

Wearable Physical Activity and Sleep Tracker Based Healthy Lifestyle Intervention in Early Intervention Psychosis (EIP) Service: Patient Experiences

Chris Griffiths , Kate Walker, Chloe Leathlean

Innovation and Research Department, Northamptonshire Healthcare NHS Foundation Trust, Northampton, UK
Email: Chris.Griffiths@nhft.nhs.uk

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Abstract

Background: Physical activity, sleep, mental health, physical health, wellbeing, quality of life, cognition, and functioning in people who experience psychosis are interconnected factors. People experiencing psychosis are more likely to have low levels of physical activity, high levels of sedation, and sleep problems. **Intervention:** An eight-week intervention; including the provision of a Fitbit and its software apps, sleep hygiene and physical activity guidance information, as well as three discussion and feedback sessions with a clinician. **Participants:** Out of a sample of 31 using an early intervention psychosis (EIP) service who took part in the intervention, fifteen participants consented to be interviewed—9 (60%) males and 6 (40%) females, age range: 19 - 51 years, average age: 29 years. **Method:** In-depth interviews investigating patient experience of the intervention and its impact on sleep, exercise, and wellbeing were undertaken. Thematic analysis was applied to analyse the qualitative data and content analysis was used to analyse questions with a yes/no response. **Results:** Most of the participants actively used the Fitbit and its software apps to gain information, feedback, and set goals to make changes to their lifestyle and daily routines to improve quality of sleep, level of physical activity, and exercise. **Conclusion:** The intervention was reported to be beneficial, and it is relatively easy and low cost to implement and therefore could be offered by all EIP services. Furthermore, there is potential value for application in services for other psychiatric disorders, where there is often a need to promote healthy lifestyle, physical activity, and effective sleep.

Keywords

Psychosis, Sleep, Physical Activity, Physical Exercise, Health

1. Introduction

First episode or early psychosis is when a person experiences a combination of clinical symptoms, divided into “positive symptoms” (added experiences), including hallucinations (perception in the absence of any stimulus), delusions (fixed or falsely held beliefs), and “negative symptoms” (experience losses), including emotional apathy, lack of motivation, poverty of speech, cognitive deficits, social withdrawal and self-neglect [1]. The weighted average incidence of psychosis in England is 31.7 per 100,000 and psychotic disorders prevalence across all ages is 0.07% [2] [3]. A range of common mental health problems (including anxiety and depression) and coexisting substance misuse may also be present [4].

Experience of first episode psychosis occurs most commonly between late teens and late twenties [2]. In the UK, support and treatment is provided by an early intervention in psychosis (EIP) service as part of free at point of need National Health Service (NHS) [3]. People experiencing first episode psychosis commence a National Institute for Health and Care Excellence (NICE) recommended package of care and treatment within two weeks of referral [3].

Compared to the general population, levels of physical activity and exercise are lower and levels of sedation are higher in people who experience psychosis [5] [6]. These low levels of physical activity are linked to more depression symptoms, lower wellbeing, greater hopelessness, insomnia, lower quality of life, and physical health diseases, such as: cardio vascular disease (CVD), stroke, hypertension, osteoarthritis, diabetes, and chronic obstructive pulmonary disease (COPD) [7] [8]. The National Clinical Audit of Psychosis (NCAP; EIP spotlight 2018/19) identified that 46% of patients required intervention for weight gain or obesity [9]. Lack of physical activity and poor quality of sleep are contributory factors to the reduced life expectancy of people who experience severe mental illness such as psychosis and schizophrenia, with a weighted average of 14.5 years of potential life lost [10].

A person’s sense of wellbeing can be enhanced by regular physical activity; in addition, physical activity and doing physical exercise are preventive factors against at least 25 chronic medical conditions [7]. For people with experience of psychosis, engaging in physical exercise is associated with improved quality of life, cognition, functioning, physical health and reduced psychotic symptomatology [11]. To benefit physical and mental health, WHO recommends adults should do at least 150 - 300 minutes of moderate-intensity or at least 75 - 150 minutes of vigorous-intensity aerobic physical activity, or an equivalent combination, per week [12].

Daily night-time sleep duration outside of the recommended 7 to 9 hours increases risk for mortality, diabetes, cardiovascular disease, stroke, coronary heart disease, and obesity [13] [14]. Sleep disorders in people who experience psychosis are high (rates of 80% reported) and are linked to lifestyle factors and psychosis symptoms [15] [16]. Sleep hygiene advice and support for sleep problems

in psychosis may improve quality of sleep [15] [16]. Wearing and using the information provided by a wearable tracker such as a Fitbit can be helpful to increase physical activity, self-awareness of activity, motivation to engage in physical activity, and goal-setting/goal-achievement [17].

