BMJ open

An evaluation of the efficacy of the exercise on referral scheme in Northumberland, UK: association with physical activity and predictors of engagement. A naturalistic observation study

Coral L Hanson,[1] Linda J Allin,[1] Jason G Ellis,[2] Caroline J Dodd-Reynolds[1]

To cite: Hanson CL, Allin LJ, Ellis JG, *et al*. An evaluation of the efficacy of the exercise on referral scheme in Northumberland, UK: association with physical activity and predictors of engagement. A naturalistic observation study. *BMJ Open* 2013;**3**:e002849. doi:10.1136/bmjopen-2013-002849

▸ Prepublication history for this paper is available online. To view these files please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2013-002849).

Received 8 March 2013
Revised 11 June 2013
Accepted 14 June 2013

[1]Department of Sport, Exercise and Rehabilitation, Faculty of Health and Life Sciences, University of Northumbria, Newcastle upon Tyne, UK
[2]Department of Psychology, Faculty of Health and Life Sciences, University of Northumbria, Newcastle upon Tyne, UK

Correspondence to
Coral L Hanson; coral.hanson@northumbria.ac.uk

ABSTRACT

Objectives: Exercise on referral schemes (ERS) are widely commissioned in the UK but there is little evidence of their association with physical activity levels. We sought to assess the Northumberland exercise on referral scheme in terms of increased levels of physical activity and identify predictors of engagement.

Design: A naturalistic observational study.

Setting: 9 local authority leisure sites in Northumberland.

Participants: 2233 patients referred from primary and secondary care between July 2009 and September 2010.

Intervention: A 24-week programme including motivational consultations and supervised exercise sessions for participants.

Outcome measures: Uptake, 12-week adherence, 24-week completion, changes in Godin Leisure-Time Exercise Questionnaire scores after 24-weeks and attendance levels at supervised exercise sessions during the scheme. Three binary logistic regressions were used to examine demographic and referral factors associated with initial uptake, 12-week adherence and 24-week completion.

Results: Uptake was 81% (n=1811), 12-week adherence was 53.5% (n=968) and 24-week completion was 42.9% (n=777). Participants who completed significantly increased their self-reported physical activity levels at 24-weeks t (638)=−11.55, p<0.001. Completers attended a mean of 22.87 (12.47 SD) of a target 48 supervised sessions. Increasing age, being female and leisure site were associated with uptake, increasing age, Index of Multiple Deprivation and leisure site were associated with 12-week adherence and Body Mass Index and leisure site were associated with 24-week completion. Each regression significantly increased the prediction accuracy of stage of exit (non-starters vs starters 81.5%, dropouts before 12 weeks vs 12-week adherers 66.9%, and dropouts between 13 and 24 weeks 82.2%).

ARTICLE SUMMARY

Article focus

- Exercise on referral schemes are widespread in the UK and are a popular way of promoting physical activity in primary care.
- There is evidence for an association between exercise on referral and short-term increase in physical activity, but weaker evidence for longer term physical activity maintenance.

Key messages

- We found evidence of significant changes in self-reported physical activity over a 6-month period for those who completed the scheme, but levels achieved were well below the UK recommendations for 150 min of moderate activity per week.
- Increasing age was a significant predictor of uptake of and adherence to exercise on referral schemes; while a prescheme BMI of 30+ kg/m^2 was a significant negative predictor of completion.

Strengths and limitations of this study

- The use of routinely collected scheme data provides a viable way of evaluating an intervention type that is already widespread but lacks evidence about effectiveness.
- The use of a self-reported physical activity questionnaire may have led to inaccuracies in quantifying increases in levels of physical activity.
- Although the study identified which participants successfully engaged with the scheme, it has not attempted to identify the reasons for engagement or non-engagement.
- The factors analysed only minimally increased prediction accuracy levels. This would indicate that there are other factors that have not been considered in this study that are associated with how long participants engage with the scheme.

Conclusions: Completers of the Northumberland ERS increased physical activity at 24 weeks, although the levels achieved were below the current UK guidelines of 150 min of moderate exercise per week. Leisure site was associated with uptake, adherence and completion.

INTRODUCTION

Regular physical activity is known to have a beneficial effect on the risk of coronary heart disease (CHD), stroke, and mortality from all causes.[1–3] However only 39% of men and 29% of women in England are sufficiently active to benefit their health.[4] Intervention in primary care is seen as key to increasing physical activity in those at risk of developing long-term health conditions and exercise on referral schemes (ERS), established during the 1990s, are a popular method of promoting such activity.[5] Schemes generally consist of a referral by a primary care health professional to a third party (usually a leisure facility), followed by a series of consultations with an exercise specialist, and a programme of supervised physical activity over a 10-week to 12-week period.[6] There is uncertainty about the efficacy of ERS in promoting medium to long-term physical activity behaviour change due to the short duration of programmes.[7] There has been one recent pragmatic randomised controlled trial (RCT) of ERS in Wales,[8] which found increased physical activity for those with CHD only. That said, it has been argued that evaluation of ERS by RCTs is not realistic given the number of established schemes in the UK.[9]

Many existing UK schemes are commissioned by the National Health Service; however, lack of evidence about effectiveness in increasing physical activity levels means it is unclear whether they represent an efficient use of resources.[10] A Health Technology Assessment in 2011[11] identified that for ERS cost per quality-adjusted life year could change markedly when scheme differences and cost inputs are taken into account, meaning that robust evidence on cost effectiveness could not be currently provided. To provide a clear assessment of value for money, there is a requirement for robust evaluations of existing programmes.

