



Insufficient Reporting of Factors Associated with Exercise Referral Scheme Uptake, Attendance and Adherence: A Systematic Review of Reviews.

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1 **Abstract**

2 **Background:** Exercise Referral Schemes (ERS) are prescribed programmes aimed at tackling physical

3 inactivity and associated non-communicable disease. Inconsistencies in reporting, recording and

4 delivering ERS make it challenging to identify what works, why, and for whom.

5 **Methods:** PRISMA guided this narrative review of reviews. Fifteen electronic databases were

6 searched for systematic reviews of ERS. Reviewers applied inclusion criteria and quality assessed via

7 the AMSTAR tool. Data on uptake, attendance and adherence were extracted.

8 **Results:** Eleven reviews met the inclusion criteria. AMSTAR quality was medium. Definitions of

9 uptake varied within reviews. Uptake ranged from 35%-81%. Groups reported as more likely to take

10 up ERS included, (i) females and (ii) older adults. Attendance was defined variably but ranged from

11 12%-49%. Men were more likely to attend ERS. Effect of medical diagnosis upon uptake and

12 attendance was inconsistent. Exercises prescribed were unreported and therefore, adherence to

13 exercise prescriptions was unreported. The influence of theoretically-informed approaches on

14 uptake, attendance and adherence was generally lacking, however, self-determination, peer support

15 and supervision support were reported as influencing attendance.

16 **Conclusions:** There was insufficient reporting across studies about uptake, attendance and

17 adherence. Complex interventions like ERS require consistent definitions, recording and reporting of

18 these key facets, but this is not evident from the existing literature.

A Review of Reviews of Exercise Referral Schemes.

Introduction

The benefits of regular physical activity (PA) are well established ^(1,2,3,4), notably for adults who engage in at least 150 minutes of moderate intensity activity or 75 minutes of vigorous intensity activity per week, alongside activities that improve muscular strength on at least two days of the week ⁽¹⁾. Despite the clear and causal relationship between achieving PA guidelines and health outcomes ⁽¹⁾, physical inactivity is rising ⁽⁵⁾. Inactivity is now the fourth leading risk factor for global mortality (6% of deaths globally), behind high blood pressure (13%), tobacco use (9%) and high blood glucose (6%) ⁽⁵⁾. Contextually it must be acknowledged that while physical inactivity is a standalone risk factor ⁽⁵⁾ PA status is a key determinant in moderating the additional risk factors of high blood pressure and high blood glucose levels ^(5,4).

In recognition of this physical inactivity burden, the UK government has implemented population-wide programmes ⁽⁶⁾. Additionally, at the individual level, tailored attempts to manage physical inactivity has led to the expansion of exercise referral schemes (ERS). Individual's showing evidence of non-communicable disease coupled with an inactive lifestyle are directly referred by allied health practitioners to independent third party exercise facilities to undertake a structured and prescriptive exercise programme ⁽⁷⁾. The popularity of the ERS model drove a rapid rise in the number of centres offering referral programmes despite limitations presented within the literature evaluating the implementation of schemes ⁽⁸⁾ and thereby limited evidence of what works, why and for whom.

Since 1998, a combination of systematic reviews, meta-analyses or narrative reviews of ERS have been published focusing on different constructs surrounding the effectiveness of ERS ^(2, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19). It is evident from this body of work that ERS is considered an important element in the armoury to increase PA and tackle chronic disease ⁽²⁰⁾. However, the United Kingdom's National Institute for Health and Care Excellence (NICE) have indicated that the varying nature of ERS programmes makes it impossible to differentiate between the effectiveness and acceptability of different schemes ⁽⁴⁾ in addressing physical inactivity and non-communicable disease. This conclusion

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is largely due to little evidence of any effectiveness of specific schemes ⁽⁴⁾. It is crucial therefore, that clear reporting of key ERS components is available to allow for components associated with effectiveness to be replicated in future schemes. Factors such as reporting of referral uptake, attendance and adherence, and the behaviour change techniques (BCT's) underpinning ERS uptake and adherence are key components to understand for the following reasons:

Referral uptake

Knowledge of who does or does not take-up an ERS referral is imperative for improving the degree of take-up ⁽¹¹⁾. Whether participant characteristics influence the proportion of ERS uptake is uncertain. It is important to know what referral demographics are consistently reported, or unreported, and how they relate to uptake; to gain an understanding of what and how these are influencing scale of ERS uptake. In particular, it is not clear whether those with certain medical conditions have a greater uptake, and whether socio-economic or demographic characteristics influence an individual's uptake ⁽²¹⁾. Unless uptake and characteristics of people using ERS are known then it is difficult to interpret the extent of generalizability of effect to groups of the population i.e. understand what works, why and for whom.

Attendance and Adherence

Slade et al. ⁽²²⁾ described adherence as the extent to which a person's behaviour corresponds to the agreed referral. It is important within the context of the present review to distinguish the difference between adherence and attendance. Presently, adherence to ERS refers to the percentage of sessions attended ^(11, 15), which may be more appropriately classified as attendance. Adherence then would refer to the participant's behaviour in completing the prescribed PA. Attendance alone does not signify a suitable level of exercise intensity undertaken to benefit from the prescribed PA. For those who complete ERS, promising results were reported for reduced skinfolds, systolic blood pressure and BMI ⁽²³⁾, greater self-efficacy to overcoming PA barriers ⁽²⁴⁾ and higher self-reported PA levels ⁽²⁵⁾. However, failure to attend and adhere to the prescribed programme reduces the

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opportunity a participant has for achieving these benefits. As such, it is important to understand what characteristics influence participants' attendance and adherence levels. A valid and reliable assessment of both attendance and adherence is essential for drawing valid conclusions about ERS⁽²²⁾.

Behaviour Change Techniques

In evaluating a complex intervention such as ERS, there is a requirement to understand the theoretical underpinning at every stage of the intervention, what it is based upon, and the mechanisms through which behaviour change is achieved^(26, 27). In the same way that the PA content of ERS schemes varies, and is determined between service provider and participant⁽²⁸⁾, no single explicit behaviour change theory or technique is embedded within ERS⁽²⁶⁾. The explicit reporting of the components within a complex intervention such as ERS, including its contextual factors such as BCT's utilised, is imperative in understanding; what facilitates uptake, attendance and adherence to ERS and further implementation of ERS⁽²²⁾.

The current review of reviews aims to systematically collate and evaluate the evidence base of review level findings around ERS. It will address what is reported and the consistent and contradictory observations at both a theoretical and practical level. The review aims to: 1) describe definitions rates and participant characteristics associated with ERS uptake; 2) to describe definitions rates and participant characteristics associated with attendance at and adherence to ERS schemes; and 3) to describe theoretically-informed approaches associated with ERS uptake and attendance. Furthermore, this review will establish what key features of ERS reporting go relatively under-reported to inform future studies of ERS. This review may lead to a clear consensus positively affecting both research and practice in a critical area that could improve the health and wellbeing of individual's with non-communicable disease referred to ERS.

