A systematic review and economic evaluation of exercise referral schemes in primary care: a short report

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Scientific summary

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Scientific summary

Background

Clinical effectiveness

There is a considerable body of evidence demonstrating the benefits of physical activity in terms of both treating and preventing diseases. Current recommendations suggest that adults should undertake at least 150 minutes of moderate-intensity activity each week; however, according to the 2008 Health Survey for England (Health Survey for England. *Health Survey for England – 2008: Physical Activity and Fitness*. Leeds: Health and Social Care Information Centre; 2009) only 39% of men and 29% of women achieved these levels.

Interventions to promote increased levels of physical activity require a wide variety of approaches, with each facilitating small increments in behaviour change. These may include interventions targeted at the population level, such as changes in the environment, as well as interventions targeted at the individual level, such as brief advice delivered in primary care. Physical activity can be promoted in primary care in different ways, including delivery of advice, provision of written materials and referral to an exercise programme. The UK has seen an expansion in exercise referral schemes (ERSs) over the past two decades, but there are concerns that these might not produce sustained changes in physical activity beyond the typical programme length of 12 weeks. In 2006, the UK National Institute for Health and Care Excellence (NICE) advised that there was insufficient evidence to recommend the use of ERSs to promote physical activity other than as part of research studies where their effectiveness can be evaluated. Despite this recommendation, the schemes are still widely used.

The NICE guidance *Four commonly used methods to increase physical activity: brief interventions in primary care, exercise referral schemes, pedometers and community-based walking and cycling* (London: NICE; 2006), which included guidance for ERSs, drew on a review of evidence which included four randomised controlled trials (RCTs). An additional four studies have been included in the more recent Pavey *et al.* review [Pavey TG, Anokye N, Taylor AH, Trueman P, Moxham T, Fox KR, *et al.* The clinical effectiveness and cost-effectiveness, of exercise referral scheme: a systematic review and economic evaluation. *Health Technol Assess* 2011;**15**(44)], three of which have been published since 2006.

The scope for this systematic review was to be an update of the Pavey *et al.* systematic review of the evidence. However, this update is more limited than Pavey *et al.* owing to the time and resource constraints of this project. In this update we have not included observational studies to explore issues of adherence and uptake, but we have used the data from the included RCTs and explored explanations given within the papers themselves. We have done this by qualitatively analysing the discussion and conclusion sections of the included trials and, additionally, we identified qualitative studies undertaken as part of a mixed-methods analysis of exercise referral.

Cost-effectiveness

In 2011, Anokye *et al.* (Anokye NK, Trueman P, Green C, Pavey TG, Hillsdon M, Taylor RS, *et al.* The cost-effectiveness of exercise referral schemes. *BMC Public Health* 2011;**11**:954) published the results of a cost-effectiveness model of ERSs based on data from a systematic review of the effectiveness of ERSs by Pavey *et al.* They concluded that ERSs are associated with a modest increase in lifetime costs and benefits and that the cost-effectiveness of ERSs is highly sensitive to small changes in the effectiveness and cost of ERSs and is subject to some significant uncertainty, mainly because of limitations in the clinical effectiveness evidence base.

This model was later amended to inform the NICE public health appraisal of brief advice in primary care to promote physical activity (PH44; Anokye *et al. National Institute for Health and Clinical Excellence Public Health Intervention Guidance on Physical Activity – Brief Advice for Adults in Primary Care: Economic Analysis*. London: NICE; 2012).

The scope for the economic analysis of ERSs for this brief report was to update the Anokye *et al.* (Anokye N, Jones T, Fox-Rushby J. *National Institute for Health and Clinical Excellence Public Health Intervention Guidance Physical Activity: Brief Advice for Adults in Primary Care: Component 2 Economic Analysis. Review of Economic Evidence.* London: NICE; 2012) brief advice model with evidence from an updated systematic review on the effectiveness of ERSs and to update the costs.

Objectives

To undertake a systematic review to re-assess the evidence for ERSs in order to determine clinical effectiveness and estimate cost-effectiveness using a previously developed Markov model.