There have been a limited number of observational studies that have examined data from established schemes in England.[12–19] These studies have examined how many of those who were referred initially participated in the scheme (uptake)[12 14–16 19] and for how long individuals engaged with the scheme (adherence).[12 14 15 17 18] Levels of uptake were reported to be between 58% and 79% and adherence, between 34% and 57%. Moreover, a recent systematic review[20] found a pooled adherence level of 49% across observational studies. In addition to analysing levels of uptake and adherence, studies[12 14–17 19] have examined whether ERS is more successful for certain types of participants. There has been little consensus other than increasing age is a predictor of adherence.[12 14 15]

Although the primary aim of ERS is to increase physical activity, few studies have robustly reported on changes in physical activity as a result of participation. Dugdill *et al*[12] reported significant increases in self-reported physical activity but other studies have used attendance at consultations as a proxy measure of attendance at sessions. Some studies[17 21 22] have indicated participants achieved 80% of target attendance but did not define number of attendances required to achieve 'target attendance'. In a RCT of an ERS in Hailsham[23] completers on average attended 9 of 20 (45%) possible exercise sessions over a 10-week programme.

The present study was an evaluation of routinely collected data from an ERS in North East England (Northumberland), which had an intended primary outcome of increasing physical activity. This naturalistic observational study was designed to investigate whether engagement in scheme consultations (prescheme, after 12 weeks and postscheme after 24 weeks) (1) resulted in increased physical activity and (2) was predicted by factors relating to the referral.

METHOD

Anonymised data were extracted from a database compiled by scheme providers (provider 1 and 2) about referrals made between July 2009 and September 2010. Ethics approval was not sought; guidance from NHS National Research Ethics Service indicated that this was not required as the evaluation was considered to be a service audit of anonymised data.

Scheme structure

Referrals to the ERS could be made to nine local authority leisure sites in Northumberland by primary or secondary care professionals on a standardised form. The scheme was operated by provider 1 (sites B–F) and provider 2 (sites A and G–I). The scheme was newly established at site A, where it was implemented with shared learning from both providers. Scheme staff (employed by the leisure providers) held a minimum of a Register of Exercise Professionals (REPs) recognised level 3 exercise on referral qualification. Staff dealing with cardiac rehabilitation referrals held a REPs recognised level 4 cardiac rehabilitation qualification.

Demographic and other personal data (age, postcode, gender, employment status, primary and secondary reason for referral) were provided on the referral form. Where possible, information from missing data fields was requested by scheme staff at initial contact with referrals. All data were recorded in the scheme database. There were set inclusion criteria for referral (eg, primary/secondary CVD prevention, mild-to-moderate mental health issues) and exclusion criteria (eg, resting systolic blood pressure of ≥180 mm Hg or diastolic blood pressure of ≥100 mm Hg, severe anxiety or depression; see figure 1 for full details).

There was a standardised pathway for referrals (figure 2).

Figure 1 Scheme inclusion and exclusion criteria.

Inclusion Criteria
Cardiovascular disease (CVD) primary and secondary prevention *(hypertension, hypercholesterolemia, post-cardiac event or procedure and having completed phase III cardiac rehabilitation, established CVD with a clinical assessment within previous 6 months)*
Overweight / obesity *(BMI 25+ kg/m^2)*
Mental health problems *(mild to moderate anxiety and depression where the referring health professional considered that group exercise would be suitable and beneficial)*
Metabolic / endocrine disease *(type 2 diabetes or impaired glucose tolerance)*
Musculoskeletal problems
Respiratory conditions *(mild to moderate asthma and chronic obstructive pulmonary disease)*
Neurological conditions *(e.g. mild Parkinson's disease)*
Exclusion Criteria
Resting systolic blood pressure of ≥180 mmHg or diastolic blood pressure of ≥100 mmHg
Unstable angina *(diagnosed within the previous month, following no established pattern, occurring at rest or with minimal exertion, not relieved by rest or oral medication taken at the onset of symptoms)*
Uncontrolled tachycardia *(resting heart rate ≥100 bpm)*
Uncontrolled arrhythmias
Significant drop (≥15 mmHg) in blood pressure during exercise
Severe anxiety and depression *(no definition provided)*
Severe neuromuscular disorders *(no definition provided)*
Unstable or acute heart failure *(excessive breathlessness, unexplained weight gain of more than 2kg over a 5 day period, ankle oedema)*
Uncontrolled diabetes (*poorly controlled blood sugar levels)*
New or worsening breathlessness, palpitations, dizziness or lethargy
Aged under 16 years

The scheme was longer than many others previously studied, being 24 weeks in duration. Participants were asked to attend three consultations at the leisure site where they had chosen to take part (prescheme, after 12 weeks and postscheme after 24 weeks). Consultations, based around the Transtheoretical Model,[24] involved an assessment of stage of change and a discussion about reason for referral, activity preferences, current activity and potential barriers to increasing activity.

Participants accessing the scheme were encouraged to attend two supervised exercise sessions per week (maximum 48 sessions). Sessions were group based, with different activities available (gym, circuit classes, racquet sports and swimming). Although group based, activities were tailored to individuals. Cost for sessions ranged from £1.55 to £5.70. Participants were encouraged to undertake independent physical activity and given advice based on the (then current) 30 min, 5× per week, moderate activity message.[25]

Dated attendances at sessions were recorded for each participant. Staff contacted participants who had not attended sessions for 1 week by telephone (maximum three calls) or by post. Participants who did not wish to return or did not respond within 1 month were recorded as dropouts. Twelve-week and 24-week consultations were offered to all participants not classed as dropouts, regardless of levels of attendance at sessions.