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Methods

Data Sources and Search Strategy

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement guided the conduct of this narrative review of reviews ⁽²⁹⁾. Studies were identified by structured electronic database searches. One author (RP), who is a librarian and information specialist, searched 15 electronic databases (CINHAL, Medline, Embase, Cochrane Library, SportsDiscus, PsychInfo, SCOPUS, HMIC, AMED, Public Health Database, ASSIA, CRD databases, Prospero, Web of Knowledge, Campbell Collaboration Library and PubMed), in November 2016, for systematic reviews and meta-analysis of exercise referral schemes in adults published in English language with no date restriction. Additional reviews were searched until June 2017, via reference lists of included literature, alongside searches of UpToDate, BMJ Best Practice and Dynamed Plus. Search strategies were constructed and then amended and agreed by group consultation of all authors. As an example, search terms used for Medline are available within the supplementary material (Supplementary material 1). The protocol and the purpose of the current study were designed beforehand; however, these were not published or uploaded on the web.

Review Selection.

Review inclusion and exclusion criteria were constructed by CS and then amended and agreed by group consultation and described in Table 1. One author (CS) independently examined titles and abstracts against the inclusion and exclusion criteria. Three authors (GH, TG & SG) independently assessed a randomised sub sample of papers, amounting to 20% of the total title and abstract sample. A group (CS, GH, TG & SG) consensus conferred on which papers were progressed further to full text review and which excluded. Full text review articles were then obtained and assessed by two authors (CS & SG) against the inclusion and exclusion criteria described in Table 1. Figure 1 describes the justification of excluding papers at multiple stages of the PRISMA protocol. Any discrepancies were discussed until a consensus was reached.

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Data Extraction

Data was extracted by one author (CS) against a data extraction template and verified by one co-author (SG), with any discrepancies discussed until resolution. Eleven predefined constructs relating to the effectiveness of interventions were used (supplementary material 2), taking guidance from work conducted by Greaves et al. ⁽³⁰⁾.

Grading of Evidence

Each review was graded independently and empirically in duplicate (by CS & SG) with any discrepancies discussed. The AMSTAR (A Measurement Tool to Assess Systematic Reviews) criteria was used to grade reviews. AMSTAR grades scores as low quality (0-3), medium (4-7) and high (8-11) ⁽³¹⁾. While the AMSTAR tool was developed to assess reviews of randomized controlled trials (RCTs) only, it has been shown to be applicable to reviews of non-randomized studies, demonstrating good psychometric properties ⁽³²⁾. Cohen's kappa was calculated as a measure of reliability for each AMSTAR item. Kappa values less than 0 were rated as less than chance agreement; 0.01–0.20, slight agreement; 0.21–0.40, fair agreement; 0.41–0.60, moderate agreement; 0.61–0.80, substantial agreement; and 0.81–0.99, almost perfect agreement ⁽³²⁾. Additionally, reviews were graded on the type of evidence they were reviewing, such as randomised controlled trials (see Table 2). The classification of AMSTAR (e.g. 9) was then combined with the type of evidence (e.g. A). For example, high-quality systematic reviews of randomised controlled trials was coded as 9A.

Analysis

A narrative synthesis of the results indicating the quality of the evidence was more appropriate for a review of reviews and was considered for the following reasons: a lack of consistency within reporting of results to undertake a meta-meta-analysis, and the variety of study interventions examined within the reviews. Furthermore, the present review aimed to understand the 'how and why' of ERS in order to gain an insight into the manner that ERS is reported. In accordance with reporting guidelines for systematic reviews, a PRISMA checklist is available for this review.

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Results

A systematic search identified 3211 potentially relevant articles (Figure 1). Following exclusion of duplicates and non-relevant articles, 39 articles were retrieved in full and assessed. One additional article was identified in March 2017 via a database alert that was initially set up from the original database search. Eleven reviews met the pre-established inclusion criteria (Table 1).

Review Characteristics

All eleven reviews reported upon an aspect of effectiveness within ERS: seven reviews examined referral to, uptake and attendance at ERS (2, 9, 10, 11, 12, 14, 15) with eight reporting for whom ERS is successful (9, 11, 12, 13, 14, 15, 16, 18). Eleven reviews make comment on the theoretical underpinnings or BCT's within ERS (2, 9, 10, 12, 13, 14, 15, 16, 18, 19). Eight reviews reported upon changes of physical activity levels (10, 12, 13, 14, 15, 16, 18, 19). Reviews included data from a range of referral populations (e.g. hypertension, diabetes, raised cholesterol, mental health and obesity) and delivery settings (e.g. leisure centre, primary care, green settings, such as community outdoor walks or community gardening). Dates of published studies included within the reviews ranged from 1966 to 2015 and incorporated 221 cited papers of which 98 were duplicated across reviews. We further draw attention of the reader to three linked reviews resulting from our search by Pavey *et al.* (11, 12, 13), who report different aspects of the same systematic search, and one by Campbell *et al.* (14) who based their initial search upon that of the Pavey papers(11, 12, 13) and built upon it. Where appropriate, unique items are reported separately.

Review quality

The methodological quality of included reviews was generally of a medium standard (median AMSTAR score = 7.50, mean AMSTAR = 7.00). Only three systematic reviews examined evidence adjudged to be of high strength (Table 2). Table 3 illustrates the combined duplicate reviewer AMSTAR scoring and strength of evidence within the reviews. The mean inter-rater reliability (Kappa) for applying agreement on review quality was 0.67 (95% CI 0.87 to 0.48). The most common

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methodological weaknesses adjudged via AMSTAR were, the lack of lists indicating the included and excluded studies and the assessment of potential bias within the selection of articles (e.g. in meta-analysis assessment of publication bias should include a combination of graphical aids such as funnel plot and/or statistical tests such as Egger regression test or Hedges-Olken). The greatest methodological strengths were the comprehensive nature of the literature searches performed and the assessment and documentation of the scientific quality of the included studies. Table 4 highlights the reported uptake and attendance figures across reviews. Some reviews were able to pool results in order to conduct meta-analysis. Other reviews were not able to achieve this due to the lack of consistent reporting within the original papers. Recording and reporting methods of uptake, attendance, adherence and theory varied within reviews and are detailed below.

