

The effectiveness of public health interventions for increasing physical activity among adults: a review of reviews

*Evidence briefing*

*2nd edition, February 2005*

*Melvyn Hillsdon,<sup>1</sup> Charlie Foster,<sup>2</sup> Nick Cavill,<sup>2</sup>  
Hugo Crombie<sup>3</sup> and Bhash Naidoo<sup>3</sup>*

*This review updates the previous version published in February 2004*

<sup>1</sup>*Department of Epidemiology and  
Public Health, University College London*

<sup>2</sup>*British Heart Foundation Health Promotion Research Group,  
University of Oxford*

<sup>3</sup>*Health Development Agency*

This document is also published on the  
Health Development Agency website at:  
[www.hda.nhs.uk/evidence](http://www.hda.nhs.uk/evidence)

# Foreword

The Health Development Agency (HDA) was established in 2000. Since then it has been engaged, among other things, in building the evidence base in public health with a special focus on reducing inequalities in health. It has developed a number of ways of taking a systematic approach to compiling the evidence, identifying gaps and making the evidence base accessible. The evidence briefing series is one of the ways in which the HDA Evidence Base is disseminated (full details of the process of developing the Evidence Base and the associated methodological activities can be found in Swann et al., 2002; Kelly et al., 2002, 2003, 2004; Killoran and Kelly, 2004; Graham and Kelly, 2004).

This evidence briefing is a review of reviews about the effectiveness of public health interventions for increasing physical activity among adults. The necessity for reviewing reviews, or tertiary level research, stems from the proliferation over the last decade or more of systematic and other types of review in medicine and public health. The HDA has published other evidence briefings that deal with teenage pregnancy and parenthood, HIV prevention, the prevention of sexually transmitted infections, obesity, prevention of low birth weight, breastfeeding, accidental injuries in children and older people, alcohol misuse, smoking and public health, drug misuse, youth suicide and health impact assessment.

Taken together these briefings provide a comprehensive synthesis of the evidence drawn from systematic and other kinds of reviews. They are available on the HDA's website – [www.hda.nhs.uk/evidence](http://www.hda.nhs.uk/evidence) – and the electronic versions are updated on a regular basis as new evidence becomes available.

The evidence briefings have been based on evidence drawn from systematic and other kinds of reviews. This means that the type of evidence that does not traditionally

find its way into systematic reviews has not been considered in detail for these documents. In another HDA Evidence Base series, called evidence reviews, the scope of the coverage is extended to primary research and other kinds of evidence and other types of study. Evidence reviews on resilience, transport, housing, maternal and child nutrition, drug misuse prevention, accidental injury prevention for children, chronic illness, and alcohol misuse by children and young people are currently in preparation.

The construction of the HDA Evidence Base has involved collaboration with a number of partners who have interests and expertise in practical and methodological matters concerning the drawing together of evidence and its dissemination. In particular the HDA would like to acknowledge the following: the NHS Centre for Reviews and Dissemination at the University of York; the EPPI-Centre at the Institute of Education at the University of London; Health Evidence Bulletins Wales; the ESRC UK Centre for Evidence Based Policy and Practice at Queen Mary College, University of London and its nodes at the City University London and the MRC Public Health Sciences Unit at the University of Glasgow; members of the Cochrane and Campbell collaborations; the United Kingdom and Ireland Public Health Evidence Group and the members of the Public Health Evidence Steering Group. This latter organisation acts as the overall guide for the HDA's evidence-building project. The cooperation of colleagues in these institutions and organisations has been of significant help in the general work in preparing the framework for how we assess the evidence. The HDA is, however, responsible for the presentation and organisation of the material in the briefings.

We would also like to express our gratitude to the Physical Activity Evidence Base Reference Group as well as to HDA colleagues who assisted in organising the literature searches.