This study conducted in-depth interviews with patients in an EIP service who were taking part in an eight-week intervention that incorporated a Fitbit, exercise and sleep hygiene advice, as well as three engagement, feedback and discussion sessions with a member of clinical staff. The aim of this study was to understand peoples' experiences of sleep, physical activity, as well as the impact of the intervention on these experiences within the context of the management of psychotic symptoms. The study is undertaken to inform sleep, physical activity, and lifestyle interventions in psychosis services.

2. Methods

2.1. Methodology

The ontological and epistemological assumptions underpinning the methodology were constructivist and interpretivist. The analysis was approached from the perspective of understanding participants' subjective experience, and aligned with constructivism which acknowledges human reality is constructed through individuals' interactions and interpretations of the world and others [18]. Meanings therefore emerge from constructions (or reconstructions) of individuals' experiences of an empirical reality [19]. The resultant knowledge from the qualitative data is constructed by the interviewee and interviewer [20]. In interpretivism, social reality is interpreted by the meanings participants produce and reproduce [21], and interpretive research attempts to understand phenomena through accessing the meanings participants assign to them [22]. The methodology employed placed the onus on the participant's view of the situation [23].

2.2. Design

Semi structured interviews were conducted with 15 participants. Interview questions were informed by the research literature and with input of a person with lived experience of psychosis. Semi-structured interviews enabled the participants to share their experiences. All the data were analysed together.

2.3. Ethical Approval

Ethical approval was gained from United Kingdom's (UK) Health Research Authority (HRA); Research Ethics Committee (REC) reference: 21/EM/0047. All participants provided informed consent.

2.4. Recruitment and Participants

Participants were recruited from an NHS early intervention psychosis service. Forty participants were recruited as part of a mixed methodological project, 31 undertook the intervention. Fifteen participants from the full sample were re-

cruited for interview. For inclusion in the study, participants needed to be within the age of 18 to 65, a patient of the early psychosis service, based in the community and able to understand written and oral English. Any participants who for a medical reason could not wear a watch like device on their wrist, or who did not have the capacity to consent were excluded.

Sampling was non-probabilistic, accessible, and purposive to achieve a representative sample of 15 adults in terms of age, gender and ethnicity. The characteristics of the 15 participants are presented in **Table 1**.

2.5. Intervention

The eight-week intervention incorporated: a free to keep Fitbit (including instructions and set up), exercise and sleep hygiene advice sheets, as well as three patient engagement sessions with EIP clinical staff. Each engagement session offered support and encouragement; and facilitated a discussion regarding the use of the Fitbit, the application of exercise and sleep hygiene advice, as well as relevant feedback.

Table 1. Participants' characteristics.

	Age	Range: 18.7 - 50.7 <i>M</i> (<i>SD</i>): 28.83 (9.84)
Gender		<i>N</i> (%)
Male		9 (60)
Female		6 (40)
Ethnicity		
White British		6 (40.0)
White Irish		1 (6.6)
Bangladeshi		1 (6.6)
Mixed British		1 (6.6)
Gypsy/Romany		1 (6.6)
Other Asian Group		1 (6.6)
Other White Background		1 (6.6)
Black/African/Car Black British		1 (6.6)
Polish		1 (6.6)
Not stated		1 (6.6)
Diagnosis		
F29X Unspecified nonorganic psychosis		6 (40.0)
F302 Mania with psychotic symptoms		3 (20.0)
F239 Acute and transient psychotic disorders		1 (6.6)
F319 Bipolar Affective Disorder		1 (6.6)
F531 Mental and behavioural disorders associated with the puerperium		1 (6.6)
Depressive Disorder Moderate to Severe with Psychotic Symptoms		1 (6.6)
Drug induced psychosis		1 (6.6)
Unspecified nonorganic psychosis		1 (6.6)

2.6. Procedure

Informed written consent was obtained from all the participants. Two researchers working separately carried out one-to-one semi-structured interviews over the phone. A series of closed questions were initially asked regarding the functionality and usability of the Fitbit (e.g., did you have any problems wearing the Fitbit?); these responses were subjected to content analysis. The remainder of the interview was semi-structured, with questions relating to sleep, exercise, and well-being—as well as to participants' experiences of using the Fitbit. One participant (P12) spoke limited English and a translator was used to relay answers to the interviewer. All interviews were recorded, the length of the interviews ranged from 19.57 - 56.03 minutes ($M = 37.24$, $SD = 9.42$); interviews were transcribed verbatim.