Measurements

The Godin Leisure-Time Exercise Questionnaire (GLTEQ)[26] was used to assess self-reported physical activity at prescheme and postscheme consultations. Participants were asked to report the number of times they participated in light, moderate and vigorous activity for at least 15 min over a typical 7-day period. The number of incidences of light activity were multiplied by three, moderate by five and vigorous by nine (multipliers related to metabolic equivalents (METS) for each activity intensity). These results were then added together to give the Godin weekly activity score. An equivalent weekly amount of moderate activity was calculated by dividing the weekly activity score by its metabolic equivalent for moderate activity (ie, 5 METs) and then multiplying by 15 min (the minimum amount of time for each bout of activity reported) to determine an overall typical weekly duration of moderate activity. A moderate benchmark was used in order to provide comparison with the current guidelines of 150 min of moderate activity per week.[27]

Referrals were initially classified as either

- Non-starter: did not attend prescheme consultation or excluded at prescheme consultation as not meeting referral criteria;
- Starter: attended prescheme consultation and was admitted to the scheme.

Length of engagement for starters was further classified by stage of exit

- Dropout (before 12 weeks): admitted, but dropped out before 12-week consultation;
- Twelve-week adherer: attended 12-week consultation;
- Dropout (12–24 weeks): attended 12-week consultation but dropped before 24-week consultation;
- Completer: attended 24-week consultation.

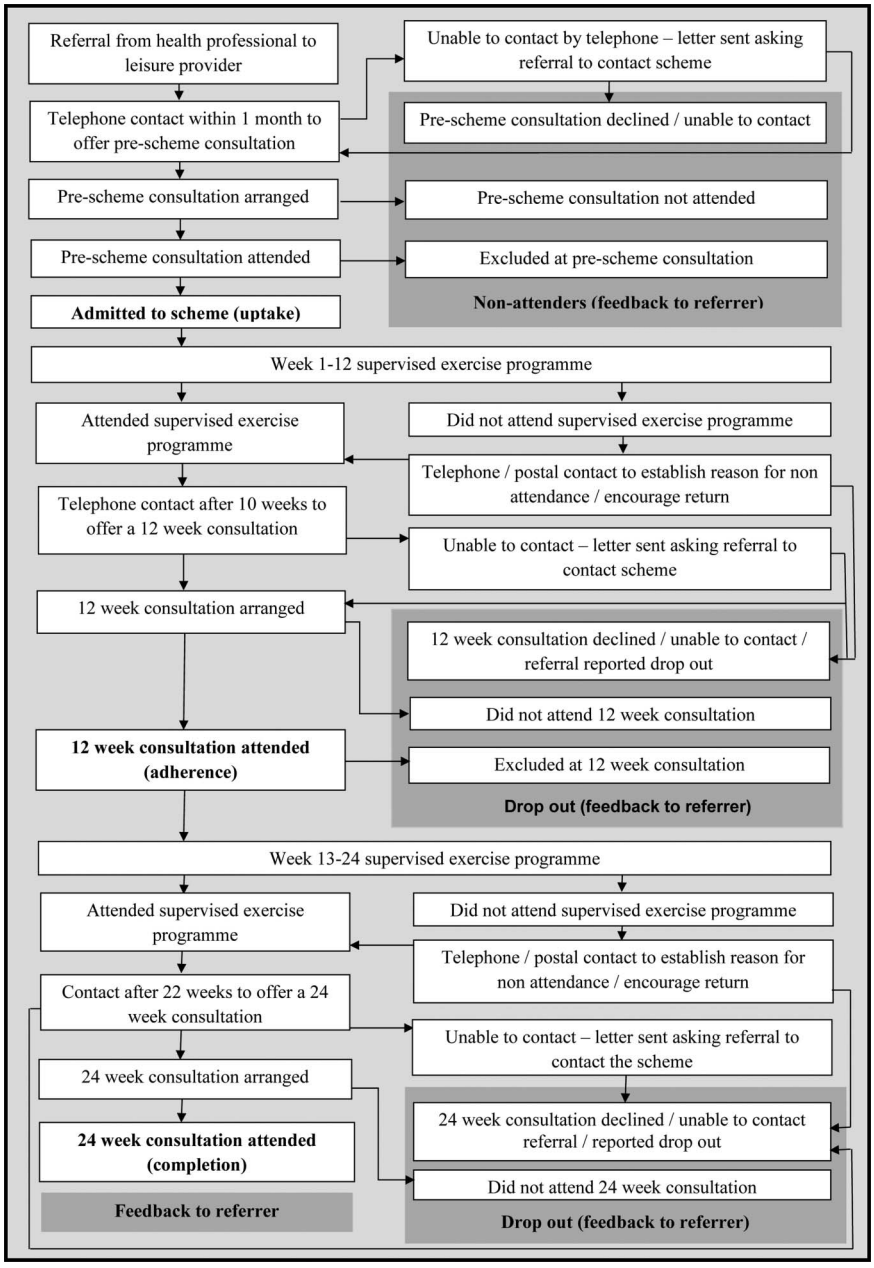

Figure 2 Scheme process.

To make comparisons with previously published studies, uptake (defined as number of participants admitted to the scheme following the prescheme consultation) and adherence (defined as number of participants who attended the 12-week consultation) were calculated. As 12 weeks was the midpoint of the ERS studied, a measure of completion (defined as number of participants who attended the 24-week consultation) was added.