Narrative of Results

Referral uptake

Uptake was defined within three linked reviews as attending the initial consultation ^(11, 12, 14). Two reviews did not provide a definition for uptake ^(10, 15), while one review indicated that it struggled to define uptake due to differences reported within evaluations ⁽⁹⁾. Table 4 highlights the reported uptake across reviews; demonstrating a range of uptake values between 35% and 85%. Three of the five reviews ^(9, 10, 12) which report on uptake highlight similar values around 65%. Importantly, no review reported characteristics for participant who failed to take up ERS representing around 30-40% of participants referred. Where reviews have reported characteristics relating to take-up, these figures are derived from participants present within the scheme.

One high quality review reported that two studies demonstrated women were more likely to take-up ERS than men ⁽¹²⁾. However, two studies within that review showed no association between gender and uptake of ERS. Pavey et al. ⁽¹¹⁾ concluded that being female and of increasing age was a positive predictor of uptake. A low quality review summarised that uptake was greater within females (60 – 40% for females vs. males) ⁽⁹⁾. Their review importantly highlighted that reporting of

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characteristics was poor and only reported within five primary studies ⁽⁹⁾. Pavey et al. ⁽¹¹⁾ reported that participants who were more deprived and suffered from a respiratory diagnosis were more likely to take-up ERS than those with the same diagnoses who were least deprived (OR 1.45, 95% CI 1.06 to 1.99, $p<0.05$). A high quality review reported that pre-existing medical diagnoses were not separately reported which prevented conclusions being drawn within these subgroups ⁽¹³⁾. One medium quality review reported that participants referred with mental health problems were more likely to participate in ERS than those with no medical referral (OR 1.79, 95% CI 1.24 to 2.39, $p<0.01$) ⁽¹¹⁾. However, participants with cardiovascular disease were more likely to engage than participants with mental health problems (OR 0.33, 95% CI 0.27 to 0.57, $p<0.01$), musculoskeletal problems (OR 0.75, 95% CI 0.58 to 0.99, $p<0.05$), or overweight/obesity problems (OR 0.63, 95% CI 0.50 to 0.81, $p<0.01$). Overweight or obese participants were more likely to take-up ERS than smokers ⁽¹¹⁾. Referral uptake to ERS was greater for participants referred from a cardiac nurse over those referred from either a general practitioner or practice nurse ⁽¹¹⁾.

Attendance and Adherence

The most important finding from the reviews, was a lack of reporting on exercise prescription adherence. No review detailed the type of exercise prescribed or the extent to which the participant adhered to the prescription. Reviews did report the term adherence, however, it must be understood that this term was a reference to attendance at the programme. As such, the term adherence from the original reviews is replaced by the more appropriate term of attendance in the current manuscript. Large inconsistencies were observed surrounding attendance figures. Four studies failed to define attendance by determining a threshold, instead acknowledging the term as, 'duration of participation within ERS' ^(9, 10, 14, 15). Pavey and colleagues used a threshold of $\geq 75\%$ attendance of available sessions within an ERS programmes as its inclusion criteria for studies ^(11, 12). Objective measures, such as the use of leisure centre records, were underutilised ⁽⁹⁾.

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One high quality and one medium quality review, based upon the same initial systematic search, reported that males were more likely to attend from two studies, while three further studies within the reviews found no such association with attendance ^(11, 12). A further low quality review reported attendance was higher in males ⁽⁹⁾. Their review did report one primary study citing higher attendance in women and two RCT's finding no relationship between sexes ⁽⁹⁾. Increasing age was positively associated with attendance to ERS from five studies in one review, however, it additionally reported two studies suggesting no such relationship ⁽¹¹⁾. Gidlow et al. ⁽⁹⁾ reported two evaluations indicating increasing age and being retired were associated with better attendance. However, increasing age was found to reduce participation in PA from one RCT and one evaluation, while one RCT reported no relationship ⁽⁹⁾. One medium quality review adds to these mixed views surrounding increasing age by reporting that attendance appeared to be higher in older participants ⁽¹⁶⁾. Increasing attendance was more prevalent in participants who had higher baseline activity levels and were overweight ⁽¹⁶⁾. Gidlow et al. ⁽⁹⁾ reported one study, which indicated that socioeconomic characteristics were unrelated to attendance. One high and one medium quality review indicated that socioeconomic characteristics were poorly reported, preventing any clear conclusions on the impact of different socioeconomic characteristics ^(16, 18).

One review acknowledged that a medical diagnosis was a factor that could affect attendance, however they reported it was not consistently demonstrated throughout their included studies ⁽⁹⁾. Participants with cardiovascular disease were more likely to attend than participants with pulmonary disease ⁽¹¹⁾. Physical health problems were a greater predictor of attendance than mental health issues (22% vs 34%, $p < 0.001$), however it was not reported what was defined as a physical health problem ⁽¹¹⁾. Diabetic participants were less likely to attend ERS (OR 0.76, 95% CI 0.63 to 0.93, $p < 0.01$) than those with cardiovascular disease ⁽¹¹⁾. Conversely, a medium quality review reported that participants referred with sedentary lifestyles or diabetes demonstrated a higher adherence than those with cardiovascular disease or obesity ⁽¹⁵⁾. A high quality review reported no consistent

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241 difference in attendance rates between participants within one of three at-risk groups: smoking,
242 obesity and hypertension ⁽¹⁴⁾.

243 One high quality review identified seventeen studies which highlighted peer support and supervision
244 support from staff as a facilitator for attendance to the referral programme ⁽²⁾. Barriers to
245 attendance were noted as: the location (distance to travel); difficulties reaching the activities by
246 public transport; perceived safety of the location; timings of sessions; and cost ⁽²⁾. A medium quality
247 review indicated that European programmes had greater attendance over American, Australian or
248 Canadian programmes ⁽¹⁵⁾. A meta-regression shows the duration of an ERS programme is not
249 correlated to the attendance rate ⁽¹⁵⁾. However, a follow up period greater than six months, after the
250 cessation of the programme, did have a positive effect on attendance when the scheme was running
251 ⁽¹⁵⁾.

