

Long Term Individual Fitness Enablement LIFE

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7 Scope

Long-term individual fitness enablement (LIFE) study

- Participation in regular exercise provides health and social benefits for all
- Adults with neurological conditions have low levels of participation in leisure time physical activities
- People with neurological conditions may receive limited and intermittent short-term support for exercise through therapy interventions funded from statutory NHS services, but their ongoing daily activity needs fall outside current models of exercise provision and support in the UK.
- The support of physical activity in community facilities available in most localities in the UK is an attractive relatively low cost option for attaining ongoing physical activity.

AIMS

PHASE I INVESTIGATIONS

- Aim1. To identify and explore the experiences, views and beliefs of people with neurological and neuromuscular disease regarding participation in physical activities and preferences for service delivery.
- Aim 3. To determine whether physical activity delivered with a physical activity provision support system (PASS) is feasible and able to change individual physiological and psycho/social variables?
- **Aim 2. To determine community mobility in individuals with a range of neurological conditions**

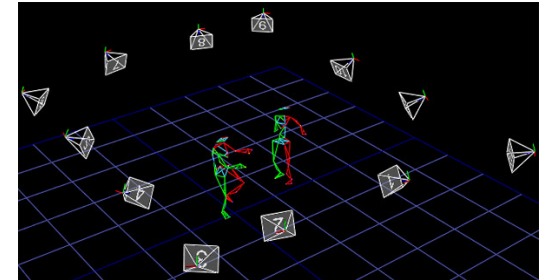
- PHASE II INVESTIGATIONS

- **Aim 4. To determine the need for a trial to determine whether a physical activity provision support system is effective and cost-effective in improving activity levels for neurological patients compared with waiting list control patients and to inform the design of such a trial.**

Temporospatial Gait Measurements

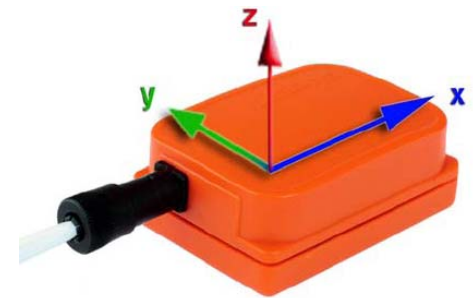
Optical motion camera system

- Relatively expensive and time consuming
- Restricted measurement volume
- Gold standard



