

# EXI

ANYTHING IS EVERYTHING

**Determining the effectiveness of the 12-week EXi digital exercise prescription app in increasing physical activity levels in people who have a wide range of long-term medical conditions.**

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WHITE PAPER

# SUMMARY

## TITLE

Determining the effectiveness of the 12-week EXi digital exercise prescription app in increasing physical activity levels in people who have a wide range of long-term medical conditions.

## AIM

To determine the effectiveness of the 12-week EXi digital exercise prescription app in increasing physical activity levels in people who have a wide range of long-term medical conditions.

## COHORT

n = 100, 45 male, 55 female, average age 54 years. Range of long-term conditions or co-morbidities.

## METHODS

Subjects consented and downloaded the EXi app for free from the App Store. Face-to-face assessment with a physiotherapist in Week 0, and then at regular intervals (every 2 weeks) until week 12. Subject data was available for the clinical team to review, and reports could be sent directly from the app by the subject.

## PRIMARY OBJECTIVE MEASURES

Programme adherence/percentage of programme completed (level of weekly physical activity), classification of activity (sedentary, moderately active, highly active) change from baseline to completion, change in health data: Resting HR, weight/BMI, abdominal circumference, blood pressure, mood, 6MWT, fatigue, lung function, pain, joint stiffness, blood glucose level.

# BACKGROUND

## EVIDENCE BASE FOR EXERCISE

Prescribed physical activity is strongly recommended by the UK's National Institute for Health Care Excellence (NICE), the World Health Organisation (WHO) and the US Center for Disease Control and Prevention (CDC) as a key factor in the management of several chronic conditions (NICE guidance 2020).

## HEALTHCARE INDUSTRY - NCD'S

Health systems have unsustainable rising care demands and non-communicable diseases (NCD's) are one of the most significant global health crises of the time. Inactivity is one of the leading causes of chronic conditions and chronic conditions are at epidemic levels. At the same time, high cost drugs are being over-prescribed and low cost physical activity is being under-prescribed.

	UK - Annual cost	US - Annual
<b>Chronic Conditions</b>	£98bn (70%)	\$3.6tn (86%)
<b>Diabetes</b>	£7.8bn + £1bn on drugs (4.7m people and 90% reversible)	\$327bn (30.3m people) (8.4m people with pre-diabetes)
<b>Cardiovascular Disease</b>	£11bn (7m people) 50% access rehab, reduces risk 26%	\$326bn (121.5m people)
<b>Obesity / Overweight</b>	32m adults	125m adults
<b>Hypertension</b>	£2.1bn (13.5M people) 5.5m expected to be undiagnosed.	\$131bn
<b>Depression</b>	£8.6bn	\$44bn lost productivity. 19m adults experience major episode.
<b>Anxiety</b>	£10bn	40m adults

The evidence to prescribe physical activity is globally accepted. Yet 40% of UK adults and 76% of US adults are physically inactive [1,2]. Only a fraction of the NHS healthcare spend (£8bn) is on prevention/self-management strategies [3]

Compounding demand and impact, 60% of adults with a physical health condition will have a mental health condition [2]. Several research studies have demonstrated significant therapeutic effectiveness of exercise, superior to no-activity controls and comparable with established depression/anxiety treatments such as drugs and CBT [4,5].

There is little evidence for the effectiveness of mindfulness or meditation as a standalone treatment for mental health disorders [6,7].

## HEALTHCARE INDUSTRY - COST OF INACTIVITY

There has been little progress in improving physical activity levels globally between 2001 and 2016 and therefore it is unlikely if trends continue, the 2025 WHO global activity target of a 10% relative increase in activity will be met [2].

### **Sport England and Public Health England (PHE):**

- Estimates that physical inactivity costs the wider UK economy £7.4bn each year [8].
- Regular exercise can save between £1750 and £6900 in healthcare costs per person [8].
- Estimates that 1 in 4 premature deaths are caused by CVD, and 7m people in the UK have CVD. There is a direct cost of £11bn/year [1].
- Estimates that reduction of blood pressure will avert: <10k heart attacks, 14.5k strokes – potentially saving £274.2m [8].

### **The British Heart Foundation**

- Estimates that keeping physically active can reduce risk of early death by 30%, will reduce risk of coronary heart disease and stroke by as much as 35%.
- Inactivity contributes to almost 1 in 10 premature deaths from coronary heart disease and 1 in 6 deaths from any cause [1,9].

### **The World Heart Federation**

- Has estimated that the total global cost of CVD is set to rise from US\$863bn in 2010 to US\$1044bn in 2030; 55% in direct healthcare costs, 45% productivity losses [9].

### **Center for Disease Control and Prevention (USA)**

- Has estimated the direct cost of inactivity to be as high as US\$117bn in US healthcare costs alone [10].