252 ***Behaviour Change Techniques***

253 High quality evidence from two reviews of randomised controlled trials ^(13, 18) showed that the
254 transtheoretical model of behaviour change was the most frequently utilised underlying theory of
255 intervention design, while social cognitive theory, theory of planned behaviour, and health belief
256 model were used less. One low quality review ⁽¹⁹⁾ that did not directly report on any theoretical
257 underpinnings, suggested that schemes should consider implementing theory driven approaches to
258 behaviour change. One medium ⁽¹⁰⁾ and one high ⁽¹¹⁾ quality review commented that the greatest
259 challenge for ERS was in increasing uptake and improving attendance ^(10, 11). One review reported
260 directly on how attendance were affected by theoretical techniques ⁽¹⁶⁾. Four reviews reported on
261 theoretical techniques to increase PA time or clinical markers ^(12, 13, 14, 18). With the exception of a few
262 primary studies, reviews reported little reference to the delivery, fidelity, or BCT's of health
263 behaviour change ^(10, 12, 13, 14, 18). Motivational interviewing was the most frequently utilised BCT, cited
264 within eight reviews ^(9, 10, 12, 13, 14, 16, 18, 19), with only one review indicating the fidelity of the technique
265 ⁽¹⁴⁾. One medium quality review reporting upon on a primary study, report that participants who

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received motivational interviewing combined with free vouchers had a greater self-reported physical activity score at 12 weeks, than a control group given advice alone (all groups combined, $P < 0.001$)⁽¹⁶⁾. The greatest increase in PA was observed in the intensive motivational interviewing and free vouchers group which offered six motivational interviewing sessions (55%, $P < 0.001$). No difference was evident at one year post-intervention between groups⁽¹⁶⁾. Morgan⁽¹⁶⁾ further reported that exercise-plus-motivation vs exercise-only elicited a greater attendance over a 20 week programme (62% vs 38%, $P < 0.05$). A further primary study reported that there was no significant difference between three groups attending sessions when comparing, exercise alone, instructions based on the 'relapse prevention' model, or sessions that included re-enforcement methods (prizes for high attendance). Attendance attrition was reported at 30% and 72% for all groups at 9 and 18 weeks, respectively⁽¹⁶⁾. One high quality review indicated that motivational interviewing was utilised predominantly by different practitioners but provides no indication of its impact⁽¹⁸⁾. A high quality review reported two contrasting studies; one indicated that attendance was positively influenced by participant levels of self-determination, and one study found no association between these parameters⁽¹²⁾. A medium quality review reported participant dissatisfaction when lacking social support, or with an exercise leader lacking motivational skills⁽¹⁰⁾.

Discussion

This review is the first to systematically identify, collate, and grade the evidence from review level findings on ERS. The creation of this review highlights and summarises the consistent and contradictory findings surrounding the reporting of: 1) uptake to ERS; 2) attendance and adherence to ERS; and 3) BCT's relating to attendance and adherence. We discuss the characteristics of studies and definitions used within them and how they affect uptake, attendance and adherence. We highlight how a lack of reporting and knowledge of what is delivered within ERS limits our insight into both attendance rates and adherence to the prescribed programme. Where reported, considerations are made as to why participants with certain characteristics (e.g. medical referral) are more likely to take up and attend schemes. Lastly, we discuss the reporting of theoretical constructs

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292 and BCT's, proposing reporting tools that could be considered to help improve uptake and
293 attendance.

294 **Referral uptake**

295 Historically, through the reviews, it is reported that uptake of ERS sits around 60-70% of those
296 referred. This suggests that no improvements have been made in increasing the number of
297 participants starting a scheme over the years examined. Uptake to ERS was greater in randomised
298 controlled trials than observational evaluations, as reported in Table 4. Explanation for this could
299 centre on participants offering full consent, coupled with more stringent recruitment processes
300 often excluding participants, which might have elicited higher commitment to the programme ^(33, 34).
301 Importantly, no review reported detailed characteristics of participants who are referred, but fail to
302 make contact with an ERS. Instead, reviews have commented upon uptake figures from those who
303 start a scheme. While this review cannot comment on the research priorities of previous reviews or
304 individual studies, we suggest that this reflects a crucial gap in understanding within the primary
305 data. It is important to this review to question why this gap exists, because if large sub groups of the
306 population are not taking up a referral they cannot benefit from the programme.

307 Reviews have attempted to unpick participant referral characteristics, for example, there have been
308 suggestions that participants referred for a medical reason may show greater referral uptake
309 compared to those with no specific referral ⁽¹¹⁾, however, most reviews are less clear on such a
310 hierarchy of take up. Referral to ERS from a cardiac nurse appears more effective than referral from
311 any other health professional ⁽¹¹⁾, from which it could be inferred that the hospitalisation
312 surrounding the condition has served as a teachable moment. 'Teachable moments' have been
313 described within health behaviour as a noticeable feature of a patient's circumstance which prompts
314 a change of behaviour ⁽³⁵⁾. These opportunities are utilised within the patient-clinician interaction or
315 by patients alone to foster positive health behaviours, such as increasing physical activity levels ^{(35,}
316 ³⁶⁾. It is important to acknowledge that teachable moments do not occur within isolated situations.

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317 Systemic features, such as the expectations of those involved, communication skills of the health
318 practitioner, and medical practice setting will influence the situation ⁽³⁶⁾.

319 Reviews have indicated participant profiling is varied and this lack of information on subgroups
320 prevents any inference being drawn about who ERS is best suited for. Pampel et al. ⁽³⁷⁾ comment that
321 low socioeconomic status groups have fewer opportunities to engage in services that promote good
322 health, yet the picture is not clear in ERS. For example, Pavey et al. ⁽¹¹⁾ have shown participants who
323 had a medical referral coupled with a low socioeconomic status were more likely to take up ERS over
324 participants with a higher economic status, but this was only within participants with a respiratory
325 diagnosis. Further reviews ^(16, 18) suggest that insufficient reporting of socioeconomic status within
326 ERS prevents any conclusions being reached.. The complexity of uptake of ERS, insufficient reporting
327 within ERS ^(16, 18) coupled with a lack of clear guidance within the socioeconomic and health
328 behaviour literature ⁽³⁷⁾ means it is very difficult to produce generalizable statements surrounding
329 the socioeconomic status and take up of ERS.

330 **Adherence and Attendance**

331 In contrast to uptake, attendance figures across reviews appear greater within observational studies.
332 Interpretation of attendance and completion rates should be treated cautiously due to a lack of a
333 standardised protocol (i.e. objective, standardised, universally consistent measure of attendance) for
334 reporting these figures across the literature. The lack of a standardised measure-surrounding
335 attendance could see participants being classified as completing a scheme ⁽¹²⁾, while the reality may
336 be attendance at a couple of sessions and attendance at the final exit session of the scheme. This
337 invites questions as to why there is no standardized use of an objective count for attendance, since
338 all outcomes of ERS are dependent upon attendance at, and adherence to the programme ⁽⁹⁾. The
339 review by Pavey et al. ⁽¹¹⁾ concluded that the number of exercise sessions made available within a
340 scheme might elicit higher rates of attendance. Meanwhile Arsenijevic and Groot ⁽¹⁵⁾ reported that
341 attendance rates were not correlated to the duration of the programme. Additionally, they report

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that a prolonged follow up with increased contact time with researchers and exercise practitioners post ERS could offer explanations to why attendance was greater during the programme ⁽¹⁵⁾. This in itself is suggestive that observational studies may reflect the true nature of ERS ⁽¹¹⁾.

