The Busy General Practitioner’s Reference Guide to Increasing Physical Activity Levels in the British Population and Associated Benefits/Risks: A Review of the Literature

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Abstract

Whilst most General Practitioners (GPs) recognise the importance that physical activity plays in a healthy nation, many feel unprepared to provide physical activity counseling. GPs therefore do not routinely include physical activity in the consultation as readily as alcohol or tobacco, despite inactivity having a similar health burden. This review of relevant literature using Embase, SPORTDiscus, PubMed, and the Cochrane Library intends to refresh GP’s knowledge regarding the vast benefits of physical activity and to investigate the evidence concerning the risks of physical inactivity. In addition, an evaluation of the efficacy of interventions to increase PA levels will be undertaken.

Keywords: Exercise; Exercise therapy; Economics; Family practice; Health promotion/economics; Health promotion/methods; Humans; Life style; Motor activity; Physical fitness; Rescriptions/economics

Introduction

An inactive nation

The disease burden associated with a reduction in Physical Activity (PA) amongst the population has become increasingly apparent, in 2009 inactivity was the “fourth leading risk factor for non-communicable diseases” (World Health Organisation (WHO), 2010) and accounted for 5.3 million out of 57 million worldwide deaths in 2008 [1]. In the United Kingdom (UK), physical inactivity (patients who do not meet Government guidelines) is responsible for 3.1% of morbidity and mortality at a cost of over £1.8 billion to the National Health Service (NHS) [2]. When indirect costs (days off work etc.) are included this figure rises to £8.3 billion [2]. These costs are particularly significant as the Government has asked the NHS to make annual savings of £20 billion to cope with rising expenditure from an ageing population [3]. Aside from financial costs, it is estimated that 35,000 lives could be saved [2] if the inactive UK population, 61% of men and 71% of women in 2008, met Government guidelines for PA [4].

Healthcare has been identified as one of the eight sectors which can influence physical activity levels (PALs) (National Physical Activity Plan, 2010) and General Practitioners (GPs) are in a unique position when creating projects and schemes that will improve PALs in the population. The specialty contains doctors who are aware of the scale of the problem, the benefits of rectifying the problem, have regular contact with patients and have the skill-set to introduce appropriate and effective public health measures within multidisciplinary teams.

Why is this review needed?

Although public health campaigns focus on the benefits of physical activity, there are risks associated with increasing PA and these are often overlooked or absent from PA campaigns [5,6].

Many clinicians currently feel unprepared to provide PA counselling [7], resulting in a five-fold reduction in PA promotion amongst those unprepared practitioners [8]. It will also highlight the substantial benefits to increasing PA levels to healthcare professionals. The majority of GPs and nurses recognise that increased PA is important for health [8,9] but many do not see PA promotion to be a priority in practice or relevant to the consultation [7]. Healthcare professionals are often more concerned about tackling tobacco and alcohol consumption [10] despite inactivity having a similar health burden [11]. This review of the literature aims to refresh clinician’s knowledge regarding the vast benefits of physical activity and to investigate the evidence concerning the risks of physical inactivity. In addition, an evaluation of the efficacy of interventions to increase PA levels will be undertaken. This will allow GPs to have the necessary knowledge and tools to enable them to play a role in the promotion of PA.

Review process

This literature review included resources from electronic documents, peer-reviewed journals, organisation/Government websites and textbooks. To compile a database of relevant literature from 1955–current day and written in English, searches were undertaken using Medline, Embase, SPORTDiscus, PubMed, and the Cochrane Library. These searches included various combinations of keywords and as the number of articles returned was deemed excessive (>3000) various exclusions were added until a manageable number of articles was returned. The titles of these articles were examined and the 642 deemed ‘potentially relevant’ were added to the database. In order to feasibly investigate the literature, the numbers had to be reduced further and so the abstracts were evaluated with those articles not relevant to the project being discarded, leaving 218 articles to be fully reviewed. Government documents on PA were also searched for using Google, yielding 57 articles and a further 53 journals/articles were added to the database by reviewing the reference lists of existing articles.

Benefits of physical activity

Public campaigns to promote PA often focus on the health benefits...
of increasing PA in several key public health areas identified by review articles [1,12-14]. These include cardiovascular disease, hypertension, obesity, type 2 diabetes, breast cancer, colon cancer, rheumatoid arthritis, pregnancy, chronic obstructive pulmonary disease, osteoarthritis, osteoporosis and depression. In addition to these benefits, being physically active (meeting or exceeding Government guidelines for PA) has been shown by the Physical Activity Guidelines Advisory Committee (PAGAC) (2008) to reduce mortality from all causes by 20-30%. Large, prospective studies such as Leitzmann and Park [15] which included over 1.2 million person-years of follow up have demonstrated a causal link between inactivity and mortality by comparing inactive individuals to those whose PA improves across multiple assessments and noting the mortality reductions associated with physically active individuals. These benefits are seen in all demographics, including the obese and smokers, although the mortality reduction is lessened in these groups. Even those undertaking less PA than Government guidelines will still benefit from a reduction in the relative risk of mortality (0.81). Observational studies have also demonstrated that there is a dose-response relationship, with an increase in intensity or quantity leading to a reduction in mortality rates, between PA levels and all-cause mortality [16]. It must be noted that as these are observational studies, further evidence is required to confirm these dose-relationship findings.