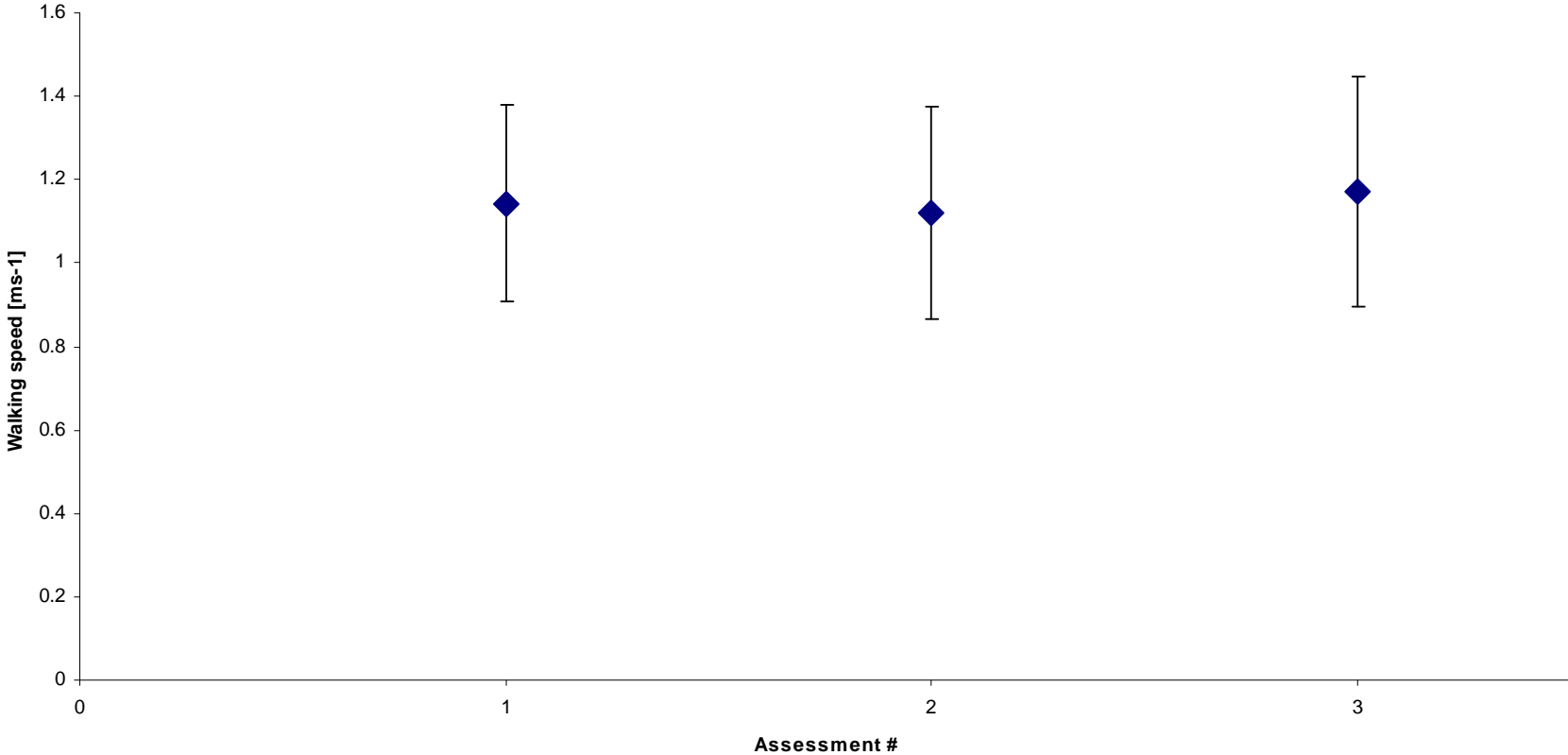
Our system is based on Accelerometry (IMU)

- Micro Electric-Mechanical System (MEMS)
 - Tri axial Accelerometer, Gyroscope, Magnetometer
- Lightweight (~30g)
- Wireless