While uptake to ERS was reported to be slightly higher in females, overall, males were more likely to participate within a programme ^(9, 11, 12). However, various primary studies within these reviews found no association between gender and attendance. This review questions why there is such a poor base level of reporting with only three reviews, of which two reviews are based upon the same study search criteria ^(11, 12), reporting on gender characteristics and referral uptake ^(9, 11, 12). The present review does highlight a greater number of reviews reporting upon medical conditions and the impact they have upon attendance. Despite this greater breadth of reporting, no clear consensus can be reached, with reviews reporting no difference in attendance between at risk groups ⁽¹⁴⁾; either participants with cardiovascular disease were more likely to attend ⁽¹¹⁾; or conversely participants with cardiovascular disease were less likely to attend ⁽¹⁵⁾.

Inference on reporting of attendance figures could be suggestive of at least two aspects of ERS. First, it could suggest a referral process where the wrong participants are being referred into the system. Resolution of this could be gained through a clearer and more robust understanding of who is referred to ERS ⁽⁹⁾. Second, it could reflect a lack of knowledge of what participants adhere to within the programme. With no understanding of what is delivered within a programme, from an exercise prescription standpoint, and no reporting on the extent to which individuals adhere to the prescription, few conclusions can be drawn about the effectiveness of the scheme. It is important to question why this gap exists, because if sub groups of the population are not completing the prescribed programme then they clearly cannot benefit from the programme. It is important to acknowledge that participants will stand to benefit from any episode of PA completed, regardless of meeting the prescribed dose. However, it is important to know and understand the frequency, intensity, type, and time (FITT) of prescribed exercise in these programmes, but this is not commonly

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recorded or reported. Knowledge of the prescribed dose could help to understand if it is too demanding, thus leading to participant drop out, or insufficiently demanding to engage participants or provide a clinical benefit. Development of the Consensus on Exercise Reporting Template allows detailed and explicit reporting of the delivery of ERS for policy makers and practitioners alike ⁽²²⁾. Implementation of the Consensus on Exercise Reporting Template will further enhance the knowledge base and understanding for whom prescribed exercise is beneficial. Ultimately, it must be understood that both attendance and adherence are multidimensional constructs affected by the relationship between participant and practitioner intertwined with participant centric factors (e.g. mood state, self-efficacy, time and forgetfulness) ⁽²²⁾ and potentially exercise prescription centric factors (e.g. frequency, intensity, time and type of prescription).

Behaviour Change Techniques

Development of ERS was based upon policy recommendations rather than theoretical guidelines developed for health promotion interventions ⁽¹⁵⁾. Riddoch, Puig-Ribera and Cooper ⁽¹⁷⁾ reported that early ERS's were not based upon any behaviour change model. Failure to acknowledge, deliver or evaluate behaviour change models during a programme prevents clear evaluation of the ERS. More often, the end point (e.g. PA levels, blood glucose concentration, attendance and adherence levels) is the result of behaviour change. Evaluating and reporting interventions on outcomes alone is problematic with an array of influences that could determine the path between behaviour and outcome ⁽³⁸⁾. This is evident within the literature where success of ERS is judged as the outcome evaluation without taking into consideration the methods underpinning it, such as BCT utilised to motivate uptake or increase attendance levels to ERS or the quality of those delivering these BCT's. Theories of behaviour change provide a validated framework to understand not only how behaviour changed, but importantly why behaviour changed ⁽³⁹⁾. A review by Dombrowski et al. ⁽³⁹⁾ found that the delivery and features of behaviour change techniques was heterogeneous in nature. Additionally, a later review reported 44% of interventions did not report use of a theoretical

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framework⁽⁴⁰⁾. This lack of reporting within both reviews of ERS and the wider field of health behaviour prevents any clear guidance upon which theory or BCT, or how it is operationalized, is most effective to understand health behaviour, and health behaviour change⁽⁴⁰⁾.

In the present review we have highlighted how uptake of ERS and attendance at ERS could be influenced by participant characteristics or external factors. Whilst factors such as that of socioeconomic status and teachable moments, have been discussed, a further consideration would be the theoretical perceived risk. The health belief model and the common-sense model hypothesise that perceived severity combined with perceived susceptibility and external cues to actions are strong contributing factors within an individual's perception of threat^(41, 42). While our review cannot comment upon direct causality to why individuals with certain medical conditions have a greater uptake or attendance rate, we can stress the importance of trying to understand these factors. This understanding comes from the ability to record, report and evaluate these perceptions. Tools such as the Illness Perception Questionnaire - allow for a greater understanding of what an individual perceives of their condition⁽⁴³⁾. The brief Illness Perception Questionnaire has been shown as a valid and reliable measure of illness perception distinguishing between various illness groups and importantly for ERS, is a predictor of attendance at cardiac rehabilitation classes⁽⁴³⁾. Incorporation of tools such as the Illness Perception Questionnaire seem essential to trying to understand theoretical factors or BCT's impacting upon ERS uptake or attendance.

In line with Prestwich et al.⁽⁴⁰⁾, we report that the transtheoretical model of behaviour change and social cognitive theory, alongside BCT's such as motivational interviewing, are used, but ultimately are underutilised tools. Fundamentally, the lack of theoretical reporting within ERS generates more questions than it solves. Is the lack of reporting due to there being a lack of delivery or, more an inability to efficiently test and report its delivery? Without assessing any possible association between the BCT's in conjunction with the theory they are based within, we are unable to further our understanding of possible effects⁽³⁹⁾. The reporting of an intervention's BCT and delivery (e.g.

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duration, intensity, setting, group vs individual, verbal vs written and the skill level of the practitioner deliverers)⁽³⁹⁾ is imperative if we are to understand which techniques are appropriate within ERS for improving uptake and attendance.

Implications for practice and policy

This review highlights the need for consistent reporting methods to be implemented within ERS. The ability to robustly detail participant characteristics from the point of referral to exiting the scheme (at any stage) will only enhance the understanding of the ERS process. The ability to gain an understanding of what is being delivered at a theoretical level (e.g. BCT's, such as goal setting or relapse prevention and the delivery process of these BCT's) and physical activity level (e.g. frequency, intensity, type and time) would allow strong associations to be attributed, or not, to these features, notably for understanding levels of attendance and adherence. Failure to have these fundamentals in order places increased pressure upon ERS, notably when the National Institute for Health and Care Excellence⁽⁴⁾ are highlighting the scarce evidence of effectiveness for ERS schemes. The use of tools such as the Consensus on Exercise Reporting Template, Illness Perception Questionnaire or behaviour change taxonomies will further help to understand how and why behaviour changed within programmes. Greater understanding at any level will benefit stakeholders, health practitioners and participants alike, by providing individualised care pathways, in achieving the most effective results from stretched resources and improving programme implementation and viability.