Every effort has been made to be as accurate and up to date as possible in the preparation of this briefing. However, we would be very pleased to hear from readers who would like to comment on the content or on any matters relating to the accuracy of the briefing. We will make every effort to correct any matters of fact in subsequent editions. Comments can be made by using our website, [www.hda.nhs.uk/evidence](http://www.hda.nhs.uk/evidence)

**Professor Michael P. Kelly**  
**Director of Evidence and Guidance**  
**Health Development Agency**

Graham, H. and Kelly, M. P. (2004). *Health inequalities: concepts, frameworks and policy*. London: Health Development Agency.

Kelly, M. P., Swann, C., Morgan, A., Killoran, A., Naidoo, B. and Barnett-Paige, E. (2002). *Methodological problems in constructing the evidence base in public health*. London: Health Development Agency. [www.hda.nhs.uk/evidence](http://www.hda.nhs.uk/evidence)

Kelly, M. P., Chambers, J. Huntley, J. and Millward, L. (2003). *Method 1 for the production of effective action briefings and related materials*. London: Health Development Agency. [www.hda.nhs.uk/evidence/EIP\\_Protocol\\_july03.pdf](http://www.hda.nhs.uk/evidence/EIP_Protocol_july03.pdf)

Kelly, M. P., Speller, V. and Meyrick, J. (2004). *Getting evidence into practice in public health*. London: Health Development Agency. [www.hda.nhs.uk/documents/getting\\_eip\\_pubhealth.pdf](http://www.hda.nhs.uk/documents/getting_eip_pubhealth.pdf)

Killoran, A. and Kelly, M. P. (2004). Towards an evidence-based approach to tackling health inequalities: the English experience. *Health Education Journal* 63: 7-14.

Swann, C., Falce, C., Morgan, A. and Kelly, M. P. (2002). *HDA Evidence Base: process and quality standards manual for evidence briefings*. London: Health Development Agency. [www.hda.nhs.uk/evidence](http://www.hda.nhs.uk/evidence)

## Acknowledgements

The HDA acknowledges the contribution of the following:

### Membership of the Physical Activity Evidence Base Reference Group

|                  |  |
|------------------|--|
| Mary Allison     | Scottish Executive Health Department                               |
| Len Almond       | Loughborough University<br>(HDA Collaborating Centre)              |
| Jackie Brennan   | NW Physical activity coordinator                                   |
| Stuart Biddle    | Loughborough University<br>(HDA Collaborating Centre)              |
| Fiona Bull       | Loughborough University<br>(HDA Collaborating Centre)              |
| Kim Buxton       | Loughborough University<br>(HDA Collaborating Centre)              |
| Nick Cavill      | University of Oxford<br>(HDA Collaborating Centre)                 |
| Sue Collett      | Health Development Agency  |
| Hugo Crombie     | Health Development Agency  |
| Charles Foster   | University of Oxford<br>(HDA Collaborating Centre)                 |
| Ken Fox          | University of Bristol  |
| Ilana Freestone  | Sport England East Midlands  |
| Rod Griffiths    | Faculty of Public Health   |
| Carol Healy      | Department of Health   |
| Melvyn Hillsdon  | University College London  |
| Michael Kelly    | Health Development Agency  |
| Niall McKenzie   | Department of Health   |
| Val Moore        | Health Development Agency  |
| Nanette Mutrie   | University of Glasgow  |
| Mike Parker      | Chair of NW Health and Physical<br>Activity Forum                  |
| Felicity Porritt | Move4Health  |
| Andy Ramwell     | Manchester Metropolitan University                                 |
| Mike Rayner      | University of Oxford<br>(HDA Collaborating Centre)                 |
| Chris Riddoch    | University of Middlesex  |
| Nick Rowe        | Sport England  |
| Harry Rutter     | South East Public Health Observatory<br>(HDA Collaborating Centre) |
| Adrian Taylor    | University of Exeter   |
| Nick Wareham     | University of Cambridge  |
| Daniel Warm      | Health Development Agency  |
| Martin White     | University of Newcastle upon Tyne                                  |

We also thank Adrian Taylor and Martin White for peer review comments and Daniel Warm for assistance in the production of this briefing.