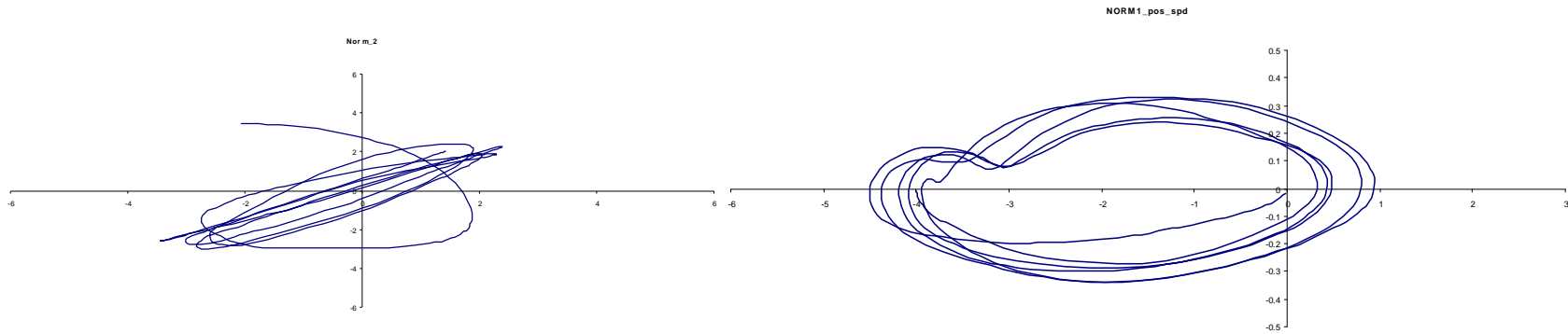
Community Mobility

Average walking speeds PD

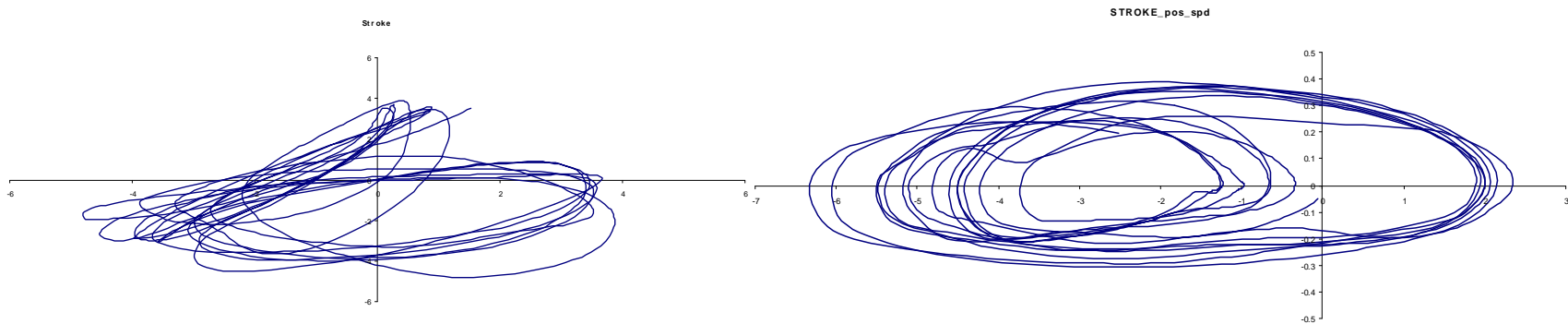


Pattern Recognition

- Non-linear analysis – Aged matched controls

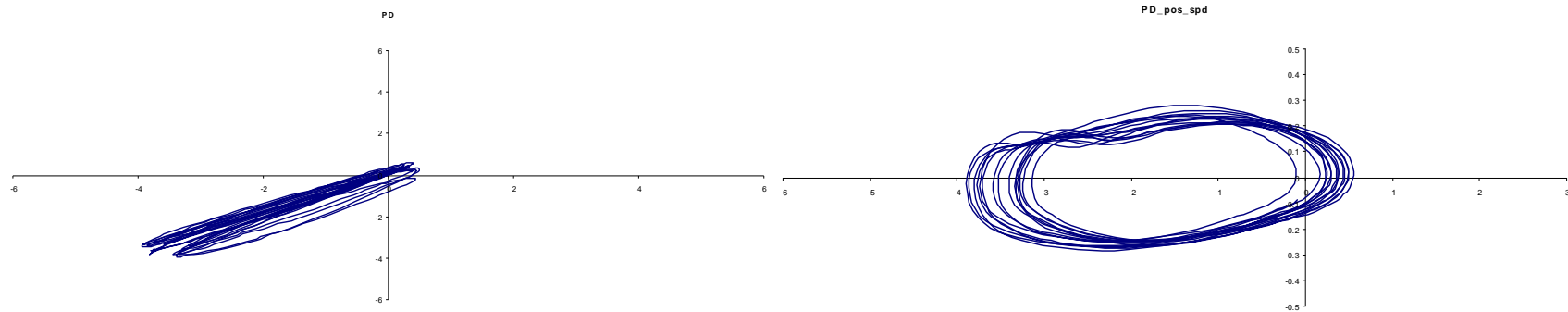


- Non-linear analysis – Stroke Victims

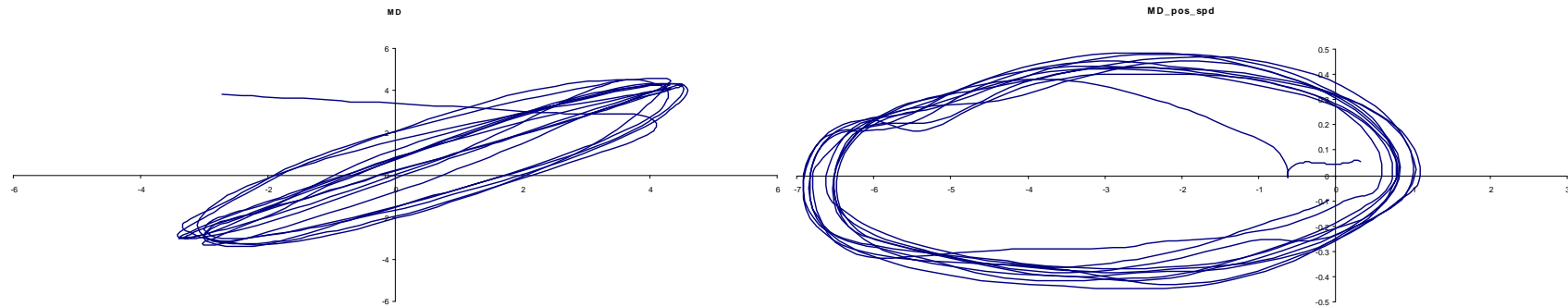


Pattern Recognition

- Non-linear analysis – Parkinson's Disease



- Non-linear analysis – Muscular Dystrophy



What do we have (to do)?

Quick, easy, valid & reliable method to monitor neurological conditions using gait parameters

Can be used to monitor progress during rehabilitation of patients
(i.e. Parkinson's Disease, Stroke, Multiple Sclerosis)

- Patent application → Applied for (GB0823374.4)
- Paper accepted by J Bmech → Volume 42(10); 2009
- Paper submitted to Gait&Posture
- Wellcome translation grant approved

Future aims:

- Develop a method to measure effort & 'smoothness' of movement
- Differentiate neurological pathologies based on gait
- Develop a complete clinical gait analysis tool

Phase II trial: Long-term individual fitness enablement (LIFE) study

LIFE Intervention- background

1. Theoretical framework for participation
2. Focus groups/questionnaires
3. Pilot single case evaluations of the developed physical activity support system
4. Content from current guidance

Physical Activity Support System - PASS

- **Inclusive Fitness Initiative (IFI) gym**
- **Fitness trainer (expertise in exercise in clinical populations)**
 - **Individually profile participant and prescribe exercise**
 - **Patient directed – self determined (components of fitness) i.e. strength, power, speed, endurance, flexibility, skill, CV training**
- **Physiotherapist – initial link – handling, medical issues ~ 5 sessions**
- **Physical Activity Booklet**

Travel Costs

Design: A single blinded phase II RCT with independent assessments

Primary outcome measure

- The self-report Physical Activity Scale for the Elderly (PASE).