Strengths and limitations.

This is the first systematic review of reviews focusing on ERS. By taking an overarching view of all the reviews we have been able to highlight key areas that require exploration to inform future evaluation of ERS. However, due to the nature of reviewing systematic reviews, we are unable to explore and provide detailed in-depth mechanistic knowledge surrounding ERS effectiveness. Additional problems arise for evidence reporting namely around AMSTAR grading. While AMSTAR

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has been shown to demonstrate good psychometric properties, it was developed after four of the included reviews had been published. Subsequently two of these reviews were classified as low quality yet they provide vital insights into ERS. Whilst this review of reviews examined 11 systematic reviews, which in turn sourced 221 citations, 44% of citations were duplicated across reviews reducing the breadth of data available. While this review draws attention to tools such as the Illness Perception Questionnaire to assess a participant’s perception towards their illness, this review is unable to address participant’s perspectives towards ERS. This is impart due to the scope of this review. We acknowledge primary studies that have provided qualitative insight towards participant perspectives of ERS ^(3, 44); however, there exists a knowledge gap in utilising this for implementation refinement of ERS.

Directions for future research

Research should work hand-in-hand with practice and policy makers, in the first instance, to facilitate robust participant profiling: 1) to capture data on individuals referred but not taking up the referral to help reduce health inequalities; 2) to generate a consensus on monitoring attendance and adherence to ERS with objective measures for reporting it; and 3) to incorporate explicit reporting of BCT’s and what they are being used for. With a consistent and coherent basis for reporting, future evaluations and RCT interventions will be able to explore a multitude of potential interventions, safe in the knowledge they are grounded within consistent reporting, allowing for direct comparison between schemes. Greater research is needed surrounding ERS programme content. The very nature of ERS referral is for participants with lifestyle disease, yet only small to moderate clinical improvements have been shown within the literature. The use of tools such as the Consensus on Exercise Reporting Template will help drive research on frequency, intensity, and type of PA delivered within programmes. Tools such as the Illness Perception Questionnaire have the potential to build greater understanding of whether individuals are potential candidates for referral to ERS or not and perhaps leading to a more efficient uptake process. These tools may help in understanding who and what specifically, contributes to each part of the complexity surrounding ERS. Should

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interventions be focused upon deliverers, the content and its delivery methods within the scheme; or would research be better utilised in understanding behaviour change towards ERS. Further research is required to establish methods that address the challenging nature of measuring BCT within ecological valid environments, such as ERS. Other research may be able to track participants over the long-term, reporting on future primary care or hospital admissions with the ability to link it back to ERS data. While the potential for future research is hypothesised here, it is fundamentally reliant on robust, clear, standardised and explicit reporting.

Conclusions

Exercise referral schemes benefit from not being constrained within a rigid framework, allowing a varied spectrum of delivery. However, it would appear this currently may also be detrimental in understanding what works, why and for whom. Complex interventions such as ERS, which involves multiple input from various health practitioners, requires robust and consistent recording and reporting of all its facets at every stage of the process. ERS outcomes which are often judged in terms of increased physical activity, are subject to multiple, separate and complex constructs along the way. We have reported that uptake levels to schemes have not changed and are potentially influenced by a variety of participant characteristics. Importantly, there is a requirement to know who the people are that are not taking up referral and thus missing the opportunity to potentially benefit from ERS. We have identified that attendance within schemes is potentially influenced by both participant characteristics and scheme definition. Critically there is no knowledge or reporting to-date on what participants adhere to within ERS. We have also highlighted that BCT's are poorly reported, preventing any knowledge of how and why change may have occurred. Failure to robustly produce effective reporting methods or have a clear scheme wide consensus prevents any firm conclusions on causal effect. Ultimately, a lack of reporting prevents any research from accurately validating its hypothesis⁽⁴⁵⁾ and within the construct of this review, assigning a true reflection on the effectiveness of ERS.

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630 **Tables**

Table 1 Inclusion and Exclusion criteria used in collating Systematic reviews inclusion.

1.	Not in English language	Due to lack of translation facilities, all non-English papers were excluded.
2.	Type of study	Systematic reviews (which included RCTs, observational studies, case-controlled or other quasi-experimental studies within them) and meta-analysis were included for review.
3.	Type of Intervention	Interventions promoting changes in physical activity behaviour via a direct referral from a health practitioner within primary care to a recognised exercise programme (e.g. local leisure centre, local walking scheme). Interventions initiated from secondary care and beyond were excluded alongside any health screening programmes.
4.	Type of Participants	Adults (16 years and over) of any gender who had been diagnosed or placed at risk of non-communicable disease (e.g. type 2 diabetes, hypertension, cardiovascular disease) from their primary care practitioner. Interventions where participants were sedentary but had no further risk factors but were used as a control groups where included if reported separately.
5.	Outcomes	Reviews were selected where the primary outcome measures reported were increase in physical activity (e.g. frequency, intensity) uptake and adherence to schemes, physiological and psychological (e.g. changes in Body Mass Index or Short Form (36) health survey). Outcomes could be measured objectively (e.g. with accelerometers) or by self-reported means (e.g. questionnaires). Where reported the cost effectiveness of

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schemes was included.

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Table 2 Classification of strength based upon evidence included within reviews.

A	Systematic Reviews of RCTs
B	Systematic reviews of individual, non-RCTs, case-control studies, cohort studies, controlled before-and-after (CBA), correlation studies or similar.
C	Systematic reviews of both RCTs and non-RCTs, case-control studies, cohort studies, controlled before-and-after (CBA), correlation studies or similar.

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Table 3 Total and mean AMSTAR scoring, classification of strength based upon evidence included within reviews and Cohen’s Kappa for inter-rate reliability.