**Efficacy of interventions to increase physical activity**

Currently only four methods of increasing PA levels are recommended by the National Institute for Clinical Excellence (NICE) (2006):

- Brief interventions in primary care
- Exercise referral schemes (ERS)
- Pedometers
- Community-based exercise programmes for walking and cycling

In addition to these methods, the use of exercise ‘Green Prescriptions’ has been increasingly commonplace.

**Brief Interventions in Primary Care**

With 78% of adults in the UK visiting their General Practitioner (GP) at least once between 2009-2010 (Information Services Division, 2011), interventions based in Primary Care have been shown in Cochrane reviews to make a significant impact in key public health matters such as tobacco [17] and alcohol consumption [18]. Patients are more receptive to healthcare advice when it is delivered by a GP [19] as they are seen as "credible sources of healthcare information" [20]. GP’s typically see patients in an environment where patients are receptive to engaging in discussion about health promotion [21] and a discussion about PA promotion could easily be introduced.

Interventions can take several forms, including referral to ERS’s, but typically involve advice and the delivery of written information. Orrow et al. [22] undertook a meta-analysis and found that “the number needed to treat with a physical activity promotion intervention for one additional sedentary adult to report recommended levels of activity at 12 months was 12” in patients self-reporting PA. Estimates of the number needed to treat for Primary Care interventions related to smoking vary from 50-120 [17]. These interventions are more cost effective than many pharmaceutical interventions that are routinely provided by Primary Care Practices, with the cost per quality-adjusted life year (QALY) of turning a ‘sedentary’ patient into an ‘active’ one between £267 to £2,960 [23]. This is well within the NICE guidance that an intervention should have a cost of up to £20,000 to £30,000 per QALY (NICE 2008).

**Exercise Referral Schemes**

ERS’s, also known as exercise prescriptions, have been shown to have improvements in patients’ PA levels on completion [23-25]. They typically offer “personalized secondary prevention located in primary healthcare involving the General Practitioner or other primary healthcare staff” [25]. A recent evaluation of the cost effectiveness of the Welsh Government’s National Exercise Referral Scheme (NERS) demonstrating increased PA levels in all participant groups (odds ratio =1.19) except those referred with mental health disorders as their primary diagnosis [26]. Uptake of the scheme proved to be successful at 85%, however the NERS suffers from a weakness of many ERS’s in that a large proportion of the participants failed to complete the scheme, 14.9% failed to attend and 41.3% did not complete the programme. Despite the high drop-out rate, due to the low cost of the NERS (£385 per participant), the cost per QALY was calculated to be was £12,112 or £9,741 if participants contribute £2 per session, well within NICE guidelines (2008). Anokye and Trueman [27] demonstrated that the cost per QALY reduces further when schemes are targeted at sedentary patients suffering from obesity, hypertension or depression due to cost savings associated with the treatment of the chronic disease in addition to those gained from a reducing inactivity. These findings are broadly similar to those in other countries, and the most recent review by Pavey et al. [28] found adherence rates of 49% for observational studies and 43% for randomised controlled trials. Although studies lack sufficient power to calculate statistics, baseline activity, obesity and age seem to be the only factors influencing whether patients complete the ERS.

Although schemes such as the NERS involve supervision of participants, a 10 week study found that supervised sessions have little benefit over non-supervised prescriptions [29]. This could be significant if these findings are replicated in long-term studies as it would provide a substantial cost saving.

Whether these improvements have any clinical significance is still the subject of much debate. NICE guidance (2006) stated that ERS’s should “not be commissioned in primary care outside of well designed research studies” and this is not due to be updated until March 2013 (NICE, personal communication [30]; July 2012). NICE guidance on ERS’s has not been disputed by recent meta-analyses which demonstrated that the proportion of patients involved in ERS’s who met Government guidelines for PA only increased by 11% [28] and 16% [14].

**Pedometers**

Pedometers have been displayed in numerous studies to improve PA levels and are relatively inexpensive in addition to providing instantaneous output measures that are easily analysed by those with low literacy rates [31]. Average improvements over varying time periods up to and including 20 weeks has been calculated at 2,000 steps per day compared to control [32,33].