Statistical analysis

Analyses were performed using PSAW Statistics V.20. Descriptive statistics of referrals relating to personal characteristics (gender, age, Index of Multiple Deprivation (IMD), employment status and initial BMI) and the referral process (profession of referrer, reason for referral, secondary reason for referral and leisure site) were examined in relation to non-starters compared to starters; then for starters in relation to stage of exit. Initial analysis (χ^2 and t tests) explored whether there were significant differences (<0.05 with 95% CI) in these characteristics between non-starters and starters.

Three binary logistic regressions were used to identify whether personal and referral characteristics were predictors of the three binary outcomes of starting the scheme after referral, 12-week adherence and 24-week completion (table 1).

Seven common independent variables were entered into each regression (age, gender, IMD, profession of referrer, reason for referral, secondary reason for

Table 1 Binary outcome variables for logistic regressions

Logistic regression	Binary outcome 0		Binary outcome 1
1	Non-starter (n=422)	vs	Starter (n=1811)
2	Dropout (before 12 weeks) (n=843)	vs	12-week adherers (n=968)
3	Dropout (12–24 weeks) (n=191)	vs	Completers (n=777)

referral and leisure site). In addition, prescheme BMI was available for entry into regressions two and three. Goodness of fit tests (Cox & Snell, Nagelkerke and Hosmer & Lemeshow) were used to assess whether the regressions were good fits of the data.

A paired sample t test was used to examine whether there were significant differences in prescheme and 24-week self-reported levels of physical activity using the GLTEQ.[26]

RESULTS

Participant flow

A total of 2233 referrals were made between July 2009 and October 2010. A total of 19% (n=422) referrals were non-starters. Of these, 409 did not attend a consultation and 13 were excluded after the prescheme consultation. Eighty-one per cent (n=1811) of referrals were admitted to the scheme after the initial assessment (uptake). Of these 46.5% (n=843) dropped out in the first 12 weeks, 53.5% (n=968) attended the 12-week consultation, 10.5% (n=191) dropped out between weeks 13 and 24 and 42.9% (n=777) attended the 24-week consultation.

Baseline data

Table 2 shows personal and referral characteristics of participants. Referrals were predominantly female (59%), with a mean age of 53 years (15.9 SD). The main referrers were general practitioners (58%, n=1278) and the most common reasons for referral were overweight/obesity (42%, n=913) and cardiovascular disease primary/secondary prevention (CVD) (30%, n=649).

Differences in personal and referral characteristics between non-starters and starters

Descriptive characteristics of referrals can be seen in table 2. There were significant differences in demographics (age $t(2231) = -9.60$, $p<0.001$; IMD $t(2211) = -5.40$, $p<0.001$; employment status $X^2=40.43$, $p<0.001$) and in referral characteristics (reason for referral $X^2=31.2$, $p<0.001$, secondary reason for referral $X^2=20.8$, $p<0.001$ and leisure site $X^2=38.0$, $p<0.001$) for starters compared to non-starters.

Characteristics associated with uptake, adherence and completion

A logistic regression analysis was conducted to predict uptake of the ERS using age, gender, IMD quintile, reason for referral, secondary reason for referral, profession of referrer and leisure site as predictors. A test of the full model against a constant only model was statistically significant, indicating that the predictors as a set reliably distinguished between acceptors and decliners of the offer ($X^2(31) =168.53$, $p<0.001$).

Nagelkerke's R^2 of 0.12 and Cox & Snell R^2 of 0.08 indicated an adequate relationship between prediction and grouping. Prediction success overall was 81.5% (99.5% for starters and 4.3% for non-starters). The Wald criterion demonstrated that age (35–44 years, B=0.705, SE=0.247, 45–54 years, B=0.657, SE=0.240, 55–64 years, B=1.113, SE=0.249, 65–74 years, B=1.429, SE=0.274, 75+ years, B=2.002, SE=0.421), gender (female B=0.341, SE=0.122), IMD quintile (61–80%, B=0.533, SE=0.215, 81–100% least deprived B=0.348, SE=0.204), secondary reason for referral (metabolic/endocrine B=1.104, SE=0.409) and leisure site (site F, B=0.855, SE=0.304, site H, B=0.925, SE=0.387, site I B=0.664, SE=0.315) made significant contributions to the model.

A second logistic regression analysis was conducted to predict 12-week adherence among starters using the same predictors as in regression one, but with the addition of prescheme BMI. A test of the full model against a constant only model was statistically significant, indicating that the predictors as a set reliably distinguished between dropouts and 12-week adherers ($X^2(34) =261.82$, $p<0.001$).

Nagelkerke's R^2 of 0.19 and Cox & Snell R^2 of 0.14 indicated an adequate relationship between prediction and grouping. Prediction success overall was 66.9% (62.1% for dropouts and 70.8% for adherers). The Wald criterion demonstrated that age (55–64 years, B=1.382, SE=0.302, 65–74 years, B=1.734, SE=0.302, 75+ years, B=1.173, SE=0.354), IMD (61–80%, B=0.412, SE=0.195, 81–100% least deprived B=0.671, SE=0.199), profession of referrer (cardiac rehabilitation nurse, B=0.829, SE=0.254), BMI (35+ kg/m^2 B=−0.437, SE=0.218) and leisure site (site G, B=−1.393, SE=0.391, site H, B=−1.185, SE=0.341, site I, B=−0.961, SE=0.299) made significant contributions to the model.

The final logistic regression was conducted to predict 24-week completion among 12-week adherers using the same predictors as regression two. A test of the full model against a constant only model was statistically significant, indicating that the predictors as a set reliably distinguished between those who dropped out between 12–24 weeks and completers ($X^2(34)=159.16$, $p<0.001$).