# Contents

|  |           |
|--|-----------|
| <b>Foreword</b>  | <b>ii</b> |
| <b>Summary</b>   | <b>1</b>  |
| <b>Introduction</b>  | <b>5</b>  |
| The HDA Evidence Base  | 5         |
| Who is this briefing for?                                      | 6         |
| Limitations of the briefing                                    | 6         |
| <b>Methodology</b>   | <b>7</b>  |
| <b>Reviews identified</b>                                      | <b>8</b>  |
| <b>Findings</b>  | <b>11</b> |
| <b>State of the evidence</b>                                   | <b>13</b> |
| Healthcare settings  | 13        |
| Community settings   | 15        |
| Workplace settings   | 16        |
| Older adults (50+)   | 17        |
| Adults from black and minority ethnic groups                   | 18        |
| Adults with physical limitations                               | 19        |
| <b>Gaps in the evidence</b>                                    | <b>20</b> |
| Inequalities   | 21        |
| <b>Research and policy recommendations</b>                     | <b>22</b> |
| Healthcare settings  | 22        |
| Community settings   | 23        |
| Workplace settings   | 23        |
| Older adults (50+)   | 24        |
| Adults from black and minority ethnic groups                   | 24        |
| Adults with physical limitations                               | 24        |
| <b>Conclusions</b>   | <b>25</b> |
| <b>References</b>  | <b>26</b> |
| <b>Appendix 1: Search strategy</b>                             | <b>28</b> |
| <b>Appendix 2: HDA Evidence base – critical appraisal tool</b> | <b>32</b> |

# Summary

## Introduction

This briefing presents the current evidence from selected good quality systematic reviews and meta-analyses published since 1996. The review will be updated regularly as new evidence becomes available; the latest version can be downloaded from the Health Development Agency's (HDA) website ([www.hda.nhs.uk/evidence](http://www.hda.nhs.uk/evidence)). It aims to identify interventions shown to be effective in increasing physical activity among adults, and is intended to inform policy and decision makers, NHS providers, public health physicians and other public health practitioners in the widest sense. The briefing has been produced by the HDA and its Physical Activity Evidence and Guidance Collaborating Centre, and is an update of the first version published in February 2004.

In his report, *At least five a week*, the Chief Medical Officer notes that the scientific evidence for the health benefits of physical activity are compelling (Department of Health, 2004a). People who have a physically active lifestyle reduce their risk of major diseases such as coronary heart disease, stroke and type 2 diabetes by up to 50%. Increasing physical activity would contribute to the prevention of obesity, some cancers and to weight management. It would also increase musculoskeletal health, reducing the risk of osteoporosis, back pain and osteoarthritis as well as having positive effects for wellbeing and mental health (Department of Health, 2004a; US Department of Health and Human Services, 1996).

The report of the Chief Medical Officer (Department of Health, 2004a) found no reason to change the recommended level of activity from the *Strategy statement on physical activity* (Department of Health, 1996). This is to achieve a total of 30 minutes of at least moderate intensity physical activity on five or more days of the week. In 1998, just 40% of men and 26% of

women were physically active at either of these levels (Department of Health, 2000a). Physical inactivity is associated with lower social class, income and educational attainment indicating that the promotion of physical activity is particularly important in these groups.

Promoting physical activity is a component of many government policy statements and commitments. These include those produced by the Department of Health and other departments such as the Department for Transport, the Department of Culture, Media and Sport and the Department for Education and Skills.

Physical activity is important in reaching many of the national targets set out in *National standards, local action* (Department of Health, 2004b). These targets include:

- Substantially reduce mortality rates by 2010 (from the *Our Healthier Nation* baseline, 1995-97):
  - From heart disease and stroke and related diseases by at least 40% in people under 75
  - From cancer by at least 20% in people under 75
- Tackle the underlying determinants of ill health and health inequalities by:
  - Halting the year-on-year rise in obesity among children under 11 by 2010 in the context of a broader strategy to tackle obesity as a whole (joint target with the Department for Education and Skills and the Department of Culture, Media and Sport).