It must be noted however that most pedometer studies focus on 10,000 steps as their output measure, as this was the goal that pedometers were initially designed to achieve [34]. Le Masurier et al. [11] demonstrated that “individuals who accumulate 10,000 steps/day are more likely to meet the PA guidelines” but improvements in PA guidelines and step-counts cannot be directly compared as the correlation is insufficient [35]. Additionally, most studies focus on...
short-term improvements and the impact of pedometers on long term (>12 months) changes in PA is unknown.

Community-based exercise programmes for walking and cycling

‘Active travel’, where people commute using methods involving PA, has gained considerable interest in recent years as the health benefits of reducing congestion (and hence air pollution) and being active gain public attention. A 2006 NICE review of “the effectiveness of community-based walking and cycling programmes to promote physical activity in adults” showed that whilst popular amongst patients, there is little evidence to support their promotion. Various studies produced conflicting results and were of insufficient quality to quantify the effect (if any) of these interventions on the number of patients meeting PA. Jarrett et al. [34] has however demonstrated that over the next 20-years, up to 1% of the annual NHS budget for England and Wales could be saved by increasing walking and cycling in urban areas [36].

Exercise Prescriptions

Exercise prescriptions, often referred to as ‘Green Prescriptions’, commonly used in clinical practice is based on recommendations from the US Surgeon General’s 1996 report and was first developed by the Hillary Commission (New Zealand) in 1997. They differ from ERs in that exercise prescriptions do not provide activities for patients to attend, merely supplying advice as to what patients should be undertaking. Exercise prescriptions most recently been updated by the American College of sports medicine to include prescriptions for various health conditions such as hypertension, cardiovascular disease, obesity, type 2 diabetes, osteoarthritis, osteoporosis and depression [30] and are shown in Appendix 2. Typically exercise prescriptions do not involve supervision and a 10 week study found that supervised sessions have little benefit over non-supervised prescriptions [28].

Elley et al. [19] demonstrated that 15% of inactive patients receiving an exercise prescription met government guidelines after 12 months compared to 5% in the control group. The Writing Group for the Activity Counseling Trial Research Group [37,38] did not find any statistically significant increases in cardiovascular fitness amongst male participants but showed a mean difference in VO2max of 73.9 mL/min between participants given exercise prescription and controls. A cohort study by Sorensen et al. [24,25] in Denmark found that one in three participants achieved an increased PAL (of greater than 1 MET), 4 months after being given an exercise prescription, similar improvements were seen at 10 and 16 months although a gain of 1 MET is of clinical significance is subject to debate. It must be noted however that the base line average METs (40) was relatively high compared to normal populations.

One theory as to why exercise prescriptions have a relatively low efficacy was proposed by Prochaska and Marcus [36], entitled ‘the stage of change theory’. This theory postulates several stages into which people can be categorised when starting or maintaining new health behaviours [39]. These stages are:

1. Pre-contemplation
2. Contemplation
3. Preparation
4. Action

Maintenance

The stage of the model that participants are at when they are given an exercise prescription may have an effect on their change in PALs from the scheme. It is suggested that a patient in the pre-contemplation stage who is being introduced to the idea of increasing PA for the first time may have poorer adherence to an exercise prescription than someone in the preparation stage. Some research has been conducted into the effect that a participant’s stage has on the changes in PALs from an exercise prescription but studies have found different contradicting results. Calfas et al. [37] and Marcus et al. [38] reported positive results from trials analysing the effects of PA in participants in various stages of the model but this contradicts the later work of Naylor et al. [39] and Blissmer and McAuley [40] which showed no association between stage of the model and change in PALs when compared to controls [40–43]. It is important to note however that these studies only looked at the short term effects with these studies ranging in duration from 6 weeks to 6 months. A trial looking at a longer duration found short term associations which were not apparent in the long term (>12 months) [44], although this study focused on overweight individuals and so results must be interpreted with care.

Risks Associated with Increasing Physical Activity Levels

Sudden cardiac death

With recent high-profile cases such as Fabrice Muamba gaining much media attention, sudden cardiac death (SCD), defined as “death occurring within one hour of the onset of symptoms in a person with previously known or unknown heart disease” [45], is one of the most serious and high profile risks of engaging in PA. It is often a concern to people considering commencing an exercise programme [46]. SCD has a low incidence, 1 in 43,770 participants per year when considering athletes less than 30 years of age [47]. Corrado et al. [43] found that the relative risk of SCD was 2.4 in young athletes compared to inactive controls. SCD predominantly occurs during periods of medium-low oxygen demand such as during the warm up and inactive periods of matches [31]. Despite the severity of SCD, there is still great debate about the complex aetiological pathways involved [48,49] and the definition of SCD varies between studies [50].

The mechanisms of death vary with age, young athletes (<35 years) predominantly have congenital or cardiovascular causes (hypertrophic cardiomyopathy accounts for 46% of deaths). The origin of SCD in older athletes (>35) however is caused by myocardial infarctions secondary to underlying coronary artery disease in the majority of cases [49].

