Effectiveness of exercise-referral schemes to promote physical activity in adults:
systematic review

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ABSTRACT

Background
Despite the health benefits of physical activity, most adults do not take the recommended amount of exercise.

Aim
To assess whether exercise-referral schemes are effective in improving exercise participation in sedentary adults.

Design of study
Systematic review.

Method
Studies were identified by searching MEDLINE, CINAHL, EMBASE, AMED, PsycINFO, SPORTDiscus, The Cochrane Library and SIGLE until March 2007. Randomised controlled trials (RCTs), observational studies, process evaluations and qualitative studies of exercise-referral schemes, defined as referral by a primary care clinician to a programme that encouraged physical activity or exercise were included. RCT results were combined in a meta-analysis where there was sufficient homogeneity.

Results
Eighteen studies were included in the review. These comprised six RCTs, one non-randomised controlled study, four observational studies, six process evaluations and one qualitative study. In addition, two of the RCTs and two of the process evaluations incorporated a qualitative component. Results from five RCTs were combined in a meta-analysis. There was a statistically significant increase in the numbers of participants doing moderate exercise with a combined relative risk of 1.20 (95% confidence intervals = 1.06 to 1.35). This means that 17 sedentary adults would need to be referred for one to become moderately active. This small effect may be at least partly due to poor rates of uptake and adherence to the exercise schemes.

Conclusion
Exercise-referral schemes have a small effect on increasing physical activity in sedentary people. The key challenge, if future exercise-referral schemes are to be commissioned by the NHS, is to increase uptake and improve adherence by addressing the barriers described in these studies.

Keywords
exercise; exercise therapy; meta-analysis; primary health care; referral and consultation; systematic review.

INTRODUCTION

Despite the health benefits of regular exercise, the UK population is mainly sedentary. For the prevention of cardiovascular disease, guidelines recommend that adults undertake at least 30 minutes of moderate-intensity aerobic physical activity (defined as expending 5.0–7.5 Kcal/min of energy) on at least 5 days of the week.[1] In Wales, only 29% of adults aged 16 years and over (36% of men and 23% of women) achieve this level of physical activity;[2] a similar proportion to that in England (29%)[3] and Northern Ireland (28%),[4] but less than that in Scotland (36%).[5]

In the UK there has been a rapid creation of patient-referral schemes for supervised exercise sessions, which take place in public leisure facilities,[6] and a national quality-assurance framework for exercise-referral schemes has been published.[7] The schemes can be defined as referral by a primary care clinician to a tailored programme of increased physical activity with an initial assessment, and monitoring and supervision throughout. There have been many systematic reviews that have examined interventions for

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promoting physical activity, and four have focused on exercise-referral schemes. One of these identified nine randomised controlled trials (RCTs) up until 2002, and concluded that they appeared to increase physical activity levels in certain populations, namely individuals who were not sedentary but already slightly active, older adults, and those who were overweight but not obese.[8] However, the increased level of physical activity may not be sustained beyond 12 weeks. The review included six RCTs that did not involve primary care referral to exercise-referral schemes. It did not attempt any data synthesis, and did not include non-randomised studies. The other reviews had more limited scope; two were rapid reviews for the National Institute for Health and Clinical Excellence,[9,10] and another only examined rates of attendance.[11] The latter found that approximately 80% of participants who took up exercise referral dropped out before the end of the programme. None of these reviews evaluated qualitative studies, which could be used to identify why participants drop out, and what would motivate them to continue exercising after the scheme has ended.

The aim of this systematic review was to assess whether primary care-initiated exercise-referral schemes were effective in improving exercise participation in sedentary adults, particularly in the long term, and to find reasons for non-adherence.

METHOD

Inclusion criteria for studies to review

- Type of study: RCTs, non-RCTs, observational studies, process evaluations and qualitative studies.
- Type of participant: adults referred to exercise-referral schemes from primary care.
- Type of intervention: exercise-referral schemes were defined as referral by a primary care clinician to a programme that encouraged increased physical activity or exercise, involving an initial assessment and a programme tailored to individual needs, as well as monitoring and supervision throughout the programme. Eligible participants could be recruited during routine consultations, or after searching the primary care medical record database. The programme usually took place in a leisure centre, swimming pool or private gym, but could also involve gardening or walking. Exercise interventions whose main purpose was not to increase physical activity, but had some other objective such as falls prevention were excluded.
- Type of outcome: any.
- Language restriction: none.