2.7. Analysis

Reflexive thematic analysis (TA) was used to analyse the data [24] [25]. Reflexive TA is a systematic process of developing, analysing and interpreting patterns within a qualitative data set to establish a set of themes [24]. Thematic network analysis (TNA), a type of reflexive TA was utilised to develop basic, organising, and global themes [26]. The analytical process undertaken was aligned to six steps: 1) dataset familiarisation; 2) data coding; 3) initial theme generation; 4) theme development and review; 5) theme refining, defining and naming; and 6) writing up [25]. NVivo software v.12 was used to assist analysis. Initial codes were generated by two researchers (one recruited as an advisor with lived experience of psychosis) working independently. Themes were further categorised into subthemes by three researchers who collaborated to refine and relabel the finalised themes. To further strengthen the interpretation of the analysis, the research team discussed and reviewed the findings. To ensure trustworthiness of the data, guidance was followed to promote credibility, transferability, dependability, and confirmability [27]. Group analysis was undertaken, *i.e.* not split on gender.

3. Results

3.1. Content Analysis

Content analysis of responses regarding usability of the Fitbit, as well as sleep and exercise habits prior to using the Fitbit was undertaken. The numerical results and an illustrative quote are presented in **Table 2**.

Figure 1 presents a theme map of the use of the wearable physical activity and sleep tracker (Fitbit) and the interlink between exercise, sleep and wellbeing.

3.2. Use of the Fitbit

This organising theme collates the different ways in which the Fitbit was used in relation to participants' sleep and physical exercise. It is comprised of five sub-themes:

Table 2. Content analysis from interview data.

Questions	Yes N (%)	Example Comment	No N (%)	Example Comment
Did you have any problems wearing the Fitbit?	2 (13.3)	P10: <i>I did at first, because I sort of got, get a rash underneath my right arm.</i>	13 (86.7)	P1: <i>It was perfectly fine... I've just been using as a watch and a Fitbit.</i>
Did you wear it all the time?	10 (66.7)	P1: <i>Kept it on consistently</i>	5 (33.3)	P6: <i>Not at work. As I finished work, I put it on.</i>
Did you manage to keep it charged?	14 (93.3)	P8: <i>It's got a really decent battery life it charges up relatively quickly.</i>	1 (6.7)	P9: <i>It's not charged at the minute. It's remembering to plug it in.</i>
Did you use the information on the Fitbit display?	15 (100)	P15: <i>Mainly the steps, the distance just to see how far I've gone. The heart rate, your resting heart rate.</i>	0 (0)	
Did you access Fitbit apps?	11 (73.3)	P3: <i>I track my sleep. I have just started today, tracking my food intake again. I also go swimming three times a week, so I see how many lengths I've done.</i>	4 (26.7)	P9: <i>No, I didn't do anything like that. Because I did not know how to do, to use that.</i>
Before the Fitbit did you have problems:	8 (53.3)	P8: <i>I've always had somewhat an issue with getting to sleep. I've never been one to be able to fall asleep as shortly after my head hits the pillow.</i>	7 (46.7)	P10: <i>No. No, that's not something I ever suffer with.</i>
• Getting to sleep?				
• Waking up during the night?	7 (46.7)	P5: <i>Some weeks I will wake up in the night and struggle to go back to sleep.</i>	8 (53.3)	P10: <i>No, that's not really a problem for me.</i>
• Not getting enough night time sleep?	6 (40.0)	P4: <i>Sometimes maybe staying up too late. And not getting my full hours.</i>	9 (60.0)	P9: <i>No, the thing is with me, I do like my sleep. I like a good eight hours sleep I do.</i>
• Sleeping during the day (more than a single 15-minute nap)?	8 (53.3)	P11: <i>I was napping too much and having too many naps... because I was tired for some reason. Yeah, day-time napping.</i>	7 (46.7)	P1: <i>No, thankfully, I haven't been having any of the additional, like energy problems.</i>
Did you use the sleep hygiene information sheets?	3 (20.0)	P7: <i>Yes, I did. So that's how I learned that you should, you should try not to, nap more than 15 minutes during the day and try not to nap after 5 pm. And if you try not to drink too much water after 5 pm.</i>	12 (80)	P8: <i>I didn't I'm afraid. I'll be honest, I put the paperwork aside that day when I got home, and I don't even recall where I put it.</i>

Continued

Did you exercise before you had the Fitbit?	12 (80)	P4: <i>Well, like taking the dog out for a walk, maybe sometimes going for a run. I, I do martial arts as well.</i>	3 (20)	P7: <i>I rarely did any exercise as in before using the Fitbit, I stopped exercising for roughly a year.</i>
Did you use the physical activity advice sheets?	2 (13)	P3: <i>Yeah, a little bit. I just think it mentioned, regular exercise or something like that.</i>	13 (86)	P5: <i>I did not no, I think at the time it just didn't interest me.</i>



Figure 1. Theme map: Use of fitbit and intrinsic link between exercise, sleep and wellbeing.