Nagelkerke's R^2 of 0.25 and Cox & Snell R^2 of 0.19 indicated an adequate relationship between prediction and

Table 2 Descriptive characteristics of referrals

	All referrals		Non-starters		Starters		12-Week adherers		Completers	
	n	Per cent	n	Per cent	n	Per cent	n	Per cent	n	Per cent
Age (n=2233)										
16–24	122	5.5	43	10.2	79	4.4	23	2.4	17	2.2
25–34	220	9.9	72	17.0	148	8.2	43	4.5	34	4.4
35–44	322	14.5	70	16.6	252	13.9	94	9.7	65	8.4
45–54	408	18.3	93	22.0	315	17.4	131	13.5	101	13.0
55–64	571	25.6	85	20.1	486	26.8	304	31.4	243	31.3
65–74	447	20.0	49	11.6	398	22.0	278	28.7	239	30.7
75+	143	6.2	10	2.5	133	7.3	95	9.8	78	10.0
Gender (n=2233)										
Female	1327	59.4	238	56.4	1089	60.1	566	58.5	441	56.8
Male	906	40.6	184	43.6	722	39.9	402	41.5	336	43.2
Index of multiple deprivation (n=2213)										
20% most deprived	511	23.1	135	32.1	376	21.0	183	19.0	156	20.2
21–40%	479	21.6	100	23.8	379	21.1	187	19.4	156	20.2
41–60%	413	18.7	68	16.2	345	19.2	191	19.8	158	20.3
61–80%	378	17.1	54	12.9	324	18.1	190	19.7	148	19.1
81–100% least deprived	432	19.5	63	15.0	369	20.6	213	22.1	156	20.2
Employment status (n=1447)										
Retired	525	36.3	58	22.0	467	39.4	351	52.3	320	55.1
Incapacity benefit	190	13.1	51	19.4	139	11.7	58	8.7	48	8.3
Employed	404	27.9	86	32.7	318	26.9	150	22.4	118	20.3
Job seekers allowance	93	6.4	27	10.3	66	5.6	23	3.4	19	3.2
Full time education	21	1.5	5	1.9	16	1.4	1	0.1	1	0.2
Other	214	14.8	36	13.7	178	15.0	88	13.1	75	12.9
Profession of referrer (n=2190)										
General practitioner	1278	58.4	253	60.7	1025	57.8	508	53.4	407	53.2
Practice nurse	590	26.9	117	28.1	473	26.7	257	27.0	200	26.1
Cardiac rehabilitation nurse	185	8.4	21	5.0	164	9.2	130	13.7	117	15.3
Other	137	6.3	26	6.2	111	6.3	57	5.9	41	5.4
Reason for referral (n=2161)										
CVD	649	30.0	96	23.6	553	31.6	365	38.8	308	40.8
Overweight/obesity	913	42.2	192	46.9	721	41.2	343	36.5	271	35.9
Mental health	297	13.8	79	19.4	218	12.4	95	10.1	72	9.5
Metabolic/endocrine	149	6.9	29	7.1	120	6.8	60	6.4	45	6.0
Other	153	7.1	14	3.0	139	8.0	77	8.2	58	7.8
Secondary reason for referral (n=2233)										
No secondary reason	1649	73.8	324	76.8	1325	73.2	715	73.9	594	76.5
CVD	34	1.5	3	0.7	31	1.7	18	1.9	14	1.8
Overweight/obesity	222	9.9	41	9.7	181	10.0	94	9.7	67	8.6
Mental health	130	5.8	35	8.3	95	5.2	41	4.2	31	4.0
Metabolic/endocrine	105	4.7	7	1.7	98	5.4	53	5.5	39	5.0
Other	93	4.2	12	2.8	81	4.5	47	4.8	32	4.1
Prescheme BMI (n=1776)										
Normal weight (18.5–24.9 kg/m^2)	Not available for those who did				215	12.1	131	13.6	110	14.2
Overweight (25–29.9 kg/m^2)	not start the scheme				459	25.8	273	28.3	228	29.5
Obese (30–34.5 kg/m^2)					499	28.1	272	28.2	210	27.2
Morbidly obese (35+ kg/m^2)					603	34.0	288	29.9	225	29.1
Leisure site (n=2233)										
A (Leisure provider 2)	113	5.1	22	5.2	91	5.0	67	6.9	60	7.7
B (Leisure provider 1)	186	8.3	54	12.8	132	7.3	75	7.7	71	9.1
C (Leisure provider 1)	332	14.9	83	19.7	249	13.7	152	15.7	117	15.1
D (Leisure provider 1)	103	4.6	20	4.7	83	4.6	39	4.0	34	4.4
E (Leisure provider 1)	428	19.2	89	21.1	339	18.7	186	19.2	168	21.6
F (Leisure provider 1)	501	22.4	81	19.2	420	23.2	224	23.1	196	25.2
G (Leisure provider 2)	73	3.3	10	2.4	63	3.5	27	2.8	20	2.6
H (Leisure provider 2)	156	7.0	18	4.3	138	7.6	54	5.6	24	3.1
I (Leisure provider 2)	341	15.3	45	10.7	296	16.3	144	14.9	87	11.2

grouping. Prediction success overall was 82.2% (24.2% for dropouts and 96.5% for adherers). The Wald criterion demonstrated that BMI (30–34.9 kg/m^2 B=−1.164, SE=0.377, 35+ kg/m^2 B=−0.921, SE=0.395) and leisure site (site G, B=−1.336, SE=0.377, site H, B=−2.102, SE=0.533, site I, B=−1.709, SE=0.473) made significant contributions to the model (table 3).