Search strategy for identification of studies

The electronic databases MEDLINE, CINAHL, EMBASE, AMED, PsycINFO, SPORTDiscus, The Cochrane Library, and SIGLE were searched from inception up until March 2007 using a combination of text words and indexed terms covering: exercise, exercise therapy, dance therapy, Tai Chi, walking, yoga, running, jogging, swimming, dancing, gardening, bicycling, physical fitness; combined with referral and consultation, primary health care, and family medicine (Supplementary Table 1). Reference lists from previous systematic reviews and included studies were also screened. Titles and abstracts identified by the searches were independently scanned and disagreements were resolved by discussion. Copies of the relevant papers were obtained and independently assessed by two reviewers. Multiple publications of the same study were identified and collated.

Data extraction and quality assessment

Structured data forms were completed and checked with the following information collected: intervention description, study setting, study population, outcome measures, and results. Quality was assessed independently by two reviewers and discrepancies resolved by consensus. Separate quality checklists were used to assess: randomised and non-randomised comparative studies (with the domains: reporting, external validity, internal validity and power);[12,13] surveys (with the domains: design, conduct, analysis, and interpretation);[14] and qualitative studies (with the domains: meaning, context, sampling, data quality, theory, and generalisability).[15] The quality of process evaluations was not formally assessed, because they describe how individual schemes operate, rather than evaluate the effectiveness of the

How this fits in

Despite the health benefits of physical activity, most adults in the UK do not take the recommended amount of exercise. Exercise-referral schemes have been introduced to encourage exercise participation in sedentary adults, particularly those with chronic ill-health. Exercise-referral schemes have a small effect on increasing physical activity, but 17 sedentary people need to be referred for one to become moderately active.