Methods

Clinical effectiveness

The search strategies used in the Pavey *et al.* systematic review of the evidence were used in this review. Searches were limited by English language and a publication date of October 2009 to May/June 2013. SPORTDiscus was not available to the research team, so Scopus (via Elsevier) was used, and the stage 1 search was conducted in this data source. Key sports and exercise science journals have been covered, as they are indexed in one or more of the databases listed: MEDLINE and MEDLINE In-Process & Other Non-Indexed Citations (via Ovid); EMBASE (via OvidSP); PsycINFO (via OvidSP); Scopus (via Elsevier); The Cochrane Library, including the Cochrane Database of Systematic Reviews (CDSR), Cochrane Central Register of Controlled Trials (CENTRAL), NHS Health Technology Assessment (HTA) Database, NHS Economic Evaluation Database (NHS EED), Database of Abstracts of Reviews of Effects (DARE); Science Citation Index and proceedings and Social Science Citation Index and proceedings (via Web of Science Thomson Institute for Scientific Information), UK Clinical Research Network Study Portfolio database; Current Controlled Trials; and Clinical Trials.gov. The *Journal of Aging and Physical Activity* was found not to be indexed in the databases searched, hence this journal was hand-searched by scanning the electronic table of contents available at http://journals.humankinetics.com/japa-contents (2009–current and in-press articles as of September 2013).

Inclusion/exclusion criteria

Population

Any adult (aged 18 years or over) with or without a medical diagnosis and deemed appropriate for ERSs.

Interventions

The ERS exercise/physical activity programme is required to be more intensive than simple advice and needs to include one or a combination of: counselling (face to face or via telephone); written materials; supervised exercise training.

Comparators

Any control, for example usual (brief) physical activity advice, no intervention, attention control or alternative forms of ERSs.

Outcomes

Physical activity, physical fitness, health outcomes, adverse events and uptake and adherence to ERSs.

Study design

Any new RCT evidence, identified in searches of electronic databases published from October 2009 to May/June 2013. We also included any qualitative studies (sibling studies that were done alongside the RCT as part of a mixed-methods study).

Titles and abstracts were examined for inclusion by two reviewers independently. Disagreement was resolved by consensus. Data were extracted and the data extraction tool was modelled on that used in the Pavey *et al.* review. The Cochrane risk-of-bias tool was used to assess study quality.

Data from new studies published since 2009 were tabulated and discussed in a narrative review. The data from studies already identified and analysed by Pavey *et al.* were used as published, and data from new studies were integrated with them. Meta-analyses were used to estimate a summary measure of effect on relevant outcomes based on intention-to-treat (ITT) analyses. These meta-analyses used data published in the Pavey *et al.* review, and new data were added.

In order to extend our understanding of the factors that predict uptake and adherence, we undertook a qualitative thematic analysis of the discussion and conclusion sections of the included RCTs. The terms 'adherence' and 'uptake' can be used variably within the literature. 'Uptake' refers to initial attendance, take up or enrolment. 'Adherence' describes the level and duration of participation, and the threshold for determining adherence may vary in different studies (Tobi P, Estacio EV, Yu G, Renton A, Foster N. Who stays, who drops out? Biosocial predictors of longer-term adherence in participants attending an exercise referral scheme in the UK. *BMC Public Health* 2012;**12**:347). The results were described in a narrative, and a logic model was used to explore and explain associations between multiple and varied barriers and facilitators to uptake and adherence of ERSs.

Cost-effectiveness

The cost-effectiveness model used to inform NICE PH44 (Anokye N, Jones T, Fox-Rushby J. *National Institute for Health and Clinical Excellence Public Health Intervention Guidance Physical Activity: Brief Advice for Adults in Primary Care: Component 2 Economic Analysis. Review of Economic Evidence.* London: NICE; 2012) was updated with evidence from the updated systematic review on the effectiveness of ERSs and the costs were uplifted to 2013. The model has a Markov structure and considers a cohort of 100,000 individuals aged 50 years who present in a physically inactive state and are given a referral to a service designed to increase physical activity that includes a physical activity or exercise programme compared with a control group with no referral to an exercise service. The age of the population was selected to reflect the populations enrolled in the studies providing evidence on the effectiveness of ERS. The model estimates the likelihood of becoming physically active and the consequent risk reduction this has on coronary heart disease (CHD), stroke and type 2 diabetes mellitus.