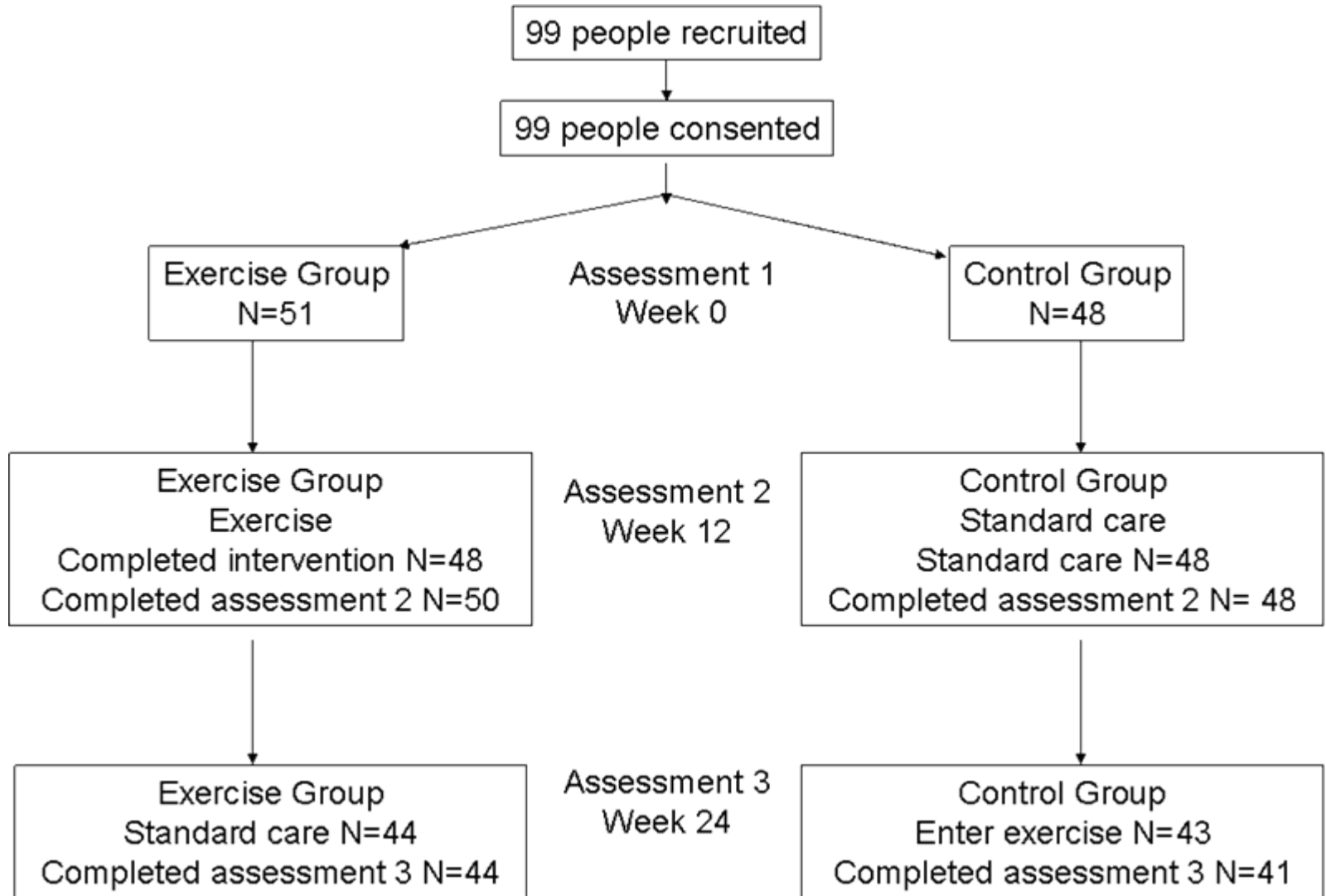
Secondary outcome measures

- Adherence
- Activity
- Body Function
- Health
- Wellbeing

Participants

Parkinson's Disease	39
Multiple Sclerosis	24
Motor Neurone Disease	7
Neuromuscular Disorders	19
Other Leigh's Syndrome Transverse Myelitis Polymyostasis Traumatic Brain Injury Transverse Myelitis Charcot Marie Tooth Spastic Paraparesis Idiopathic progressive spastic, cerebral palsy, paraparesis Mitochondrial Cytopathy	10

FLOW



Adverse Events

	Exercise	Control
Adverse	Two (3.9 %)	Three (6.25%)
Severe expected related adverse event (both cardiac related)	One (1.9 %)	One (2.1 %)

Six different fitness centres were included from Birmingham & Oxford

	Intervention group n= 48	
Gym attendances	14 (SD 9, range 0-39)	
First six weeks	eight sessions (SD 5, range 1-19)	
Second six weeks	six (SD 5, range 0-20)	
Number of people completing sessions over 12 weeks		
One or more	19	(44%)
Two or more	4	(8%)
Three or more	1	(2 %)

Change scores (Assessment 2-1) for the exercise and control group with between group independent T test = variance, one tailed and effect size data