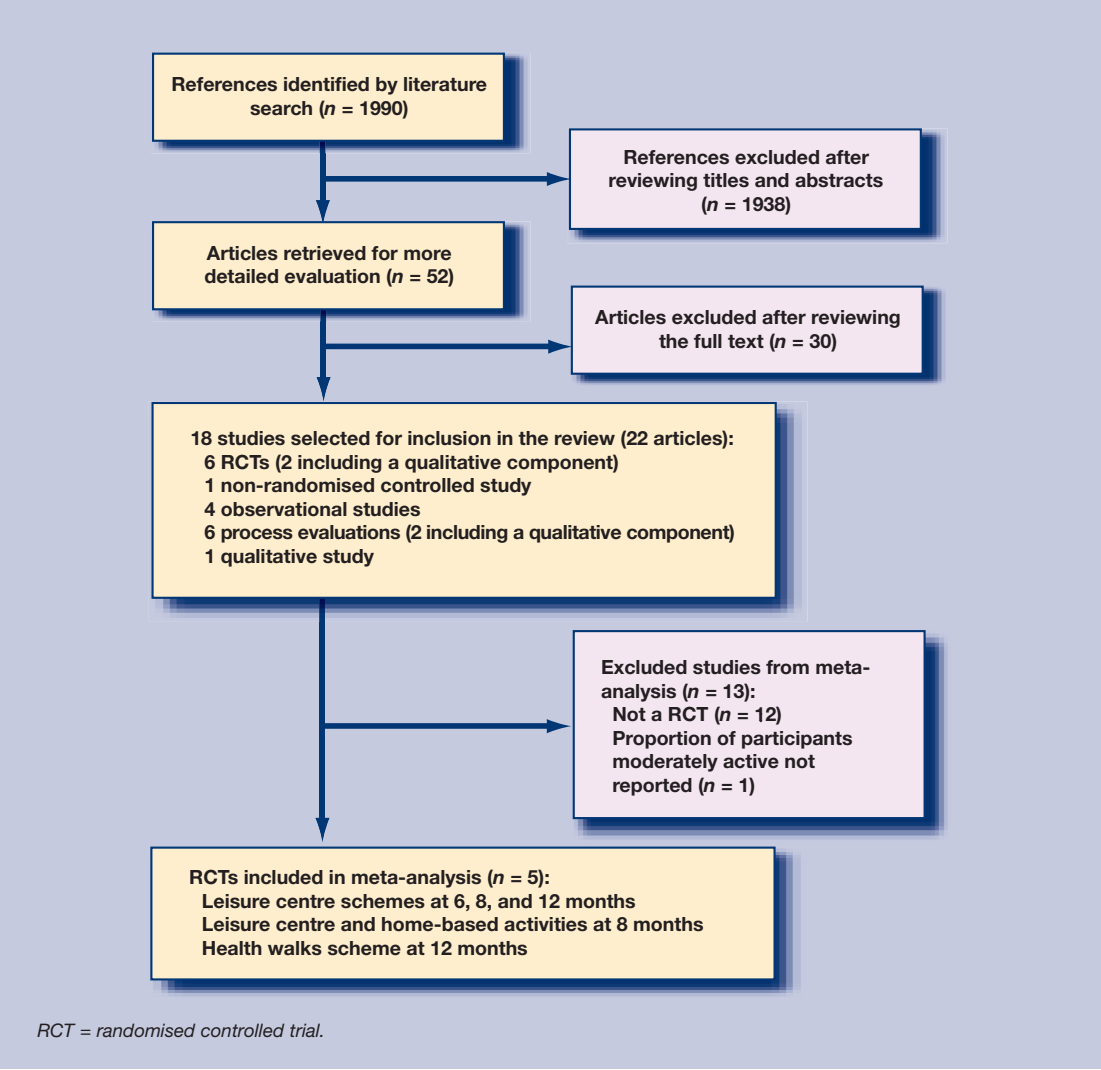


Figure 1. Systematic review flow chart.

intervention, and the information they provide is open to bias and confounding inherent in their study design.

Data synthesis

Homogeneity of the form and delivery of the interventions, their settings and the study populations were assessed in a qualitative way, and the different outcome measures were assessed for compatibility. RCT results were combined in a meta-analysis where there was sufficient homogeneity, using relative risk (RR) as the summary measure for binary outcomes. Numbers needed to treat were derived from the RR using the typical event rate from known population norms, that is, the proportion of the population over 16 years old who were moderately active.[16,17]

In a sensitivity analysis, meta-analyses were recalculated after excluding trials with a quality score of ≤17, and using a random effects model for data pooling.

RESULTS

Identification of studies

The search strategy identified 1990 potentially relevant articles. After reviewing the full text of 52 of these, 18 studies were selected for inclusion (Figure 1). These comprised six RCTs;[18–23] one non-randomised controlled study,[24] four observational studies (two surveys and two cohort studies);[25–28] six process evaluations;[29–34] and one qualitative study.[35] Two process evaluations[29-31] and two RCTs[18,21] also collected qualitative data, with additional data reported in separate papers.[36–37]

Controlled studies including RCTs

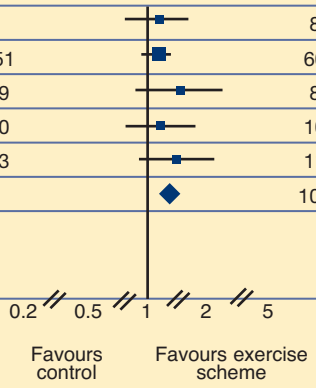
Three out of the six RCTs compared gym-based exercise-referral schemes in leisure centres in the UK, with an information sheet;[18–20] one compared exercise classes in church halls or community centres in the UK with no intervention;[21] another compared a walking scheme in the UK with exercise advice (Supplementary Table 2);[22] the other

Table 1. Meta-analysis of exercise-referral schemes compared with control according to the proportion of participants who took moderate exercise.