A lifetime horizon has been adopted to acknowledge the long-term benefits of physical activity. The economic perspective of the model is the NHS and Personal and Social Services (PSS) in the UK. Costs and health benefits were discounted at an annual rate of 1.5% as recommended by the NICE guide to the methods of technology appraisal.

Results

Clinical effectiveness

Our search of electronic databases and searching relevant journals yielded 9627 titles, of which one primary study was judged to meet the inclusion criteria. This study was a mixed-methods evaluation, incorporating RCT and qualitative evidence, undertaken in Wales. It was larger than previous studies, with 2160 participants. Earlier studies ranged in size from 52 to 943 participants. The total number of participants in all eight studies was 5190. Three studies were judged to be at moderate overall risk of bias and five to be at low overall risk of bias.

Referral to ERS was in most instances made by the general practitioner. In four of the studies, referral was made because of an individual's health risk that could be attenuated by increased levels of physical activity, most commonly risk of CHD. In the other four studies, patients were referred on the basis of being sedentary. Uptake, that is, the initial attendance, take up or enrolment following referral ranged from 35% to 100% in the included studies. Adherence, that is, continued participation in the scheme, ranged from 21.5% to 86%. Some suggested barriers included the lack of a specific appointment at invitation. Lack of private transport and deprivation were barriers to uptake and adherence. Older participants, and those referred for non-weight-related CHD risk factors and those already moderately active at baseline, were most likely to complete the programme.

The most consistently reported physical activity outcome across studies was the proportion of individual achieving 90–150 minutes of at least moderate-intensity activity per week. When pooled across studies the relative risk (RR) was 1.12 [95% confidence interval (CI) 1.04 to 1.20] of achieving this outcome with ERSs compared with usual care at 6–12 months' follow-up. These results show a decrease in the RR found by Pavey *et al.* [RR 1.16 (95% CI 1.03 to 1.30)]. In the pooled ITT analyses, the proportion achieving the physical activity threshold in the ERS group compared with usual care was RR 1.08 (95% CI 1.00 to 1.17). This is also a reduction on the RR found by Pavey *et al.* (1.11, 95% CI 0.99 to 1.25).

When the total minutes of physical activity data were pooled, there was a significant increase in the number of minutes of physical activity per week in the ERS group (mean difference 55.10 minutes, (95% CI 18.47 to 91.73 minutes).

Examining subgroups, Murphy *et al.* (Murphy SM, Edwards RT, Williams N, Raisanen L, Moore G, Linck P, *et al.* An evaluation of the effectiveness and cost effectiveness of the National Exercise Referral Scheme in Wales, UK: a randomised controlled trial of a public health policy initiative. *J Epidemiol Community Health* 2012;**66**:745–53) reported that referral and participation in ERSs increased physical activity significantly for those referred for CHD risk factors [odds ratio (OR) 1.29, 95% CI 1.04 to 1.60). However, among those referred for mental health reasons, either solely or in combination with CHD, there was no difference in physical activity between the ERS and normal-care participants at 12 months' follow-up. The effect of being in the ERS group on all referrals was an increase in levels of physical activity at 12 months, but this finding was of borderline statistical significance (OR 1.19, 95% CI 0.99 to 1.43).

Cost-effectiveness

Exercise referral gained 0.003 quality-adjusted life-years (QALYs) at an additional cost of £225 per person. The estimate for the mean incremental cost-effectiveness ratio (ICER) in the probabilistic sensitivity analysis (PSA) was £76,276.