Physical activity levels

Self-reported physical activity for those who completed the scheme was measured through the GLTEQ[26] prescheme and postscheme. Mean prescheme weekly activity scores were 17.43 units/week (15.82 SD) and postscheme scores were 27.11 units/week (20.46 SD). This equated to 52 min of moderate activity per week prescheme and 81 min postscheme, (a mean increase in moderate activity of 29 min/week). Participants who completed significantly increased their self-reported physical activity levels ($t(638)= -11.55$, $p<0.001$).

Attendance at supervised ERS sessions

Mean attendance across sites for dropouts before 12 weeks was 4.28 sessions (5.68 SD), for 12-week adherers was 13.06 sessions (9.2 SD) and for completers was 22.87 sessions (12.47 SD). For completers, this equated to 47.7% of potential attendances (maximum 48), however, there were large variations between sites. Highest mean attendance for completers at a single site (A) was 31.18 (11.87 SD) sessions and the lowest (H) 15.37 (6.69 SD) sessions.

DISCUSSION

Main findings

The aim of the present study was to examine whether participation in the ERS resulted in increased physical activity and what factors were predictors of uptake and stage of exit from the scheme. For those who completed the Northumberland ERS, there was a significant increase in self-reported physical activity. Completers attended sessions on average once a week during the referral period. Participants were asked to complete the GLTEQ[26] prescheme and postscheme. Results showed a statistically significant mean increase in activity of 29 min per week, but the average 82 min achieved was still well below the current recommendation of 150 min/ week.[27] The only other ERS study to have used this questionnaire[12] reported a mean increase of 27 min/week after 3 months and 21 min/week after a year. Although reported increases were comparable between studies, in both levels of activity achieved are below recommended levels.

Personal and referral characteristics were found to be significant predictors of both uptake and length of engagement with the ERS studied. Increasing age, being female and metabolic/endocrine condition as a secondary reason for referral were positive predictors of uptake; while greater deprivation was a negative predictor. Increasing age and being referred by a cardiac rehabilitation nurse were positive predictors of 12-week adherence; while greater deprivation and a BMI of 35+ kg/m^2 were negative predictors. BMI of more than 30 kg/m^2 was a negative predictor of completion. Leisure site was a significant predictor of uptake, 12-week adherence, and 24-week completion.

Uptake for this ERS was 81%, which compared favourably with other evaluation studies of routinely collected data,[12 14 15 19] but was lower than the 85% uptake reported by a recent UK RCT.[8] The 53.3% adherence in this study was not dissimilar to results of a recent systematic review,[20] which found a pooled adherence level of 49% across observational studies. The measure of completion in this study indicated further attrition of 10.5% in weeks 13–24. Since the highest levels of dropout occurred in the first 3 months (46.5% of uptake), understanding barriers to, and facilitators of, attendance in the earlier stages of the scheme would make the most difference to improving sustained engagement. There has only been one qualitative study[28] considering participant perceptions of ERS, although several other studies[23 29 30] have included qualitative elements. Future studies are required to explore these issues in depth.

No other observational studies have reported comprehensive attendance data. In this study the total number of attendances at sessions was reported for participants. Completers attended approximately once a week, rather than the proposed two times a week. However, this did vary between sites and the site with the highest attendance also had the highest adherence to 12-week and 24-week consultations; conversely the site with the lowest attendance also had the lowest adherence to consultations. These findings indicate that using attendance at consultations as a proxy measure for attendance in activity sessions is an appropriate index.

Compared to other studies[17 21 22] that have indicated that participants achieved 80% of attendance, the present study found much lower levels of attendance (47.7%). However, previous studies have not tended to report data about actual levels of attendance per week. The present results are, however, similar to those reported in the RCT in Hailsham[23] where completers attended on average 45% of exercise sessions. If ERS only achieve average attendance rates of one session per week (potentially 60 min of moderate exercise), there is a need to investigate whether participants increase other activity in order to make an assessment of whether they achieve the 2011 UK government recommended 150 min of moderate exercise.[27]

This study also analysed whether demographic/other factors relating to the referral were predictors of uptake and stage of exit from the scheme. As in previous studies[12 14 15] increasing age was associated with uptake and adherence; however, in the present study almost half of the referrals (48%) were under 55 years. In the short term, retention to this ERS could be increased by focusing referrals on those over 55 years or specifically