Review lead author and year	Reviewer	Total AMSTAR score	Mean AMSTAR score	Evidence classification	Inter-rate reliability
Arsenijevic et al., 2017	CS	6	7	C	0.62
	SG	8			
Campbell et al., 2015	CS	9	9	C	0.39
	SG	9			
Gidlow et al., 2005	CS	3	2.5	C	0.74
	SG	2			
Morgan et al., 2016	CS	9	9	C	1
	SG	9			
Morgan, 2005	CS	6	6	A	1
	SG	6			
Orrrow et al., 2012	CS	9	9	A	1
	SG	9			
Pavey et al., 2011a	CS	11	11	C	0
	SG	11			
Pavey et al., 2012	CS	4	5	C	0.49

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	SG	6			
	CS	9			
Pavey et al., 2011b			8.5	A	0.74
	SG	8			
	CS	2			
Sorensen et al., 2006			3.5	C	0.42
	SG	5			
	CS	7			
Williams et al., 2007			7	C	1
	SG	7			

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Table 4 Reported uptake and attendance figures for Observational studies and RCT's where reported within reviews

Review lead author and year	Strength of study	Reported uptake	Reported attendance
Campbell et al., 2015	9C	35-85%	25 - 86%
			for final assessment only
Gidlow et al., 2005	2.5C	< 67%	12 - 25%
Pavey et al., 2011a	11C	Observational studies	Observational studies
		66% (95% CI = 57-75%)	49% (95% CI = 40-59%)
		RCTs	RCTs
		80% (95% CI = 61-98%)	37% (95% CI = 20-54%)

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Pavey et al., 2012	5C	Observational studies	Observational studies
		66% (95% CI = 57-75%)	43% (95% CI = 32-54%)
		RCTs	RCTs
		81% (95% CI = 68-94%)	80% (95% CI = 61-98%)
Williams et al., 2007	7C	66%	12 – 42%

For Peer Review

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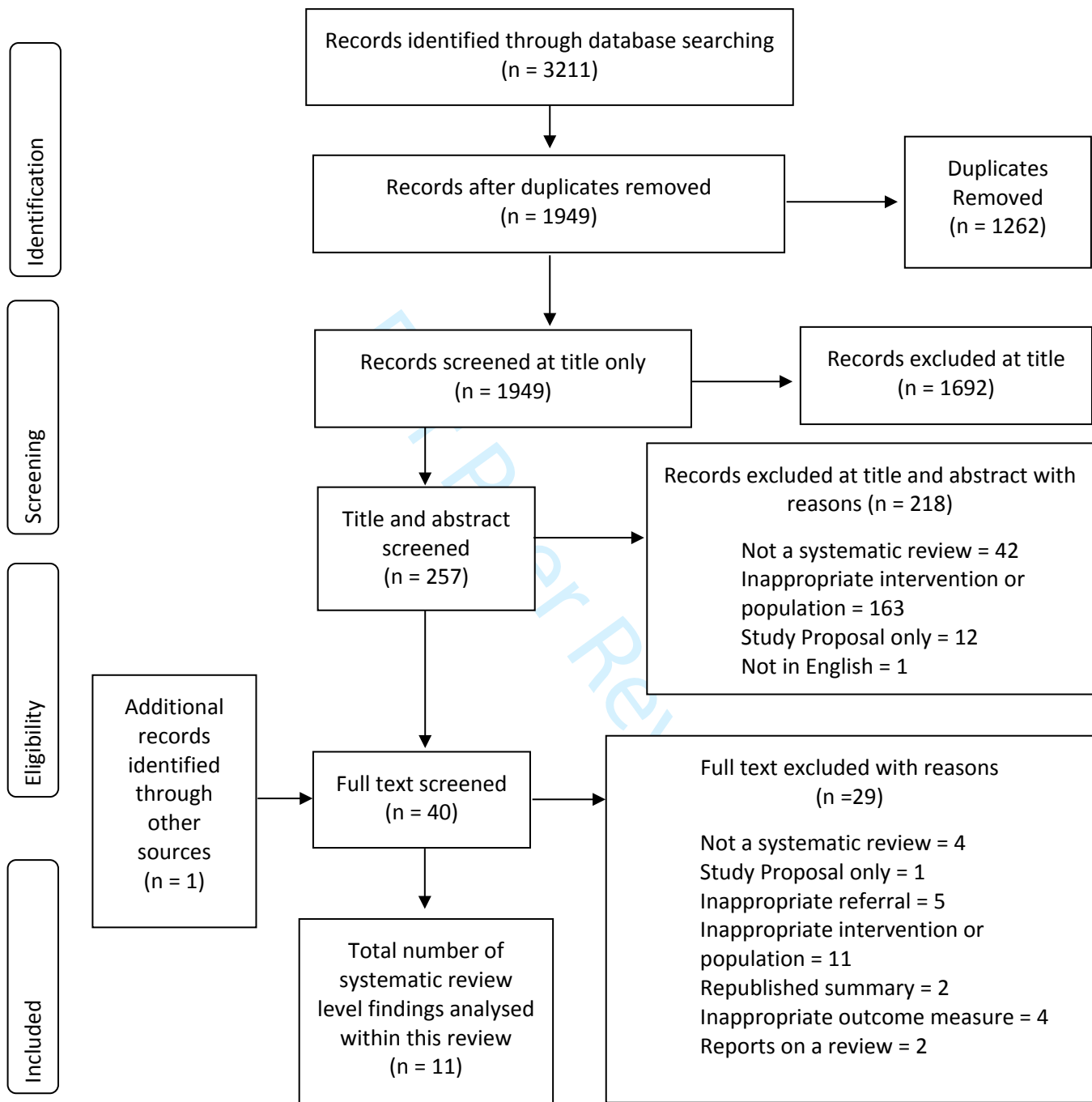


Figure 1. PRISMA flow diagram depicting study selection, screening, eligibility for inclusion and analysis.

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Supplementary data.

Supplementary data 1: Search strategy terms and protocol steps used within Medline database

Step	Search term
1	exp Exercise/
2	exp Exercise Movement Techniques/ or exp Exercise Therapy/
3	exp Sports/
4	exp Motor Activity/
5	exp Physical Exertion/
6	exercis* refer*.af.
7	refer* exer*.af.
8	exerc* prescr*.af.
9	prescr* exerci*.af.
10	(activ* refer* or refer* activ*).af.
11	(presc* activ* or activ* precri*).af.
12	6 or 7 or 8 or 9 or 10 or 11
13	exp Prescriptions/
14	(prescribing or prescribe or prescriptions).af.
15	13 or 14
16	or/1-5
17	15 and 16
18	12 or 17
19	limit 18 to english language
20	(metaanal: or meta-anal:).af.
21	exp Meta-Analysis/
22	20 or 21
23	limit 19 to meta analysis
24	19 and 22
25	23 or 24
26	(systematic* review* or review* systematic*).af.
27	limit 19 to systematic reviews
28	19 and 26
29	27 or 28
30	systematic review*.af.
31	19 and 30
32	27 and 31
33	29 not 25
34	25 or 29 or 33

Supplementary data 2: Eleven predefined constructs used as an extraction tool and relating to the reporting effectiveness of reviews

1	Aim of Review
2	Theoretical basis (any stated theory)
3	Behaviour change technique (goal setting, problem solving)
4	location(s) or setting where the intervention occurred (local leisure centre, green spaces)
5	Intervention provider (should always be 3 rd party exercise provider as part of ERS)
6	Frequency of intervention (period of time including the number of sessions, their schedule, and their duration, intensity (if mentioned in initial studies or current review))
7	Mode of delivery (group, individual, supervised)
8	Characteristics of the participants (sex, disease or risk state)
9	Amount of studies within the review
10	Number of participants within the review / Sample sizes
11	Cost effectiveness if mentioned