All of the PSA estimates show an incremental gain in both costs and QALYs; however, there is reasonable uncertainty in the magnitude of that cost and QALY gain. The probability that ERSs are cost-effective at a willingness-to-pay threshold of £30,000 per QALY gained is only 0.004.

In the univariate sensitivity analysis the results were very sensitive to increases in the effect of ERSs on physical activity uptake, the protective effect of physical activity and the process utility gains (short-term improvements in health-related quality of life) associated with increased physical activity. Small changes in these parameters led to ICERs close to £30,000 per QALY gained. Conversely, sensitivity analyses that applied more conservative assumptions on efficacy, duration of protective effect and process utility gain resulted in ICERs over £100,000 per QALY.

Discussion

Clinical effectiveness

There is evidence that ERSs can lead to improvements in self-reported levels of physical activity when compared with receiving advice only. Increasing age is a factor that appears to support uptake and adherence to ERSs, as is a greater level of physical activity at baseline. There is some evidence that, for patients referred with CHD risk factors, there is more likelihood of increases in levels of physical activity. It is not possible to identify what elements of the intervention support successful uptake of ERSs, adherence to ERSs and long-term behaviour change. Qualitative evidence suggests that interventions that enable the development of social support networks might be beneficial in promoting adherence and long-term improvements in levels of physical activity. Practical factors, such as accessibility of leisure centres, also play a part in uptake and adherence. ERSs seem to play a part in helping previously active adults regain their levels of physical activity. They seem to be less effective in promoting uptake and adherence among deprived populations.

Cost-effectiveness

There are several limitations to the analysis based on the updated model. The model only estimates the impact of physical exercise on selected morbidities, and there may be others that would also benefit from physical activity. Were these included in the model, the likely effect would be to lower the ICER, but the magnitude is difficult to assess. The updated model also does not include the impact of adverse events or injuries; however, available evidence suggests that these are minor and would have little effect on the cost-effectiveness of ERSs.

A limitation in assessing subgroups (obesity, hypertension and depression) is that, with the exception of the depression subgroup, the efficacy of ERSs is assumed to be the same as for the whole inactive population. The model also assumes that the starting utility for these subgroups is the same as for the general population. Were the utility to be lower it may lower the incremental QALY gains, resulting in a higher ICER.

We were unable to assess whether or not less-intensive ERS could be effective at a lower cost and, therefore, be cost-effective. The sensitivity analysis indicated that schemes would need a 60% reduction in costs to achieve an ICER below £30,000 per QALY gained. However, less-intensive schemes may be less effective and so data on both effectiveness and costs would be required to assess cost-effectiveness.

The results are very sensitive to small changes in some of the model parameters. A relatively small increase in the efficacy of ERS or a 3-year increase in the length of the process utility gains both lead to ICERs that are below £30,000 per QALY gained. In contrast, removing the process utility attributed to ERS results in an ICER in excess of £180,000 per QALY gained, and using efficacy data from the ITT analysis, which provides a more conservative estimate of effectiveness (RR 1.08, 95% CI 1.00 to 1.17), resulted in an ICER of around £114,000.

The model oversimplifies the clinical situation because it does not recognise that more than one of the three conditions can be present in the same individual and also that the presence of one comorbidity may impact the likelihood of experiencing another. We are constrained here to using an existing economic model in which type 2 diabetes mellitus, CHD and stroke are treated as mutually exclusive conditions. Also, the model does not account for the fact that stroke patients are at a higher risk of having recurrent strokes and, thus, the utility loss and additional costs associated with this are not taken into account. The impact of these limitations on the cost-effectiveness of ERSs is difficult to estimate. It also excludes any long-term benefits of physical activity that fall outside these three conditions.

Conclusions

Our analysis indicates that the ICER for ERS compared with usual care is around £76,000 per QALY, although the cost-effectiveness of ERSs is subject to considerable uncertainty and is particularly sensitive to the assumptions made regarding the effectiveness of ERSs in increasing physical activity and the size and duration of process utility gains.

Study registration

This study is registered as PROSPERO CRD42013005200.

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