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everything
Exercise Intelligence



Evaluation of the EXI mobile app in the Provision of Physical Activity to a Multidisciplinary Weight Management Clinic at St. Bartholomew's Hospital, London

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Summary

Aim:

The aim of this investigation is to evaluate the effectiveness of a digital exercise prescription tool (EXI) on a smartphone in engaging and providing an exercise programme to patients referred to a tier 4 obesity clinic.

Method:

This investigation took the form of a real world observational clinical study. The clinical team contacted eligible participants by phone (due to the coronavirus pandemic) during their usual consultations and discussed exercise and the EXI programme. A referral was made to a physiotherapist who contacted patients with a letter explaining the programme and scheduled in a 10-minute call to discuss. The participants downloaded EXI and entered their demographic, health and fitness data which was analysed by the EXI programme. EXI produced a digital personalised physical exercise plan lasting 12 weeks. Once on the programme, the physiotherapist would use the EXI data portal to assess each patient's progress and follow up with an SMS and occasionally a phone call every 2-4 weeks.

After 12 weeks, the user was referred back to the clinical team at Barts hospital with an update showing the patient's exercise level and health metrics. The patient could then continue to use EXI indefinitely, but without follow-up from the clinical team.

Patients:

n = 71, 20 male, 51 female, average age 43 years. Range of longterm conditions or co-morbidities.

Results:

Members of the Tier 4 obesity team initially discussed the benefits of exercise with their patients and introduced the EXI solution. 71 patients downloaded the EXI app and were provided with an automated, yet individualised activity programme. Of these people, 92.9% stayed engaged with the activity programme for 4 weeks, 69.0% stayed engaged for 6 weeks, 64.7% stayed engaged for 8 weeks and 56.3% stayed engaged for 12 weeks. The participants were able to increase their average step count at all time points when compared to baseline measures. Participants who recorded their health data demonstrated a weight reduction of 2.4kg and a waist circumference reduction of 4.4cm.

Some Key findings

Prescription Adherence

56.3%

 Over 12 Weeks

24%

More Steps

 At 12 Weeks

Highlights

The evaluation of the EXI app in a real world tier 4 obesity service demonstrates that it is an effective tool for prescribing an automated, yet personalised, graded physical activity programme, resulting in increased physical activity levels in patients with obesity.

Results also suggest that individuals using EXI, in combination with care provided by the multidisciplinary team within the obesity service, reduced their BMI and waist circumference.

Some Key findings

Patients:

2.4kg



Weight
reduction

4.4cm



Waist
reduction

About EXI

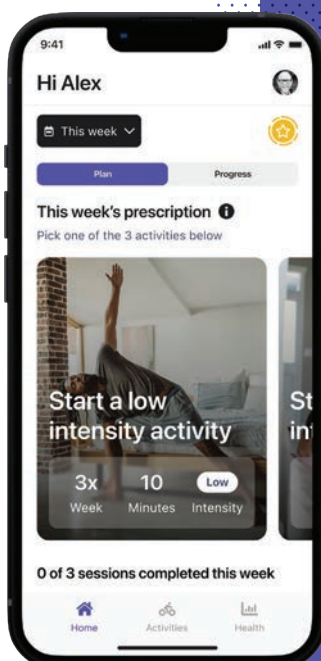
Brief Description

EXI is an evidence-based, NHS approved and award-winning app which analyses user health and fitness and prescribes a personalised physical activity programme. Set at exactly the right intensity for each person, the app will help users to safely and gently increase their activity levels and improve their health.

The user can specifically tailor their programme to any number of 23 physical and mental health conditions, such as diabetes, heart disease and depression, with all of the necessary safety features built-in. EXI follows the latest medical guidelines for exercise prescription. Each user is given an individualised goal for each week and is given the option of meeting this goal via either intensity-based minutes of exercise (e.g. 4 days of 15 minutes at low intensity) or step count which is tracked in the background via their smartphone (e.g. 4 days of 6,000 steps).

Activity and health outcome data is delivered directly back to health and fitness professionals in real-time to help inform and plan care, via the secure, penetration tested and GDPR compliant web-based data portal. The information provided includes weekly exercise time, percentage of goals completed, allowing the clinician to have an informed conversation with patients about their exercise programme.

EXI can help obesity services to provide a PA solution for all their patients in an efficient way that fits in to the patient's life. The EXI web portal improves accountability from the patient to the clinical team and allows the patient to demonstrate that they are compliant with the PA programme provided to them, which amongst other benefits, can potentially improve their access to bariatric surgery if indicated. This is unique in prescribed exercise solutions for this group.