The 2004 white paper, *Choosing health*, is based on three underpinning principles (Department of Health, 2004c):

- Informed choice – people want the freedom to make decisions about their own health
- Personalisation – people want support in making healthy choices. Support should be tailored to the realities of individual lives to ensure health inequalities are addressed

- Working together – government and individuals alone cannot make progress on healthier choices. Effective partnerships are required between government and key stakeholders.

Physical activity is one of six priorities identified in the white paper and actions to promote physical activity are examined in several chapters ('Health in the consumer society', 'Children and young people – starting on the right path', 'Local communities leading for health', 'Work and health', and 'Health promoting NHS').

Four public service agreements (PSAs) have a bearing on physical activity. These are:

- Halt the year-on-year increase in obesity among children under 11 by 2010 in the context of a broader strategy to tackle obesity in the population as a whole (DH/DCMS/DfES joint PSA)
- By 2008, increase the take-up of sporting opportunities among adults and young people aged 16 and above from priority groups who participate in active sports, excluding walking, at least 12 times a year by 3%; and increase the number of people aged 16 and above from priority groups who engage in at least 30 minutes of moderate intensity level sport, including walking, at least three times a week by 3% (DCMS PSA)
- Enhance take-up by 5-16 year olds of a minimum of two hours a week on high quality PE and sport to 75% by 2006 and 85% by 2008 in England (DfES/DCMS joint PSA)
- Lead the delivery of cleaner, safer and greener public spaces ... with measurable improvement by 2008 (ODPM PSA).

National Service Frameworks for coronary heart disease, diabetes and the *NHS Cancer Plan* provide models to support the achievement of these reductions in morbidity and mortality (Department of Health, 2000b, 2000c, 2001b).

*The NHS Plan* set out comprehensive plans for investment in and reform of the NHS. It included the commitment to develop 'local action to tackle obesity and physical activity, informed by advice from the Health Development Agency on what works' (Department of Health, 2001a).

The 1998 white paper, *A new deal for transport: better for everyone*, was the first transport white paper to make explicit links between transport and health, stating:

*'The way we travel is making us a less healthy nation.'*  
(Department for Transport, 1998)

It noted that coronary heart disease is the biggest killer of adults and that an over-reliance on motorised transport was implicated because people do not walk or cycle as much as they used to do. The 2004 transport white paper, *The future of transport: a network for 2030*, reiterates these concerns for health and the environment. It specifically encourages walking and cycling for short journeys to increase levels of physical activity and to improve public health (Department for Transport, 2004a).

The Department for Transport's document *Walking and cycling: an action plan* notes the importance of persuading people to walk and cycle for the health benefits as well as for the positive contribution it can provide to liveability and reducing congestion (Department for Transport, 2004b).

While much is known about the potential health gains of a physically active and fit population, far less is known about effective interventions for increasing physical activity. This review considers the existing evidence and, along with the results of the review, presents policy and research recommendations.

## Methodology

This evidence briefing is a 'review of reviews'; that is, a synthesis of high-quality systematic reviews and meta-analyses to increase physical activity among adults. The briefing is not a systematic review of primary data. It updates the first version published in February 2004.

We used the following inclusion criteria to identify the reviews included in the briefing:

- Systematic reviews and meta-analyses of randomised controlled trials or quasi-experimental studies
- Public health and primary care interventions to increase physical activity
- English language only
- 1996 to April 2004
- Human studies
- Adult populations (≥16 years old).

## Findings

Sixteen systematic reviews and meta-analyses met the criteria outlined above and were included in the HDA Evidence Base. Six new review studies were found since 2001 (the previous version of this briefing covered reviews from 1996 to November 2001). Of these, three reviews covered healthcare settings (Eden et al., 2002; Petrella and Lattanzio, 2002; Smith et al., 2002). One review examined the workplace (Proper et al., 2003) and two reviews looked at older adults (Van der Bij et al., 2002; Conn et al., 2003).