### **International Journal of Cardiology**

- States Cardiac rehab (CR) was found to be available in only 50% of countries.
- Median cost to deliver traditional cardiac rehab to one person: Europe US\$1554.35, Americas US\$731.48, Africa US\$1598.30, Global US\$945.90 [11]

### The National Audit of Cardiac Rehabilitation

- In the UK, only 50% of patients will undergo cardiac rehab following a major cardiac event/cardiac surgery [12]. The target set by NHS England is to increase to 85% by 2028 [13].

## BRIEF DESCRIPTION OF EXI

### Carron Manning, Co-founder and Clinical Director

Carron is a Chartered Physiotherapist with 20 years of clinical experience in the NHS, private health and elite sport. She worked with senior Team GB athletes at the English Institute of Sport, travelling with the team to international competitions. Carron holds a Masters degree in Sport and Exercise medicine, alongside her BSc in Physiotherapy.



### Lewis Manning, Co-founder and Research Director

Lewis trained as a physiotherapist with a B.Physio at the University of Melbourne in Australia, he has 20 years of clinical experience in the UK, including 7 years in professional football, most recently worked at Arsenal FC in the English Premier League. He has a masters degree in Sport and Exercise Medicine from Queen Mary, University of London.



A clinician / health professional data management portal and a patient or end user facing application for a personalised and automated exercise prescription. Starting with a graduated 12 week programme, capturing data from a smartphone or a smart watch for guiding intensity at home, outdoors or in the gym. Annual licence model complimented by a 24 month rewards program for sustainable behaviour change.

### Making the complex simple with personalisation for 23 conditions:

Anxiety	Dementia	Obesity
Asthma	Diabetes (Type 1)	Osteoarthritis
Cancer	Diabetes (Type 2)	Osteoporosis
Cardiovascular disease	Fibromyalgia / chronic pain	Parkinson's disease
Chronic Fatigue	Hyperlipidemia	Peripheral arterial disease
COPD	Hypertension	Stress
COVID-19 rehabilitation	Metabolic syndrome	Stroke
Depression	Multiple sclerosis	

*\* can cater for multiple co-morbidities.*

- Automated prescription: low, moderate and high intensity.
- Personalised content and live feedback: HR and intensity.
- Clinically approved by the NHS and available on the NHS Apps Library.
- Winner of the GSK's global 'Transform the future of self-care' challenge.

# RESULTS

## STATISTICS

Percentage of programme completed: 88%

Average activity classification at start of programme:

Sedentary 60%, Moderately active 30%, Highly active 10%

Average activity classification at end of programme:

Sedentary 8%, Moderately active 76%, Highly active 16%

Multiple co-morbidities (e.g. diabetes, depression and hypertension, CVD and hyperlipidemia etc): 24

Cardiovascular disease:

(inc previous heart attack/myocardial infarction, coronary heart disease, heart failure): 5

Peripheral artery disease: 1

Stroke: 2

Hypertension: 15

Type 1 diabetes: 1

Type 2 diabetes: 9

Metabolic syndrome: 2

Hyperlipidemia: 2

Osteoarthritis: 7

Osteoporosis: 1

Cancer: 3

COPD: 2

Asthma: 1

Fibromyalgia: 2

Parkinson's disease: 3

Multiple Sclerosis: 2

Depression/Stress/Anxiety: 7

Dementia: 1

None: 10

Objective Measure	Start of Programme	End of Programme	Change
Average resting heart rate (BPM)	77.1	69.4	10% reduction
Average blood pressure (mmHg)	131/88	126/86	Systolic BP reduced 5.3 mmHg Diastolic BP reduced 2.1 mmHg
Average waist circumference	88.7	85.2	3.5cm reduction
Average BMI	27.9	27.2	2.5% improvement
Average 6-minute walk distance	605.55	669.47	63.92m further distance 10% improvement
Average mood score (VAS 0-10)	3.5/10	6/10	25% improvement
Average fatigue score (VAS 0-10)	7/10	5/10	20% improvement
Average blood glucose level (mmol/l)	7.9	6.7	18% reduction
Average pain score (VAS 0-10)	7/10	4.3/10	27% reduction
Joint stiffness score (VAS 0-10)	8/10	5/10	30% reduction
Lung function (PEF (l/min))	560	580	5% improvement