Study	Exercise scheme *n/N*	Control *n/N*	RR (fixed) 95% CI	Weight %	RR (fixed) 95% CI	Year
Taylor	39/57	19/31		8.38	1.12 (0.80 to 1.55)	1996
Stevens	204/363	174/351		60.20	1.13 (0.99 to 1.30)	1998
Lamb	37/131	25/129		8.57	1.46 (0.93 to 2.28)	2002
Harrison	40/275	32/270		10.99	1.23 (0.80 to 1.89)	2004
Isaacs	46/153	36/163		11.86	1.36 (0.93 to 1.98)	2007
Total (95% CI)	979	944		100.00	1.20 (1.06 to 1.35)	

Total events: 366 exercise scheme; 286 control.
Test for heterogeneity: $\chi^2 = 1.97$, df = 4 ($P = 0.74$), $I^2 = 0\%$.
Test for overall effect: Z = 3.01 ($P = 0.003$).

df = degrees of freedom. RR = relative risk.



compared a gym-based exercise-referral scheme in the UK with a walking scheme, or with advice.[23] The unit of randomisation was the individual participant in five trials,[18–20,22,23] and the referring practice in one trial.[21] A non-randomised controlled study compared a walking programme for patients with type 2 diabetes with no programme.[24] Participants were recruited from searches of primary care medical record databases in four RCTs.[18,19,21,22] They were selected for inclusion on the basis of coronary heart disease (CHD) risk factors,[18,23] or according to the results of a returned physical activity questionnaire.[19,21,22] Participants were recruited by clinicians in two RCTs from UK exercise-referral schemes that were already accepting referrals from primary care.[20,23] The duration of the schemes was 10 or 12 weeks in four RCTs,[18–20,23] 4 months in one non-randomised study,[24] and up to 2 years in one RCT.[21] There appeared to be no time limit (or none mentioned) for the walking scheme reported by Lamb *et al*.[22] The participants of most schemes were adults (mainly middle-aged) with sedentary lifestyles and cardiac risk factors, and the aims were to increase physical activity and reduce cardiac risk factors. The quality of these studies varied from 15 to 29 (median 26) out of a maximum of 34 on the quality score (Supplementary Table 3);[12] none of the RCTs scored less than 19. Items that scored poorly concerned the generalisability of the study population, blinding of outcome measurement, and adequate concealment of random allocation. Participation rates varied, with 26–92% attending the first exercise session, but less than half completing a full course of sessions.

Proportion of moderately active individuals

Five RCTs measured the proportion of individuals who were moderately active,[18–20,22,23,36] defined as taking at least 90–150 minutes of moderate-intensity exercise per week. Results from all five RCTs were combined in a meta analysis (Table 1). A test of heterogeneity did not reject the null hypothesis that the studies were homogeneous, so a fixed-effects model was used. The combined RR was 1.20 (95% confidence intervals [CI] = 1.06 to 1.35) in favour of the exercise schemes using an intention-to-treat analysis incorporating drop-outs. In a sensitivity analysis, the RR was similar when a random-effects model was used. The proportion of the adult population over 16 years old in England and Wales who performed moderate or vigorous exercise five times a week was 0.29.[2] Using this typical event rate, the numbers needed to treat were 17.2.

Anthropometric, physiological and biochemical outcomes

Outcomes such as body mass index (BMI), waist–hip ratio, percentage body fat, resting heart rate, blood pressure (BP), lung function, exercise performance, muscle strength, and cholesterol level were measured in three RCTs[18,22,23] and one non-randomised controlled study.[24] There was no statistically significant difference between exercise groups and controls. Any improvement in these outcomes in the exercise group, particularly in the subgroup that reached the exercise target, was mirrored by similar improvement in the control group. One RCT measured skinfold thickness, and found a statistically significant 8% reduction (95% CI = 3% to 13%) in the exercise group compared to the control at 16 weeks.[18]

Psychological outcomes

Two RCTs measured readiness to engage in

behavioural change by measuring stages of change.[22,23] Motivation to exercise improved more quickly in the exercise interventions of both RCTs up to 6 months compared to controls, although some of this change could be attributed to participant withdrawal from the study. In one of these the advice group was followed for up to 12 months, by which time level of motivation had caught up with that in the exercise group.[22] This RCT also found that changes in the physical self-perception profile were related to changes in skinfold thickness, and adherence to the exercise programme, but not changes in cardiovascular fitness. Two RCTs measured barriers to exercise.[23,38] There was no effect on time-related barriers in either RCT. In one RCT the exercise group significantly reduced perceptions of intrinsic and extrinsic barriers to exercise compared to the control;[38] in the other there was a significant reduction in perception of both intrinsic and extrinsic barriers in all study groups, including the control.[23] In this latter RCT all groups showed improvement in Hospital Anxiety and Depression Scale (HADS) anxiety and SF–36 mental scores between baseline and 6 months. In the same time period the HADS depression score only improved significantly for the exercise group.