Table 3 Binary logistic regression outcomes

	Regression 1 OR (95% CI)	p Value	Regression 2 OR (95% CI)	p Value	Regression 3 OR (95% CI)	p Value
Age		<0.001		<0.001		0.004
16–24	1.000 (ref)		1.000 (ref)		1.000 (ref)	
25–34	1.161 (0.711 to 1.896)	0.551	1.049 (0.556 to 1.981)	0.882	1.118 (0.279 to 4.475)	0.875
35–44	2.023 (1.247 to 3.281)	0.004	1.501 (0.838 to 2.688)	0.172	0.558 (0.165 to 1.890)	0.349
45–54	1.928 (1.204 to 3.088)	0.006	1.697 (0.954 to 3.017)	0.072	1.022 (0.301 to 3.467)	0.972
55–64	3.042 (1.866 to 4.959)	<0.001	3.984 (2.254 to 7.045)	<0.001	1.601 (0.488 to 5.247)	0.437
65–74	4.175 (2.442 to 7.137)	<0.001	5.665 (3.136 to 10.234)	<0.001	2.505 (0.740 to 8.484)	0.140
75+	7.402 (3.244 to 16.890)	<0.001	5.544 (2.771 to 11.093)	<0.001	1.894 (0.500 to 7.168)	0.347
Gender						
Male	1.000 (ref)		1.000 (ref)		1.000 (ref)	
Female	1.406 (1.106 to 1.787)	0.005	1.189 (0.952 to 1.486)	0.128	0.823 (0.554 to 1.221)	0.333
Index of multiple deprivation		0.119		0.012		0.807
20% most deprived	1.000 (ref)		1.000 (ref)		1.000 (ref)	
21–40%	1.215 (0.869 to 1.699)	0.254	1.191 (0.847 to 1.675)	0.314	0.960 (0.501 to 1.842)	0.903
41–60%	1.416 (0.948 to 2.113)	0.089	1.335 (0.913 to 1.951)	0.136	1.281 (0.622 to 2.638)	0.502
61–80%	1.704 (1.118 to 2.599)	0.013	1.510 (1.031 to 2.211)	0.034	0.894 (0..445 to 1.795)	0.753
81–100% Least deprived	1.546 (1.019 to 2.347)	0.041	1.956 (1.325 to 2.887)	0.001	0.955 (0.481 to 1.898)	0.896
Profession of referrer		0.301		0.012		0.353
General Practitioner	1.000 (ref)		1.000 (ref)		1.000 (ref)	
Practice nurse	0.802 (0. 610 to 1.055)	0.114	1.129 (0.878 to 1.451)	0.346	1.006 (0.643 to 1.573)	0.979
Cardiac rehabilitation nurse	1.243 (0.708 to 2.183)	0.449	2.291 (1.392 to 3.769)	0.001	2.045 (0.915 to 4.572)	0.081
Other	0.999 (0.616 to 1.620)	0.998	1.146 (0.738 to 1.779)	0.544	0.924 (0.455 to 1.874)	0.826
Reason for referral		0.157		0.751		0.113
CVD	1.000 (ref)		1.000 (ref)		1.000 (ref)	
Overweight/obesity	0.819 (0.560 to 1.199)	0.304	0.937 (0.673 to 1.303)	0.697	1.475 (0.832 to 2.616)	0.183
Mental health	0.751 (0.484 to 1.163)	0.199	0.823 (0.544 to 1.244)	0.355	0.753 (0.360 to 1.572)	0.449
Metabolic/endocrine	0.873 (0.521 to 1.462)	0.605	0.806 (0.511 to 1.272)	0.354	0.571 (0.261 to 1.247)	0.160
Other	1.652 (0.866 to 3.153)	0.128	0.789 (0.501 to 1.244)	0.308	1.018 (0.467 to 2.218)	0.965
Secondary reason for referral		0.031		0.667		0.820
No secondary reason	1.000 (ref)		1.000 (ref)		1.000 (ref)	
CVD	2.125 (0.618 to 7.304)	0.231	1.001 (0.450 to 2.228)	0.998	1.529 (0.392 to 5.961)	0.541
Overweight/obesity	0.829 (0.526 to 1.305)	0.418	0.869 (0.580 to 1.302)	0.496	1.233 (0.633 to 2.405)	0.538
Mental health	0.818 (0.522 to 1.284)	0.383	0.888 (0.554 to 1.423)	0.621	1.268 (0.531 to 3.028)	0.594
Metabolic/endocrine	3.016 (1.354 to 6.719)	0.007	0.894 (0.555 to 1.440)	0.644	0.778 (0.368 to1.644)	0.511
Other	1.497 (0.779 to 2.877)	0.226	1.445 (0.856 to 2.441)	0.168	0.797 (0.367 to 1.730)	0.566
Prescheme BMI (kg/m^2)				0.214		0.012
Normal weight 18.5–24.9	N/A		1.000 (ref)		1.000 (ref)	
Overweight 25–29.9 kg/m^2			0.749 (0.506 to 1.111)	0.151	0.598 (0.298 to 1.197)	0.147
Obese 30–34.5 kg/m^2			0.775 (0.511 to 1.175)	0.230	0.312 (0.149 to 0.654)	0.002
Morbidly obese 35+ kg/m^2			0.646 (0.421 to 0.990)	0.045	0.398 (0.184 to 0.863)	0.020

Continued

Table 3 Continued

	Regression 1 OR (95% CI)	p Value	Regression 2 OR (95% CI)	p Value	Regression 3 OR (95% CI)	p Value
Leisure site		<0.001		<0.001		<0.001
A (Leisure provider 2)	1.000 (ref)		1.000 (ref)		1.000 (ref)	
B (Leisure provider 1)	0.839 (0.440 to 1.601)	0.595	0.625 (0.320 to 1.217)	0.167	2.670 (0.705 to 10.117)	0.148
C (Leisure provider 1)	1.253 (0.685 to 2.294)	0.464	0.972 (0.528 to 1.788)	0.927	0.532 (0.207 to 1.365)	0.189
D (Leisure provider 1)	1.675 (0.781 to 3.589)	0.185	0.518 (0.249 to 1.078)	0.079	1.324 (0.347 to 5.052)	0.681
E (Leisure provider 1)	1.667 (0.905 to 3.071)	0.101	0.991 (0.535 to 1.835)	0.978	2.362 (0.801 to 6.967)	0.119
F (Leisure provider 1)	2.351 (1.296 to 4.263)	0.005	0.875 (0.487 to 1.573)	0.656	1.464 (0.552 to 3.883)	0.443
G (Leisure provider 2)	1.690 (0.708 to 4.030)	0.237	0.248 (0.115 to 0.534)	<0.001	0.263 (0.073 to 0.950)	0.041
H (Leisure provider 2)	2.521 (1.181 to 5.381)	0.017	0.306 (0.157 to 0.596)	0.001	0.122 (0.043 to 0.347)	<0.001
I (Leisure provider 2)	1.943 (1.048 to 3.600)	0.035	0.383 (0.213 to 0.688)	0.001	0.181 (0.072 to 0.458)	<0.001

N/A indicates that data were not available. Employments status was not included in any final regression as it did not improve the fit.

tailoring ERS interventions for those under 55 years. Further qualitative studies that improve understanding about why ERS is not as successful for those who are younger could lead to the development of more appropriate interventions for those under 55 years.