- 1) To monitor physical health, body metrics, sleep and steps
The Fitbit was used to check and monitor a range of health, body, and exercise metrics data. More specifically the following physical metrics were monitored:

Weight

P3: *Like it, it's really good because, you can work out, what your calorie intake should be and then obviously, work out what you want it to be to lose a little bit of weight and then you can keep track of it;*

Diet

P5: *I also tried to eat healthier, like having fruit daily and stuff. It just made me a lot more aware and I could see what I had done and it also gives out reminders and stuff;*

Steps

P10: *You can use it to check your steps and see and monitor how much exercise you've done;*

Heartrate

P7: *It was just nice to be able to have constant check up on my heartrate... it was interesting to find out like... to see how fast it was beating and whether it was like good or not;*

Water intake

P11: *You update it, so every time I drink water I put it into like a log. So, I log it in to the Fitbit app and it says, "okay you've drunk this much water".*

Sleep

P8: *I found the display useful being able to track your sleep.*

2) To motivate and encourage to exercise

Using the Fitbit motivated and encouraged participants to engage in, do more, and/or sustain exercise.

P3: *I think it kind of makes you more motivated... It spurs you on to do that... keep on walking or keep on swimming. It encouraged and motivated me to make physical activity, more regular. It's just made me more motivated.*

The Fitbit gave a reminder to be physically active, and this encouraged physical activity.

P12: *He was just checking how many steps he did. And of course, when he did some kind of steps, he was always motivated a little bit to make more and all of that. And also, even when he didn't get enough steps, the watch just made him alert to do another 200 step you know.*

The Fitbit modified behaviour in relation to exercise, acting as a motivating factor on occasions when participants felt like they did not want to exercise.

P9: *It changes my behaviour to think it encourages me to do more. I think it does, definitely it does. I just keep on looking at me watch and keep walking. I try and then hit the steps target. The Fitbit can sometimes motivate me when I don't want to [Exercise].*

Part of the motivation and encouragement came from how participants used the Fitbit to set goals.

P7: *I think it helped me to keep, because one of my goals was to lose a bit of weight, and to maintain that weight loss. So, it helped me main, it helped me to, to keep track of the 10,000 steps, helped me to on that trajectory, really. So, it*

encouraged me in some ways to do more and achieve those goals.

Fitbit feedback and monitoring provided a sense of achievement; further motivating individuals to set and accomplish goals.

P4: *I've got this achievement in the App and, that I think that can sort of boost your mental health a little bit, that you know, you are doing stuff, you are being active. It helps my mental health because it's about the achievement and what I'm doing.*

P10: *I guess it's just kind of, it's interesting to be able to look at your stats and judge on that base and try and reach goals based on that. I would say it motivates me. I am trying to achieve something.*

3) Cognisance of physical activity

Participants used the Fitbit to gain awareness and insight of physical activity levels as well as keep a track record of accomplishments.

P2: *I was more conscious of my activity, my physical activity. More aware of it, more aware, the how much, doing, like so much physical activity.*

P6: *When you do the steps and you get, and then this, for some reason, sends a message to the app. And it says you achieve your goals. And you know, you've done this, you've done that. And it's quite, it's quite good to know that.*

P5: *But the steps, I didn't really—like it made me aware of how many steps I take and want to take more. I was more aware of it and wanting to do it because it would remind me.*

Another positive outcome of being cognisance of physical activity was that it provided participants with a deeper comprehension of their physical health, the positive impact of physical activity, and fostered confidence for self-management and control.

P7: *The amount of information shared a lot of the information about your activity levels means that you're constantly aware of your health. I am much more concerned about my health. Where I am health wise... it's made me feel more in control of my health as well.*

4) Cognisance of sleep and sleep patterns

This theme acknowledges the reassurance and awareness provided via Fitbit's sleep data insights.