Health-economic analyses

Three RCTs calculated cost-effectiveness or cost–utility ratios.[19,21,23] Costs of the exercise programme were measured in all three, and the unit cost per exercise session quoted in two of these was between £4 and £8.[21,23] One RCT collected data on hospital admissions, outpatient, accident and emergency, and general practice services, but did not include them when calculating their cost–utility ratio.[21] Only one RCT collected health service and participants' costs as well as costs of the exercise programmes, and combined them in a cost-effectiveness analysis.[23] In this RCT the exercise interventions were more costly and only marginally more effective than advice alone.

Observational studies

Four observational studies, three from the UK,[25–27] and one from the US[28] (Supplementary Table 4), provided data on the long-term effect of exercise schemes on physical activity level. Study quality was moderate to poor (Supplementary Table 5). Response rates to two UK surveys were only 40–55%.[25,26] Activity levels varied, with one survey finding no difference between adherers and non-adherers of an exercise programme, in terms of activity level at 6 month intervals up to 3 years after completion.[25] Neither group attributed current activity level to participation in the scheme. The other UK survey reported that two-thirds of responders were more active than before referral, 3–5 years later, although this was a poor-quality study and did not ask whether increased activity was a consequence of the scheme.[26] A cohort study from the US found that one-third of urban, female, over 50-year-old patients referred to an exercise scheme from primary care were still attending after 1 year.[28] Greater expectation of exercise outcome, not smoking, and the convenient location of the clinic site contributed to logistic regression models predicting participation in the scheme. Finally, a cohort study from the UK reported that a tailored exercise scheme for frail elderly patients delivered within a primary care setting found that 89% of those referred started the programme, 73% completed, and 63% made the transition to a leisure centre-based programme.[27]

Process evaluations

Six process evaluations were identified that provided data on typical exercise-referral schemes that were not influenced by any controlled study (Supplementary Table 6).[29–34] These all found that uptake was low, with around one-third of patients referred not participating in the schemes at all. Adherence to the schemes was also poor, with between 12% and 42% completing a 10–12 week programme. Sustained increase in physical activity level was reported in those that completed the exercise programme.[31–33] Reported improvements in physiological outcomes included increased aerobic fitness,[30] reductions in BP, pulse, resting heart rate, weight, and BMI.[31–34] Psychological improvements were reduction in anxiety and depression,[29,32] progress in stages of behaviour change,[32] and statistically significant improvement in SF–36 emotional role dimension score.[30] Positive lifestyle changes were also reported.[29]

Qualitative studies

There was one qualitative study,[35] and four other studies that had qualitative components (Supplementary Table 7),[18,29,31,36,37] all of which were poor quality (Supplementary Table 8). Two had used semi-structured interviews;[18,31] two had conducted focus groups;[29,35] no detail of the data collection method was given for the other.[37] The studies focused on participants' views about the exercise schemes and reasons for adherence or non-adherence. Satisfaction with schemes was largely attributed to the professional, supportive, encouraging, and friendly service provided by the staff.[31,35] Participants reported that they had derived physical, social, and psychological benefits as a result of attending the schemes.[18,35,36] Dissatisfaction

related to inconvenient operating hours for working people,[18,35,36] congested facilities,[18,36] insufficient staff,[18,35,36] intimidating gym environment or equipment,[34,35] narrow range of activities, and limited social interaction.[35] Reasons for non-adherence included lack of self-efficacy and poor body image;[18,36,37] poor organisation of the scheme, such as inconvenient opening hours or inadequate supervision;[29] poor personal organisation, such as finding time, transport, or interruptions of routine by illness or holidays;[29,31,37] adverse social or psychological factors, such as poor social support,[31,35,37] feeling uncomfortable in the gym environment;[35] and an exercise leader lacking motivational skills.[35]

All of these qualitative studies tended to ask superficial questions and provided only superficial analyses. There was no in-depth exploration of participants' experience of exercise-referral schemes; for example, the importance of feeling comfortable in the gym environment was identified, but there was little attempt to discover in what way people felt uncomfortable, what aspects of the gym environment contributed to their discomfort, and what changes could be made to improve their experience.