Background Physical activity in people with obesity

People with overweight or obesity are defined by having a body mass index of 25-30 kg/m² and 30 kg/m²+ respectively with approximately 2/3 of the adult population in the UK (1) and USA (2) having excess weight or obesity. Obesity is also associated with many other adverse health conditions such as hypertension (3) (4), heart disease (5), diabetes (6), lower limb osteoarthritis (OA) especially of the knee (7), mental health problems (8) and some cancers (9) as well as social and economic deprivation (10) (11) (12) (13). People between the ages of 20-30 and who have a BMI > 45 kg/m² will have, on average, a reduced life span of 13 years for men and 8 years for women (14). The COVID-19 pandemic has also brought into sharp focus the relationship between obesity, especially when combined with reduced physical activity, and poor outcomes such as increased hospitalisation and mortality in COVID patients (15) (16). The annual medical costs of obesity is £6.1bn in the UK (2017 figures), £27bn in wider costs to society (17), and \$260bn in the USA (18), with the overall costs to society being many times greater.

Physical activity (PA) as part of a multidisciplinary team approach including nutrition and psychological support is considered to be a key component of obesity management in the healthcare setting. The NICE guidelines in the UK state that physical activity and a physical activity therapist should be provided to patients on Tier 3 and 4 weight management services (14). Other medical interventions that can be considered for people with obesity including pharmacological management

(such as orlistat) and bariatric surgery (17). It is also important that for patients to be considered for weight loss surgery, they should have been shown to consistently engage with the MDT plan set for them, including physical activity (14).

It has been shown in cross sectional studies that reduced levels of PA are associated with obesity (18) (19), with obesity being both a cause and consequence of reduced PA (20). PA interventions have been used to prevent weight gain, promote weight loss and maintain weight loss. The evidence suggests that there is a dose-response relationship between PA levels and weight management in all 3 of the above scenarios with < 150 min/week of moderate intensity PA being associated with minimal weight loss and between 200-300 min/week of moderate intensity PA having moderate weight loss (21).

“We all get stuck in a rut and lose the purpose of why we need to look after ourselves. I realised that I needed to look after myself, I wanted to live. The encouragement from Barts and EXI helped kickstart my journey.”

It may be difficult for people with obesity who don't reduce energy intake to reach the required levels of PA to reduce weight in a meaningful way. Therefore, the combination of PA and reduced energy intake maximises weight loss in people with obesity (22). A review of weight loss interventions found that programmes which combined diet and exercise resulted in 20% greater weight loss versus diet restriction alone (23); however, this effect is lost when energy intake is severely reduced (21). Exercise also changes the distribution of fat, by reducing the less healthy visceral (abdominal) fat – for some individuals, body weight may stay the same as muscle is built up but the reduction in visceral fat is highly beneficial for health (24).

“The app had been fantastic in encouraging me to take a moment from the busy day and go for a walk, or to do a quick 10 minute boost of exercise. It is also a great way to have a workout routine.”

Barts Hospital

Barts Hospital Tier 4 Bariatric Service

The Barts Hospital runs a busy multidisciplinary tier 4 bariatric service which manages severe and complex obesity patients (including obesity surgery, obesity medicine, specialist weight management programmes, post-surgical and annual follow up). Tier 4 services will offer more specialist and intensive input than tier 3 (14) and deal with the most complex of obesity patients.

The Barts tier 4 team consist of 2 obesity physicians, specialist registrar, dietician and obesity specialist nurse and a pathway coordinator, with the team seeing around 50 patients in total a week. Previous to the introduction of EXI, the service had no provision for formal exercise prescription.

The patients are mostly referred from primary care and are complex patients who need to have a BMI of at least 35 kg/m².



Method

This investigation took the form of a real world observational clinical study obesity.

The clinical team contacted eligible participants by phone (due to the coronavirus pandemic) during their usual consultations and discussed exercise and the EXI programme. A referral was then made via secure email to a physiotherapist who then made email contact with the patient with a letter explaining the programme and scheduled in a 10-minute call to discuss. The participants downloaded EXI and then entered their demographic, health and fitness data which was analysed by the EXI programme. EXI produced a digital personalised physical exercise plan lasting 12 weeks. Once on the programme, the physiotherapist would use the EXI data portal to assess each patient's progress and follow up with an SMS and occasionally a phone call every 2-4 weeks.