Change scores Ass2- Ass1	Delayed Exercise (N=48)			Immediate Exercise (N=50)			P value	Effect size
	N	Mean	(SD)	N	Mean	(SD)		
BMI (kg/m ²)	41	-0.13	0.95	45	-0.15	0.95	0.45	-0.03
2 mins (m) distance	43	0.82	21.58	45	7.13	20.23	0.08	0.30
10m walk time (s)	36	0.04	3.29	41	-0.20	5.35	0.41	-0.06
Left Hand Grip (kg)	36	0.18	5.07	42	1.75	4.34	0.07	0.33
Right Hand Grip (kg)	36	0.90	5.39	42	1.35	4.35	0.69	0.09
Power - left (N)	25	10.23	47.53	29	27.38	47.20	0.10	0.36
Power - right (N)	18	12.64	39.35	25	14.43	40.14	0.44	0.05
Leg strength megascore	35	0.09	0.71	44	0.14	0.62	0.38	0.07

Effect size: calculated from change scores ($\mu_1 - \mu_2/s$) Cohen's criteria (Cohen: 0.1 - 0.3 = small effect, **0.3 - 0.5 = moderate effect**, > 0.5 = large difference effect)

Change scores (Assessment 2-1) for the exercise and control group with between group independent T test = variance, one tailed and effect size data

Change scores Ass2- Ass1	Delayed Exercise (N=48)			Immediate Exercise (N=50)			P value	Effect size
	N	Mean	(SD)	N	Mean	(SD)		
PASE social	35	15.08	32.57	44	11.61	29.16	0.31	-0.11
PASE home	35	9.34	42.26	43	-1.37	28.85	0.10	-0.30
PASE work	35	9.17	27.34	44	1.30	34.46	0.37	-0.25
PASE	46	25.43	62.23	49	11.12	48.11	0.11	-0.26
FSS	45	-0.15	0.91	50	-0.30	1.64	0.38	-0.12
SF-36: P component	33	0.66	8.79	42	4.12	9.31	0.05	0.38
SF-36: M component	33	1.10	11.95	42	0.86	12.10	0.47	-0.02
SAM	39	-377.87	1055.48	38	-218.63	1567.94	0.30	0.12

Effect size: calculated from change scores $(\mu_1 - \mu_2/s)$ Cohen's criteria (Cohen: 0.1 - 0.3 = small effect, **0.3 - 0.5 = moderate effect**, > 0.5 = large difference effect)

Discussion

- Participants adhered to the community exercise programme well, generally achieving 14 attendances over the 12 weeks and more than once a week in 55% of participants which compares favourably to primary care exercise referral schemes running in a subset of the exercise centres (42% completion of weekly twelve week scheme)
- We found that individuals did not increase their overall activity as measured by all activity measures in response to the additional exercise intervention. Possibly some individuals adapted to the scheme by reducing physical activity in other areas of their weekly routine as shown by a trend to reduce step counts.
- We found no significant change in outcome. However we observed moderate effect sizes in some markers of mobility and wellbeing.

Conclusions

- Certainly we found that community exercise supported in this way was well tolerated with only three dropouts during the exercise intervention
- This approach may offer a means of effectively enabling physical activity for people with LTNC that should now be evaluated in a Phase III trial.
- The ability of such a scheme to support activity in the longer term and the health and wellbeing benefits and costs need to be explored.