P8: *I do see it as useful being able to track your sleep as well. I find it intriguing more than anything... and monitoring my sleep out of curiosity.*

P10: *It was just sheer curiosity and awareness about my sleep.*

P1: *It's been really good to have the Fitbit recording the sleep because you just get to know a little bit more about your patterns and stuff like that... it's not something that you'd normally be able to easily get data on.*

P7: *I think it's helped in terms of tracking how many hours of sleep I'm getting because when I look at the app, it tells me how many hours and it tells me what the, what the divided is, what the split is between REM, light sleep. Yeah, so REM, light sleep and deep sleep.*

P14: *There is the element of understanding how you have slept or being able*

to see how you've slept. Again, it's reassurance. I'm less agitated so is it this reassurance that helps me not be so agitated. It tells your mind that you had a good sleep so you're gonna have a good day as well.

5) Reminder, cue and prompt in order to get enough sleep

The Fitbit was a tool for the participants to achieve better sleep habits and to endeavour to get enough sleep each night. One Fitbit function used to achieve this was to set a reminder or prompt to go to bed at a reasonable time, thus facilitating an effective number of sleep hours.

P7: There's a prompt at 9.07. It tells me I need to get ready for bed. At 9.07 on the dot. So that's when it tells me to go to bed. Most of the time I follow the instruction.

P14: It acts as a reminder and happens and can mean that I go to bed earlier and try and get more sleep.

P15: It does give me notifications at 10, to go to sleep, which I do, I do follow sometimes.

Several participants used the Fitbit to assess quantity of sleep, and then adapted sleep behavior accordingly to ensure sufficient sleep was achieved the following night.

P3: When I can track and see how long I've actually slept, sometimes if I, if I have not had enough sleep that I know I need to go to bed a bit earlier the next day.

Both the ability to monitor sleep habits and enhanced awareness resulted in participants endeavouring to go to sleep at a reasonable time and get enough sleep.

P5: It was more awareness and like because I knew it was monitoring my sleep so my sleep schedule I would try to go to sleep at reasonable times and stuff like that and get a good fair amount of sleep.

4. Discussion

Participants from an early intervention psychosis (EIP) service were interviewed and provided information on the links between exercise, sleep, and wellbeing from their perspectives. They provided valuable insights about their experiences of an eight week intervention incorporating a Fitbit; sleep hygiene and exercise advice; as well as three engagement, feedback, and discussion sessions with clinical staff. Consistent with prior psychosis research, most of the sample experienced sleep problems [15] [16]. Within the intervention most participants actively used the Fitbit and its app to improve their quality of sleep, level of physical activity and exercise.

Based on feedback from Fitbit data and software app information participants adopted healthier lifestyle behaviours and daily routines to facilitate more effective sleep. These improvements in behaviour and self-management are connected to health and wellbeing benefits. They may lead to sustained improvement in sleep quality which can benefit mental and physical health in the long term [13] [14].

Furthermore, participants reported increased physical activity and exercise due to the use of the Fitbit and its software apps. It was found that Fitbit/app data and information reflecting objective feedback increased physical activity motivation and awareness. Due to links with physical and mental health, it is especially important in a psychosis population to undertake sufficient physical activity and exercise. The Fitbit facilitated a more active lifestyle promoting physical activity in daily/weekly routines; long term increased physical activity levels can potentially reduce daily adjusted life years (DALY) and improve life expectancy [7] [10] [11].

5. Limitations

A possible bias may be present, as interviews were only conducted with participants who agreed to be interviewed following the intervention. Thus, it is possible more participants with a positive experience of the intervention and those in a better mental health (e.g., experiencing fewer psychotic symptoms) agreed to interview. In addition, there was a relatively small sample size limiting generalisability. However, the sample size was deemed appropriate for an in-depth interview study, as saturation often occurs at around 12 - 15 participants in relatively homogeneous groups [28]. The present sample was a reasonably homogeneous group; although participants had various specific diagnoses related to psychosis and some had additional mental illness diagnosis—this is often the case in EIP service patients.

6. Conclusion

Any form of regular physical activity of sufficient intensity and duration can prevent many chronic medical conditions and is associated with improved cognition, functioning, and mental and physical health in people who experience symptoms of psychosis [7] [11] [12]. Effective night time sleep duration and quality can reduce risk for mortality, diabetes, cardiovascular disease, stroke, coronary heart disease, and obesity [13] [14]. People with experience of psychosis often have ineffective sleep and insufficient physical activity [5] [6] [15] [16], thus it is important for mental health services to offer interventions which can improve sleep duration and quality and levels of physical activity. EIP service patients benefit from the project's relatively simple and lowcost intervention; therefore, it is recommended for introduction to all EIP services. In addition, the intervention has the potential to be introduced to benefit a range of other mental health services supporting people with various psychiatric disorders.

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Declaration of Interests

No other authors have any conflicts of interest to declare.

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