DISCUSSION

Summary of main findings

Exercise-referral schemes resulted in a statistically significant increase in the numbers of sedentary people becoming moderately active. However, the absolute risk reduction was small, with 17 sedentary people needing to be referred for one to become moderately active. This was most likely due to poor participation and compliance rates. This small increase in physical activity was probably not an efficient use of resources. The qualitative studies identified barriers to participation, which included personal barriers such as lack of self-efficacy, poor body image, poor time management, and lack of social support, as well as exercise scheme barriers such as intimidating environments, inadequate supervision, and inconvenient opening hours.

Strengths and the limitations of the study

The literature search was comprehensive and included non-randomised studies. Observational studies provided additional information not reported in the RCTs, such as the activity levels of those who did not adhere to the exercise scheme regime, and longer-term adherence rates. Qualitative studies reported participants' views of the schemes and explored reasons for non-adherence. However, the quality of most of these non-randomised studies was poor. The results from five of the RCTs that had reported on the proportion of participants who undertook moderate exercise in a meta-analysis were combined. Other outcomes such as physiological variables, cardiovascular fitness, health status, and psychological outcome were reported less consistently, and it was not possible to combine these in additional meta-analyses.

Eight studies that had been included in the previous systematic reviews were excluded. The reasons for these exclusions were that: there was no primary care referral; the intervention comprised advice or exercise promotion but not a physical activity scheme; and the purpose of the intervention was not to increase physical activity. Although this allowed the review to focus on studies that were most relevant to exercise-referral schemes available in the UK, it could have resulted in the exclusion of studies of more successful interventions. Four of the included trials recruited patients by searching the participating practices' medical record database, and were not typical of most of the schemes operating in the UK.[18,19,21,22] Two RCTs recruited patients during primary care consultations, to schemes that were already accepting referrals, but did not report how many eligible patients were not recruited.[20,23]

The numbers-needed-to-treat calculation should be interpreted with caution, as although the participants were probably representative of the population referred to exercise schemes, they were not representative of the total eligible population. Also, setting a threshold of 30 minutes' moderate activity, five times per week may be too high for many sedentary people. Although the threshold reported here is slightly lower, it will still have ignored those with smaller improvements in physical activity, which could still have important health benefits.

Comparison with existing literature

This review includes three RCTs;[19,22,23] one non-randomised controlled study;[24] four observational studies;[25–28] three process evaluations;[30,32,33] and one qualitative study[35] that were not included in any of the previous reviews. The present findings are similar to these previous reviews in that it was concluded that exercise-referral schemes increased physical activity in some people.[8,10] However, exercise referral was more costly than usual care,[9] increases may not be maintained in the long term,[10] and attendance was poor.[11]

Implications for future research and clinical practice

Exercise-referral schemes have a small effect on

increasing physical activity in sedentary people, but it is not certain that this small benefit is an efficient use of resources. This conclusion is broadly in agreement with NICE public intervention guidance on increasing physical activity,[39] which states that exercise-referral schemes should only be recommended if they are part of a properly designed and controlled research study to determine effectiveness. The key challenges for future schemes are to increase uptake and improve adherence, perhaps by considering readiness to engage in behavioural change,[40] or by considering individual differences in self-determination and behavioural regulation.[41] The intensity and variety of the exercise programmes on offer could be more closely tailored to individuals' preference, and the barriers identified in the qualitative studies could be addressed. Well-conducted qualitative studies are needed to explore in more depth the barriers to participation in exercise schemes, and to ascertain how the schemes improve motivation and reduce barriers in those who do attend. More RCTs need to be conducted of interventions addressing identified barriers, such as concurrent psychological interventions addressing lack of self-efficacy and poor body image. They also need to investigate other types of physical activity such as green gyms or water-based exercise. Attention must be paid to the control interventions, so that they stay distinct from the exercise intervention. Health-economic evaluations need to be incorporated into these RCTs to determine whether any improvement in physical activity is an efficient use of resources.

Supplementary information

Additional information accompanies this article at http://www.rcgp.org.uk/bjgp-suppinfo

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Competing interests

Nefyn H Williams and Clare Wilkinson are part of a research team that has been funded by the Welsh Assembly Government to evaluate the effectiveness of the National Exercise Referral Scheme in Wales

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