Baseline Characteristics

	Delayed Exercise (N=48)		Immediate Exercise (N=51)		p-value	Total (N=99)	
	N	Mean (SD)	N	Mean (SD)		N	Mean (SD)
Gender (male)	48	28 (58%)	51	23 (45%)	0.2	99	51 (52%)
Age (Years)	48	57 (12.31)	51	55 (13.43)	0.4	99	56 (12.88)
Barthel Index	48	19 (2.17)	51	19 (1.76)	0.8	99	18.57 (1.96)
Weight (kg)	47	80.9 (13.43)	50	78.4 (16.20)	0.4	97	79.6 (14.90)
Height (m)	48	1.7 (0.09)	51	1.7 (0.10)	0.4	99	1.7 (0.09)
BMI (kg/m ²)	47	27.3 (4.14)	50	26.7 (4.60)	0.5	97	27.0 (4.37)
Distance walked in 2 mins (m)	44	105.9 (46.87)	49	98.6 (48.71)	0.5	93	102.0 (47.73)
Time taken to walk 10m (s)	36	10.0 (4.92)	44	12.3 (9.10)	0.2	80	11.3 (7.56)
Left Hand Grip (kg)	36	29.7 (10.92)	45	25.0 (11.23)	0.06	81	27.1 (11.27)
Right Hand Grip (kg)	36	29.4 (12.08)	45	26.7 (12.51)	0.3	81	27.9 (12.32)
Power - left (N)	40	82.1 (69.3)	39	81.4 (57.22)	0.9	79	81.8 (63.22)
Power - right (N)	33	80.7 (80.2)	35	84.15(66.23)	0.9	68	82.5 (72.84)
Leg strength megascore	47	0.05 (0.63)	51	-0.02 (0.69)	0.6	98	0.01 (0.66)
PASE	48	88.2 (57.31)	50	96.3 (73.78)	0.5	98	92.3 (66.02)
FSS	46	4.4 (1.33)	51	4.4 (1.55)	0.9	97	4.4 (1.44)
SOMC	37	25.8 (3.39)	44	26.3 (2.56)	0.4	81	26.1 (2.97)
SF-36: Mental Component	35	50.5 (12.67)	43	51.4 (12.43)	0.8	78	50.9 (12.46)
SF-36: Physical Component	35	28.6 (11.13)	43	28.9 (11.56)	0.9	78	28.8 (11.30)
Falls (yes): median (range)	11	1 (1 – 5)	18	2 (1 – 9)	0.1	29	1 (1 – 9)
SAM	44	3051 (2347)	46	2827 (2129)	0.6	90	2936 (2229)

SF 36

Change scores Ass2- Ass1	Delayed Exercise (N=48)			Immediate Exercise (N=50)			P v a l u e	Effect siz e
	N	Mean	(SD)	N	Mean	(SD)		
SF-36: PF	35	-0.71	12.73	43	-0.70	19.96	0.50	0.00
SF-36: RP	36	3.47	37.39	44	17.61	34.35	0.04	0.39
SF-36: RE	36	5.56	42.54	44	-3.79	47.80	0.18	-0.21
SF-36: SF	35	-2.50	23.05	44	7.10	27.81	0.05	0.38
SF-36: MH	34	3.41	16.48	44	5.09	17.07	0.33	0.10
SF-36: EV	34	-0.88	20.36	44	3.86	18.10	0.14	0.25
SF-36: PA	35	0.36	22.58	44	5.40	24.32	0.18	0.21
SF-36: GHP	34	3.82	13.71	44	2.27	14.61	0.31	-0.11
SF-36: CH	36	-1.39	27.35	44	9.09	30.06	0.06	0.37
SF-36: P component	33	0.66	8.79	42	4.12	9.31	0.05	0.38
SF-36: M component	33	1.10	11.95	42	0.86	12.10	0.47	-0.02

Question 1. How important were the following factors to your ability to participate in the exercise intervention? Attitudes to each category of support reported as a percentage of total replies. ***n=26 responses***

	Very	Quite	Neither	Not very	Not at all
Parking	46.1	15.3	19.2	7.7	11.5
Access	50	38.5	7.7	3.8	0
Staff attitude	65.4	26.9	7.7	0	0
Equipment	46.2	50	0	3.8	0
Support of FP	50	41.7	4.2	0	4.2
Support of HP	33.3	45.8	16.7	0	4.2
People in gym	16	16	40	24	4
Travel costs	38.5	23.1	19.2	7.7	11.5

HP – health professional
 FP – fitness professional

Physiotherapist support sessions.

Face to face sessions

Distance sessions

	Number	Advice time (mins)	Support time (mins)	Number	Advice time (mins)
Average	3	27	33	3	12
SD	3	37	33	2	24
Min	1	1	1	0	0
Max	11	300	555	10	145