Supplementary data 3: Key characteristics of included systematic reviews

Review lead author and year											
Characteristics of reviews	Arsenijevic et al., 2017	Campbell et al., 2015	Gidlow et al., 2005	Morgan et al., 2016	Morgan, 2005	Orrow et al., 2012	Pavey et al., 2011a	Pavey et al., 2012	Pavey et al., 2011b	Sorensen et al., 2006	Williams et al., 2007
Type of review performed and its search period											
Descriptive	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Meta-analysis	✓	✓				✓	✓	✓	✓		✓
Economic Evaluation		✓					✓				
Date period searched	2000 onwards	October 2009 – June 2013	Origin - 2003	1995 – June 2015	1966 - 2002	Origin - May 2009	1990 – October 2009	Origin - October 2009	Origin - October 2009	1980 – June 2005	Origin – March 2007
Objectives and outcomes markers of review											
Overall effectiveness (increase of PA levels)	✓			✓	✓	✓			✓	✓	✓
Clinical effectiveness		✓					✓		✓		
Cost effectiveness		✓					✓			✓	
Uptake to ERS							✓	✓			
Attendance or completion of ERS			✓	✓			✓	✓			✓
Implementation / design ERS	✓									✓	
Reported inclusion criteria of reviews											

Any study design considered	✓				✓		✓	✓	✓		✓
RCT only						✓					
Males and females ≥ 18	✓	✓		19 ≥		16 ≥					
Peer reviewed and published in English	✓		✓							✓	
Referral from primary care to improve clinical outcomes or physical activity levels			✓	✓	✓	✓		✓	✓	✓	✓
Programme designs more intensive than advice alone		✓					✓			✓	
UK based studies			✓								

Supplementary data 4: Protocol to undertake systematic review of reviews.

Insufficient Reporting of Factors Associated with Exercise Referral Scheme Uptake, Attendance and Adherence: A Systematic Review of Reviews (Protocol)

Review Question

1) Describe definitions, rates, and participant characteristics associated with ERS uptake; 2) to describe definitions, rates, and participant characteristics associated with attendance at and adherence to ERS schemes; and 3) to describe theoretically informed approaches associated with ERS uptake and attendance.

Searches

We will systematically search the Databases:

- CINHAL, Medline, Embase, Cochrane Library, SportsDiscus, PsychInfo, SCOPUS, HMIC, AMED, Public Health Database, ASSIA, CRD databases, Prospero, Web of Knowledge, Campbell Collaboration Library and PubMed.

We will perform additional non-systematic searches of UpToDate, BMJ Best Practice and Dynamed.

We will hand search reference lists of included articles for additional material. The searches will be restricted to English language, reviews published within peer viewed journals, and with no date restrictions.

Type of Study to be included

We will include systematic reviews that themselves have reviewed RCTs, observational studies, case-controlled or other experimental studies and meta-analysis.

Condition or domain being studied

Exercise referral schemes. Commonly used terms within the literature are 'Exercise on Prescription' and 'GP Referral', which we will also be search for to ensure no data is missed.

Participants/population

Inclusion: We will search for adults (18 years and over) of any gender who had been diagnosed or considered at risk of non-communicable disease (e.g. type 2 diabetes, hypertension, cardiovascular disease) by their primary care practitioner. Interventions that use participants that were sedentary with no further risk factors of non-communicable disease, but are used as a control groups will be included if reported separately.

Exclusion: We will exclude youths and children.

Intervention(s), exposure(s)

Inclusion: We will include systematic reviews that have reviewed interventions known as 'exercise referral', 'GP referral', or 'exercise on prescription'. Interventions promoting changes in physical activity behaviour via a direct referral from a health practitioner within primary care to a recognised exercise programme.

Exclusion: We will exclude reviews that report on interventions initiated from secondary care or are health-screening programmes.

Primary outcomes

- Define rates and participant characteristics associated with ERS uptake.
- Define rates and participant characteristics associated with attendance at, and, adherence to, ERS schemes.
- Report theoretically informed approaches associated with ERS uptake and attendance.

Secondary outcomes

- Establish what key features of ERS reporting go relatively under-reported.

Data extraction (selection and coding)

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement will guide the conduct of the narrative of the review of reviews. Results of the search strategy will be

screened for duplicates by one researcher, with duplicates being removed. One author will independently examine titles and abstracts against the inclusion and exclusion criteria. Three authors will independently assess a randomised sub sample of papers, amounting to 20% of the total title and abstract sample. A group consensus will decide which papers will be progressed further to full text review and which to exclude. Full text review articles will be obtained and assessed by two authors against the inclusion and exclusion criteria. We will provide a detailed recording of the selection process, which we will report via a PRISMA flow diagram and 'Characteristics of excluded studies' table.

Data to be extracted:

- Aim of Review / study objectives
- Theoretical basis (any stated theory)
- Behaviour change technique (goal setting, problem solving)
- location(s) or setting where the intervention occurred (local leisure centre, green spaces)
- Intervention provider (should always be 3rd party exercise provider as part of ERS)
- Frequency of intervention (period of time including the number of sessions, their schedule and their duration, intensity (if mentioned in initial studies or current review))
- Mode of delivery (group, individual, supervised)
- Characteristics of the participants (sex, disease or risk state)
- Amount of studies within the review
- Number of participants within the review / sample sizes
- Cost effectiveness if mentioned
- Author name and date
- Reporting of attendance/ adherence rates
- Reporting on non-attenders
- Attendance figures, completion rates
- Key findings from reviews

Risk of bias (quality) assessment

Two authors will grade each review independently and empirically and discuss any discrepancies. We will use The AMSTAR (A Measurement Tool to Assess Systematic Reviews) criteria to grade the reviews. Amstar is based on 11 questions and scores as reviews as follows: low quality (0-3), medium (4-7) and high (8-11). Question within the AMSTAR are as follows:

1. Was an 'a priori' design provided?
2. Was there duplicate study selection and data extraction?
3. Was a comprehensive literature search performed?
4. Was the status of publication (i.e. grey literature) used as an inclusion criterion?
5. Was a list of studies (included and excluded) provided?
6. Were the characteristics of the included studies provided?
7. Was the scientific quality of the included studies assessed and documented?
8. Was the scientific quality of the included studies used appropriately in formulating conclusions?
9. Were the methods used to combine the findings of studies appropriate?
10. Was the likelihood of publication bias assessed?
11. Was the conflict of interest included?

Strategy for data synthesis

A table of results will display the extracted information by study. We will present the findings via a descriptive narrative of the key variables associated with uptake attendance and adherence to exercise referral schemes.