After 12 weeks, the user was referred back to the clinical team at Barts hospital with an update showing the patient's exercise level and health metrics. The patient could then continue to use EXI indefinitely, but without follow-up from the clinical team.

“Doing more exercise has made me feel so much better, Before EXI I couldn't run for 2 minutes, now I can up to 40 minutes which is amazing.”

Progress follow ups made easy



Assess a patients progress



A personalised approach to a digital exercise plan

Participants

The target population of this study were adults with obesity receiving care from the Barts Hospital tier 4 obesity clinic and 71 patients were recruited to the study.

Information on gender, age, BMI, waist circumference and co-morbidities was provided directly by the patient via the EXI app. Characteristics of the participants when they started the EXI programme are included in Table 1.

Gender	20 Male, 51 Female
Age (years)	43.99 +/- 12.57
BMI (kg/m ²)	44.56 +/- 10.51
Waist Circumference (WC) (cm)	119.27 +/- 14.96
Number of co-morbidities (CMs) reported *Note: Co-morbidities are self-reported	Mean = 1.66 (Range 0-7 co-morbidities)
Common co-morbidities *Note: Co-morbidities are self-reported	Depression, stress or anxiety (n=25), Hypertension (n = 24), Type 2 diabetes (n=16), Osteoarthritis (n=13), Asthma (n=11), Fibromyalgia (n=9), Hyperlipidaemia (n=7), COPD (n=5), Chronic Fatigue (n=4), Metabolic syndrome (n=2), Cardiovascular disease (n=2), Multiple sclerosis (n=1)

Table 1: Characteristics of participants when they started the EXI Programme.

Subjects (continued)

Inclusion criteria

- Adults under the care of the obesity clinic.
- ≥ 18 years.
- Able to engage with physical exercise.

Exclusion criteria

- Patients reporting functional mobility problems which mean they are unable to leave the house without assistance.
- People who don't have access to an Android (with Android OS 7.0 or above) or iOS smartphone (iPhone 4 or above).

“EXI is realistic to the fact that you may be unlikely to get down on the floor to exercise, so all the routines are achievable.”

A range of health metric data can be collected via the EXI app which are personalised dependent on the participant's health and goals. This information is collected initially during app onboarding and then every week during the programme. It is not a requirement that the patient has to complete this information. For the purposes of this evaluation, weight, BMI, waist circumference were monitored.

The primary outcome measure of this investigation is to determine engagement rates of the subjects with the EXI programme.

The following information was captured:

- The number of referrals to EXI from the obesity clinic.
- The number of participants agreeing to start the EXI programme (as defined by recording an activity in EXI).
- The number of participants completing 4, 6, 8 and 12 weeks of the EXI programme.
- The average percentage of weekly goals completed each week. As the EXI prescription is personalised to each subject, the goals differ for the subjects.
- The average number of weeks completed for all subjects who started the EXI programme (discounting those people who had started in the past 6 weeks who were still engaged with the programme) and the average number of weeks completed for those who have completed the 12-week programme.
- Change in average step count from baseline (taken from available data for the immediate 12 weeks before starting the EXI programme) to an average step count at 4, 6, 8 and 12 weeks.

Secondary outcome measures were weight, waist circumference and body composition (BMI) change from baseline to completion of the programme.

Outcomes and measures

Data analysis

Data analysis

Data were downloaded from the EXI web portal in csv form. This allowed the analysis of baseline and weekly exercise, health and engagement data for individual participants.

Data collected:

- Health conditions.
- Exercise goals and percentage of goals completed.
- Exercise minutes.
- Step count.
- Type of activity completed.
- Anthropometric data: height, weight, waist circumference.

Results

Excercise level and engagement

Over the period of the evaluation, 89 patients were referred to EXI from the tier 4 obesity clinic. After email and telephone contact with the participants, 71 participants accepted the offer and decided to use the EXI app, recording at least one activity or registered a step count. Table 2 summarises engagement at each of the four timepoints.

Week Number	Number engaged	Percentage engaged
Week 4	66	92.9%
Week 6	49	69%
Week 8	46	64.7%
Week 12	40	56.3%

Table 2: Subject's engagement with the EXI programme

On average, the percentage of weekly exercise goals completed for the subjects on the EXI programme was 54.6%.

The average time of exercise completed for those on the EXI programme was 11.8 weeks and those participants who completed the 12-week programme stayed engaged for an average of 18.2 weeks.