### Selection of subject responses (core objective measures HR, BP, abdom, BMI, 6-min walk)

Age	M/ F	Initial resting HR	Final resting HR	diff	Initial BP	Final BP	diff	Initial abdom circum	Final abdom circum	diff	Initial BMI	Final BMI	diff	6 min walk (m)	6 min walk (6 wks)	6 min walk (12 wks)
54	M	84	75	-9	130/85	126/82	-4/ -3	98	93	-5	31	30	-1	580	602	620
42	F	72	68	-4	119/75	117/75	-2/ 0	85	80	-5	28	28	0	755	760	780
39	F	69	63	-4	121/69	124/70	+3/ +1	74	74	0	23	23	0	DNF	DNF	DNF
68	F	87	82	-5	135/89	129/85	-6/ -4	90	86	-4	30	28	-2	420	425	465
62	M	76	67	-11	124/85	122/84	-2/ -1	95	89	-6	29	28	-1	675	672	701
55	M	72	70	-2	134/90	130/87	-4/ -3	86	84	-2	25	25	0	2	645	655
41	F	65	61	-4	115/68	116/67	+1/ -1	82	84	2	26	26	0	DNF	DNF	DNF
67	M	99	82	-17	144/92	136/90	-8/ -2	105	95	-10	32	30	-2	395	405	412
49	F	68	61	-7	122/78	120/80	-2/ +2	83	84	1	27	27	0	715	710	750
59	F	75	62	-13	135/92	130/88	-5/ -4	88	85	-3	28	27	-1	688	700	708

## Selection of subject responses (additional objective measures)

Medical conditions	Additional objective measures (1)	Change	Additional objective measures (2)	Change	% complete	Activity level at start and end (Sedentary, Mod act, High Act)	Subjective feedback on usability
Pre-hypertension					95	S to MA	Easily able to fit into everyday life.
Nil	Fatigue	5/10 to 7/10 (20%)			92	S to MA	More energetic at present.
Nil	Mood	4/10 to 6/10 (20%)			100	MA to HA	Found it easy to complete, enjoyed the home aerobics, would benefit from wider range of exercises.
Hypertension Type 2 diabetes	Blood sugars	7.6 mmol/l to 6.2 mmol/l (18%)			75	S to MA	Thought that it was quite easy at first, more challenging towards the end. Very pleased that feels taking more control of health and confident will continue to improve.
Osteoarthritis	Pain	7/10 to 4/10 (30%)	Joint stiffness	8/10 to 5/10 (30%)	95	S to MA	Enjoy walking, causes minimal knee pain yet was feeling less stiff in the mornings.
Pre-hypertension	Pain	6/10 to 4/10 (20%)			100	S to MA	Will continue programme until has hip surgery, has noticed good health effects especially for hip pain and stiffness
Depression	Mood	3/10 to 6/10 (30%)			65	S to MA	Enjoyed exercising outdoors, gave me purpose for going for a walk, will be better when weather improves as rainy days put off completing programme.
CVD Hypertension Type 2 diabetes	Blood sugars	8.2 mmol/l to 6.7 mmol/l (18%)	Fatigue	4/10 to 2/10 (20%)	90	S to MA	Extremely pleased with progress. Feel fitter and healthier with more energy. Determined to continue programme.
Fibromyalgia	Pain	8/10 to 5/10 (30%)	Fatigue	8/10 to 4/10 (40%)	100	S to MA	Definitely has had positive effect on health, pain and energy levels. Would like to incorporate more exercise programmes, especially at home.
Pre-hypertension Type 2 diabetes	Blood sugars	7.9 mmol/l to 7.1 mmol/l (10%)			95	S to MA	Very happy to see my blood sugars reduce, would like to see if I can reduce this further without having to increase my metformin.



# CONCLUSION

This clinical pilot study demonstrated that EXi was effective at increasing physical activity levels in people with a wide range of long-term medical conditions. Engagement was high with 88% completion rates and subjects reported a significant increase in activity classification from baseline to 12 weeks: 92% of subjects who completed the intervention were at least moderately active compared with just 40% at the start.

The pilot study also demonstrated that EXi is effective at improving a wide range of health metrics. Subject data showed an 18% reduction in blood glucose levels (mmol/L) over a 12-week period (average reduction from 7.9mmol/L to 6.7 mmol/L). We were also able to demonstrate improvements in: Resting heart rate (10% reduction), blood pressure (systolic BP decreased by 5.3 mmHg), abdominal circumference (reduced 3.5cm), BMI (reduced 2.5%), 6- minute walk test (10% improvement), and mood (25% improvement).

Ensuring that exercise is achievable and safe, at the correct intensity level, is an effective method to engage sedentary people in a physical activity programme. EXi analyses the user's current situation, including their health and current fitness level (also taking into account any co-existing disease morbidities) and prescribes a graduated and personalised exercise programme, which safely over 12 weeks help them to achieve the correct level of activity for their health and it is this level of intelligent personalisation which is effectively enabling people to take control of their health.

A personalised exercise prescription can and should be part of the overall management of patients with long term conditions. Our pilot study very much supports the use of EXi in these patients and this reflects guidance from the WHO, the UK Department of Health and every major healthcare system in the world that exercise should be recommended to people with chronic non-communicable diseases.

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