived and actual benefits as reported by the participant and was reported to be a positive experience. The participant reported that the activity provided a structure to his/her day/activities, helped to maintain relationships with services and staff and increased the likelihood of engaging with other activities such as wales. The participant also reported physical benefits in the form of feeling fitter and losing weight as well as mental health and psychological benefits such as relieving the mind and developing self-confidence.

'It gives you some structure to your day… keeping a relationship going with the staff here … I'd just say it motivates me to walk more… I thought it would make me fitter, which it has done… And just feeling better after doing it, I have more energy after each class I did of the X-Box… it also sort of relieves my mind, it takes my mind off other things, my problems and focuses it on something else… it's helped me with the weight loss, my confidence is improving in myself.'

*Motivators*
This theme related to the factor that motivated the participant to engage with the activity as factors perceived by the participant to motivate others in to engage. Encouragement from the staff, involving others including staff and regular weigh-ins were reported to be strong motivators for engagement with the activity. The participant suggested that 'word of mouth' would likely motivate others along with a drop-in basis for the activity in which people could play against other people.

'If you could play against someone… they normally weigh me sometimes after the X-Box and that motivates me as well… Just speaking to other people who have done it and can vouch for it… It's fun, fun, fun game, it keeps you fit, it motivates you, and I do feel better after I've done it, it gives me more energy for the day.'

*Barriers*
Barrier to the participants own engagement with the activity and the engagement with others were identified. The lack of staff support generally and in trying new games was considered a key barrier alongside staff expectations about level of engagement.

As noted by the participant, a key barrier is 'Probably having no support around. Sometimes it's tricky working out how to put the X-Box on and set the whole thing up, so you do need support with that, you do. It took me about ten minutes once. And I had an appointment afterwards so it was eating into that time… Perhaps the amount of time you have to spend on it. Yes, because for me, a good twenty minutes on it is enough sometimes' The participant reported that spending longer time on the activity was 'expected of you… sometimes, it gets a bit repetitive playing the same things that you like on it… playing bowls for an hour on your own, gets a bit boring'

*Delivery*
This theme related to issues related to the general set up of the activity within the CMHT which was viewed favourably. The activity was deemed to be easy to access with an appropriate choice of games. The participant reported maintaining her level of play with the games without changing the intensity or pushing to higher levels of the game. It was suggested that support from staff would enable service users to progress with the games.

Whilst the participant viewed the CMHT setting for the activity favourably 'I prefer here. One, because I know everyone here. So I know that I can ask for help at any given time … I think it's been set up well… and would continue to use it…', it was recognised that there were challenges 'I know it's very awkward trying to find the time for that room to be empty, just to use the X-Box, so you should be given time of day, sometimes I have other appointments…' and a drop-in opportunity was proposed. However, the participant also acknowledged as stated previously that the approach used offered structure to their 'I turn up at a set date and time and it's usually set up working for me, and I usually play against, on my own, you know, by myself.'

With regard to delivery, the idea of the drop-in approach to the activity alongside having increased staff presence, engagement and support were regarded by the participant to be important potential improvements. 'If you could play against someone… with someone though, which I prefer, to be with someone, otherwise, it can get a bit boring on your own.'


**Discussion**
This feasibility study set out to explore the value and utility of open access exergaming for mental health services users in a community mental health care setting to increase physical activity. Our observations suggest that there was good engagement with the activity overall. Many service users attended regularly to use console. One participant engaged fully with the activity for the duration of the study and completed all aspect of the sub-study, including the interview. For this participant, there were significant gains in terms of health measurements across the timeframe of the project. Other regular users seemed to engage well with the intervention, coming more prepared and getting increasingly confident in using the equipment.

Four key elements are of significant note from our qualitative findings; social support aspect, benefits of fun, enjoyment and confidence building aspect; motivation and self-monitoring; CMHT context for accessibility and the delivery of the intervention.

There was a clear and strong message from our data that indicated the important role of the social context of the intervention. The service users seemed to enjoy and more actively participate when others were also engaged and this included staff participation. The social element seemed to draw the service users to attend regularly. The fun element of the intervention was important in enabling service users to build their confidence and assess their progress in a subtle way, which also helped motivate them to regularly attend. This supports the findings of Meekes and Standmore (2017) in their study exploring motivational factors for older people in assisted living facilities exergaming, in which they found intrinsic motivation came from enjoyment and perceived physical and mental benefits.

The availability, accessibility and CMHT context was also important. Service users seemed to like attending the CMHT, perhaps because it was a familiar venue with familiar faces, a place where they may feel more comfortable. It may also provide the opportunity for them to maintain a link with the mental health services, which may be a reassuring and motivating factor.  There is limited research on mental health service users' preferences in relation to undertaking physical activity within the context of mental health services. However, previous work has shown the importance of the mental health professional's role in supporting health behaviours and lifestyle changes of their clients (Roberts and Bailey, 2011; Roberts and Bailey 2013).   Previous research has suggested that for the general population, promoting physical activity within primary care increased physical activity levels at 12 months (Orrow et al, 2012). However, mental health service users may benefit from more targeted physical activity promotion within the context of mental health services to maximise the possible benefit and engagement.

We have shown that exergaming within mental health services can engage service users to be more physically active. According to a literature review by Fleming et al (2017) it is important for research to demonstrate that exergaming interventions are engaging as well as being effective.  As previously noted, research has demonstrated the value of exergaming for physical and mental health benefits (Barcelos et al, 2015; Chao et al, 2015; Karahan et al, 2017; Jenssen, 2016; Li et al, 2016; Huang et al 2017). Our study demonstrated the value of exergaming for increasing physical activity of mental health service users specifically.

Our findings support the idea that increasing physical activity can feasibly fall under the auspices of mental health services. This is line with the Department of Health's action on improving physical activity levels as part of their wider programme for improving the physical health of people with mental health problems (DOH, 2016). Naylor et al (2016) provide a strong steer about integrating physical and mental health within care can be achieved through NHS support for specific areas to develop integrated approached to establish new models of care; that all health and care professionals take a 'whole person approach'; and that local authorities and health care providers work jointly to meet the physical and mental health needs of the population.  Whilst many policy and strategy documents emphasise the need for 'parity of esteem' and integration of physical and mental health within healthcare (British Medical Association, 2016; Department of Health, 2016, Naylor et al, 2016), there are few documents that offer practitioners the tools to realise these ambitions.

Our study provides evidence of the feasibility of, and a practical example of, how mental health services can facilitate physical activity for mental health service users.


**Limitations**

This study was a mixed methods study to explore feasibility of open access provision of exergaming in the community setting. The observational successfully demonstrated the value of the intervention. However, the quantitative element was not able to robustly demonstrate the effectiveness of the intervention in relation to health benefits due to insufficient sample. Recruitment and retention of participants was a key issue in limiting the representativeness of the sample. Also, the intervention was available in only one site, again limiting representativeness and generalisability. Strategies to improve recruitment and retention for future work is necessary. Future research should focus on demonstrating effectiveness of exergaming on all the key physical and mental health indicators for this population through a randomised controlled trial as well as examine the impact on physical activity engagement outside the intervention. It is also important to further explore through qualitative research, the role of mental health services in delivering exergaming to maximise engagement.

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