“For me as a professional, the information on the patients was really fascinating and a useful tool to identify the motivated, ambivalent or not ready to make a lifestyle change. What they say in the consultation and what they then do after enrolling in the programme is so useful to me, so I know which tactic I need to adopt when I next speak to them, whether that is putting on the brakes and working them up more or stepping on the gas for those in a determined place.”

Change in activity level

Average step count at baseline was compared to average step count in weeks 4, 6, 8 & 12. The results and percentage change are shown in Table 3 below.

	Average steps	Changed from baseline
Baseline	18350	0.0%
Week 4	22497	22.6%
Week 6	25703	40.1%
Week 8	24219	32.0%
Week 12	22775	24.1%

Table 3: Change in participant step count

As shown above, there is an increase in step count from baseline levels at all time points.

Health outcomes

Health metrics relevant to this study were reported by 13 participants. This showed a reduction of 2.4kg and a waist circumference reduction of 4.4cm.

Discussion

Results show that the majority of participants engaged in the programme at week 6 continued on to week 12. As research has indicated that on average new behaviours become habitual after 66 days (29), some additional intervention halfway through the programme would likely be beneficial, to encourage ongoing engagement.

EXI includes a number of features to support behaviour change, including prompts and cues, feedback and rewards via a bronze, silver and gold badge system.

Additionally, a personalised, graduated exercise programme at low to moderate intensity has been shown to be more sustainable than high intensity programmes in this group of patients (30). It has also been shown that exercise programmes that allow people to exercise at home in a way and at a time that suits them are more likely to

be successful than those in a more structured environment (31).

Average activity (as measured by step count) was 24.1% higher at week 12 of the EXI programme compared with baseline levels. There is robust evidence of a dose-response relationship between daily steps and health outcomes, indicating that those with higher steps are at less risk of cardiovascular disease and premature death (32). The change in activity levels for the 12 weeks of the EXI intervention, shows that EXI is able to achieve and sustain an increase in activity in this cohort of patients, potentially leading to significant health benefits.

The ability for clinicians to be able to view health and exercise data via the EXI portal allowed them to monitor and encourage patients to continue on their journey and review as necessary. It also had the effect of motivating the patient by allowing them to demonstrate



Discussion (Continued)

that they were engaging with the programme, which isn't possible in traditional care. This accountability is particularly valuable for those who are potentially seeking bariatric surgery as it can help for them to prove compliance with the MDT plan.

It is recommended that clinicians actively encourage patients to enter their health metrics into the EXI app. This would further facilitate discussion about the benefits of increased physical activity during consultations, as well as providing more insight into the patient benefits of using EXI.

Additionally, feedback from both the clinicians and patients showed that EXI was generally easy to use and provided an appropriate progressive programme for people who often have very low activity levels prior to the programme and negative views of physical activity / exercise.

Conclusion

Obesity, especially for people who have been referred to a tier 4 obesity service has been linked with many chronic health conditions, poor function and quality of life and early mortality. Physical activity is a key component of the multidisciplinary management of obesity to reduce weight and maintain weight loss. Just as important as PA's effect on weight management is the effect that it has in preventing and managing the associated co-morbidities.

This evaluation in a real world tier 4 obesity clinical site demonstrates that EXI is an effective tool for prescribing an automated, yet personalised physical activity programme to increase activity levels in people with obesity. Despite some limitations in collecting ongoing health data reported by the subjects, this evaluation has also demonstrated evidence that increasing physical activity levels translates to BMI and waist circumference reductions when combined with other interventions from the MDT at Barts hospital.



“My main motivation was I just wanted to live. I wanted and needed to make that change in order to live.”

Next Steps

Future research

Future research is required to conduct a formal clinical trial in this cohort of patients which will aim to collect more data independently of the EXI app to show changes in weight, changes in health metrics and attitudes to physical activity / exercise. Having a control group to compare results against would also be advantageous.

EXI will take the learning from this evaluation from both the patient and clinician side to help improve the EXI app to facilitate even more user engagement in this important cohort and to also encourage increased reporting of relevant health metrics.



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About EXI

EXI is an evidence-based, NHS approved and award-winning app which analyses user health and fitness and prescribes a personalised physical activity programme. EXI can help obesity services to provide a PA solution for all their patients in an efficient way that fits in to the patient's life. The EXI web portal improves accountability from the patient to the clinical team and allows the patient to demonstrate that they are compliant with the PA programme provided to them. This is unique in prescribed exercise solutions for this group.

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