Apart from increasing age being a predictor of uptake and adherence, there has been little consensus about how demographics are associated with uptake and adherence to ERS. This is due to the small number of studies that have examined the associations between referral demographics and engagement and a lack of standardisation of data collection between studies. In this study, increasing age, being female, IMD, secondary reason for referral and leisure site were found to be significant predictors of uptake, while increasing age, IMD, prescheme BMI and leisure site were found to be significant predictors of 12-week adherence. As 12 weeks was the mid-point of the scheme in this study (unlike most other studies), an additional element of 24-week completion was used; prescheme BMI and leisure site were found to be significant predictors for this.

Two previous studies[12 14] found that men were more likely to adhere however, this study found that although being women was significantly associated with uptake, there was no statistical difference in stage of exit for gender for starters.

Only two other observational studies have examined whether deprivation is associated with likelihood to complete; as in this study, Sowden *et al*[15] found it was not a significant predictor of likelihood to complete, while Gidlow *et al*[14] found those from deprived areas were less likely to start and adhere to ERS (as did this study). Additionally in this study leisure site was found to be a significant predictor of uptake, 12-week adherence and 24-week completion. It is possible that processes within individual sites are associated with success. Reasons for performance varying by site are likely to be complex. Differing provision of leisure services in Northumberland created challenges in providing a standardised scheme. The highest level of adherence was seen at the site where the scheme was most recently established, and prior learning had been shared between providers. The only other study[12] to compare performance between two sites found a 12% difference in adherence.

Reason for referral was not found to be a significant predictor of uptake or stage of exit for starters; however those referred by a cardiac rehabilitation nurse (CVD secondary prevention) were more likely to adhere at 12 weeks and those with a prescheme BMI of 30+ kg/m^2 were less likely to complete at 24 weeks. Other studies have found referral for CVD to be significant; Sowden *et al*[15] found that those referred for prevention of diabetes or cardiovascular disease were significantly more likely to complete than those referred for musculoskeletal/neurological, respiratory and mental health conditions; and Dugdill *et al*[12] found that those referred for a myocardial infarction were almost twice as likely to

adhere as those referred for a mental health condition. Additionally, James *et al*[16] found that those referred for overweight/obesity musculoskeletal, and mental health issues were less likely to take up a referral than those with cardiovascular disease, but they did not find an association between reason for referral and completion for those who started. Given the identified rise in levels of obesity in the UK,[4] the benefits of physical activity for those who are obese,[31] and the high proportion of referrals made to this ERS who were obese (62% of recorded BMIs for starters were 30+ kg/m^2); there is a need to understand why the current intervention is not as successful for this group and what approach might result in more sustained engagement.

Limitations

The factors analysed only minimally increased prediction accuracy. This would indicate that there are other factors that have not been considered in this study that are associated with how long participants engage with the scheme.

The use of a self-reported physical activity questionnaire might have led to inaccuracies in quantifying increases in levels of activity. The GLTEQ[26] is limited in that it asks how many times in a typical 7-day period activity was undertaken for 15 min or more. An hour-long activity session therefore receives the same rating as a 15 min exercise session, leading to a possible underestimation of activity levels achieved. While it might be unrealistic to expect an ERS provider to routinely collect data about physical activity levels other than by self-report questionnaire, small scale studies that objectively measure activity levels prescheme and postscheme (eg, via accelerometer) would give a more realistic assessment of any increase in activity levels while also accounting for levels of physical activity outside the programme.

Although the study identified which participants successfully engaged with the scheme, it has not attempted to identify the reasons for engagement or non-engagement. Here, an examination of the experiences, expectations, attitudes and beliefs about the scheme would be a most beneficial next step, ideally through a qualitative methodology.

Implications for practice and future research

There are several key recommendations resulting from this study.

- Studies are required that explore why ERS is successful for certain groups, while failing to sustain engagement with others. In particular there is a need to focus on why ERS is less successful for those who are younger and those who are obese.
- Adherence to and completion of ERS in its present form could be improved by focusing referrals on those aged over 55 years.
- In addition to encouraging participants to attend supervised sessions, there is a need for ERS to promote physical activity outside scheme sessions in order for participants to achieve government physical activity recommendations.
- Further studies are required that more accurately determine changes in physical activity behaviour as a result of participation in ERS.

CONCLUSION

The Northumberland ERS was more successful for those aged over 55 years and less successful for those who were obese. Completers increased physical activity at 24 weeks. Leisure site attended was a significant predictor of uptake and length of engagement.

Contributors All the authors have contributed significantly to conception and design, acquisition of data, or analysis and interpretation of data, drafting the article or revising it critically for important intellectual content. Final approval of the version to be published.

Funding Blyth Valley Arts and Leisure is one of two providers of exercise on referral scheme evaluated and provider of funding for a PhD to evaluate the service.

Competing interests CLH is an employee of Blyth Valley Arts and Leisure and is currently completing a PhD that has been funded by the aforementioned company.

Ethics approval Ethics approval was not sought; guidance from NHS National Research Ethics Service indicated that this was not required as the evaluation was considered to be a service audit of anonymised data.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement Full dataset available at from the corresponding author at coral.hanson@northumbria.ac.uk. Consent was not obtained but the presented data are anonymised and risk of identification is low.

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