Studies from the 1980’s have shown that whilst unfit individuals undertaking PA increase their risk of SCD by 5,600% during the exercise, individuals routinely engaging in PA have substantially lower lifetime relative risk (0.6) of SCD compared to inactive controls [51]. Exercise is therefore both a protective factor (long-term) and a causal factor (short-term) in SCD.

Injury

Risk of injury has been cited as a major barrier to entry for increasing PA levels in the population [52] and injury is a known risk factor for the development of osteoarthritis [53,54], although more studies are needed to calculate the relative risk [53]. Reliable information on injuries from PA and sport are scarce; however statistics produced for the European Commission found that 4.5 million European Union citizens over 15 years old were treated for sports injuries (as defined by the European
Injury Database) in Accident and Emergency Departments annually between 2005-2007 [55]. The majority of injuries in any population are believed to be preventable with good athlete education, appropriate kit and application of rules/laws [56,57]. Studies investigating the effects of introducing compulsory head protection in cricket have shown a 50% reduction in head, neck and facial injuries [58] and law changes in karate have dramatically reduced injuries [59]. Care must however be taken to ensure that increased protection for the athletes does not encourage an increase is risk-taking behaviour, which is believed by many to be one of the most significant factor in injury risk [60]. Prevention of sports injuries is still poorly researched however, as highlighted by a number of articles [57,61]. There are currently no studies investigating correlations between injury and inactivity.

There is also insufficient data investigating the prevalence/relative risk of injury with increasing PA rather than in organised sport. Stress fractures are one area that may be subject to an increased relative risk with increased PA, as they typically develop when bone is “exposed to repetitive, cyclical, high volume, or intense exercise, mainly when an individual significantly increases activity levels over a short period of time” [62]. Current opinion however is that increasing PA levels by engaging in more low-impact PA (walking, gardening, cleaning etc.) rather than organised/formal ‘sport’ would be unlikely to increase the relative risk of injury much beyond that for standard activities of daily living [55].

Although several studies have investigated return to work (RTW) following injury, there is currently no research on the effects of injury on physical activity levels. This lack of information is thought to be the major reason why there is so little policy relating to injury published by Governments [63]. Future research is needed to investigate if factors affecting RTW are the same as those affecting PA levels. Key predictors of RTW are suspected to be applicable to changes in post-injury PA levels, with a prospective cohort study by Clay et al. (2010) demonstrating that strong recovery beliefs amongst participants increase the odds of returning to work at 12 weeks and 6 months by 16.7 and 3.9 times respectively. Gender [64-66] and depression status [67] do not have any effect on RTW times in various injury studies looking at injuries sustained both from trauma and non-traumatic causes. More data are expected to be available on these findings when the UK wide “Impact of injuries study” results are published later this year [68]. Studies investigating the factors impacting return to sport, although limited, suggest that fear of re-injury is a major barrier in addition to other psychological issues [69]. It would be of interest if these effects were further investigated in relation to changes in PA levels with injury.

Female Athlete Triad

Reliable prevalence data are limited for Female Athlete triad (FAT), which consists of “osteoporosis, disordered eating and menstrual disorders” [70], amongst athletes and the general population. Although data are limited, the American College of Sports Medicine has reported that the prevalence is much higher in female ‘lean-build’ athletes (such as runners) compared to controls, 31% and 5.5% respectively [71]. It is not uncommon for female athletes to resort to disordered eating patterns as they believe a low body weight will enhance their performance [72]. Increased rates of FAT in the athletic population are currently thought to be due to lack of athlete awareness and mental health disorders rather than the exercise itself [12]. Athlete awareness is currently poor, with a recent Australian study reporting that only 10% of female athletes had knowledge of FAT and that 22% of female athletes in ‘lean-build’ sports would take no action if amenorrhoeic [73-84]. There is currently no data on the relative risk of developing FAT in individuals who are not athletes as they increase their PA levels.

Conclusions

The benefits of physical activity are well documented and cover a multitude of significant public health issues. There are a number risks to increasing levels of PA which clinicians must be aware of when identifying inactive patients, implementing strategies to increase PA and when conducting research. If GPs are aware of these risks they can ensure that strategies are in place to reduce risks, spot early signs of any problems and can educate patients fully before they agree to start any intervention.

There are many interventions aimed at promoting the number of ‘active’ patients, however the evidence to support their use in this outcome is still inconclusive and requires further investigation. In view of the considerable benefits of increasing physical activity and the vast costs inactive patients place on the NHS, it is essential that clinicians stay current with these investigations and amend their clinical practice accordingly.

Disclosure/Acknowledgement

Ethical approval was not required for this article as no participants were required. The author has not received any funding from any organizations and has no conflicts of interests.

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