### *Healthcare settings*

In total, eight reviews examined the effectiveness of physical activity interventions in healthcare settings (Ashenden et al., 1997; Eaton and Menard, 1998; Simons-Morton et al., 1998; Eakin et al., 2000; Lawlor and Hanratty, 2001; Eden et al., 2002; Petrella and Lattanzio, 2002; Smith et al., 2002). The settings included general practice and hospital outpatient departments.

Review-level evidence suggests:

- Brief advice from a health professional, supported by written materials, is likely to be effective in producing a modest, short-term (6-12 weeks) effect on physical activity
- Referral to an exercise specialist, based in the community, can lead to longer-term (>8 months) changes in physical activity
- Short-term effectiveness of primary prevention interventions is associated with single-factor interventions (physical activity only) that focus on the promotion of moderate-intensity physical activity (typically walking) in a sedentary population.

### *Community settings*

Two systematic reviews investigated the effectiveness of interventions in community settings (Dunn et al., 1998; Hillsdon and Thorogood, 1996). Community settings are those where participants are not recruited via a specific setting such as general practice, a hospital department or workplace etc.

Review-level evidence suggests that:

- Interventions targeting individuals in community settings are effective in producing short-term changes in physical activity, and are likely to be effective in

producing mid- to long-term changes in physical activity

- Interventions based on theories of behaviour change, which teach behavioural skills and are tailored to individual needs, are associated with longer-term changes in behaviour than interventions without a theoretical base
- Interventions that promote moderate intensity physical activity, particularly walking, and are not facility dependent, are also associated with longer-term changes in behaviour
- Studies that incorporate regular contact with an exercise specialist tend to report sustained changes in physical activity.

### *Workplace settings*

Two reviews examined the effectiveness of physical activity interventions for adults in the workplace (Dishman et al., 1998; Proper et al., 2003).

Review-level evidence suggests that:

- Findings from studies examining the effectiveness of workplace interventions are inconsistent in promoting changes in physical activity.

### *Older people (50+)*

Three reviews examined the effectiveness of physical activity interventions for older people (King et al., 1998; Van der Bij et al., 2002; Conn et al., 2003).

Review-level evidence suggests:

- Interventions restricted to adults aged 50 years and older are effective in producing short-term changes in physical activity and there is limited evidence that they can be effective in producing mid- to long-term changes in physical activity
- A range of intervention strategies is associated with increases in physical activity with no one approach consistently and significantly superior
- Interventions that used individual-based or group-based behavioural or cognitive approaches with a combination of group- and home-based exercise sessions are equally effective in producing changes in physical activity
- Interventions that promote moderate intensity and non-endurance physical activities (eg flexibility exercises) are associated with changes in physical activity
- Interventions that provide support and follow-up are also associated with changes in physical activity.

### *Adults from black and minority ethnic groups and adults with physical limitations*

One review (Taylor et al., 1998) examined black and minority ethnic groups and adults with physical limitations. It did not identify evidence of effectiveness of interventions in these groups.

## **Gaps in the evidence base**

None of the reviews specifically explored the effectiveness of physical activity interventions in different social groups. Population surveys have reported that the prevalence of physical inactivity is higher in some minority ethnic groups, in people in low-income households, in the lower social classes and in people with low levels of education. Therefore, it is imperative that future exercise promotion research examines the independent and interactive effects of these social determinants to inform appropriate intervention study designs. Formative research will almost certainly be required to better understand the particular needs of different groups.

At present, no review-level evidence of the effectiveness of interventions aimed at changing policy or the built environment on physical activity is available. This briefing was limited to experimental or quasi-experimental study designs, so excluding a substantial amount of literature from consideration. This observation highlights the important point that when this evidence briefing has uncovered no review-level evidence to support a certain intervention or programme, it does not mean there is absolutely no evidence of its effectiveness (or even that there is evidence that it does not work), just that no evidence was found from systematic reviews that met the inclusion criteria.

Prior to including other types of study designs into reviews such as this there will need to be an agreed method for systematically synthesising or reviewing such work. There are a number of projects underway nationally and internationally to develop an appropriate methodology.

# Introduction

The Health Development Agency (HDA) has been asked by the Department of Health to develop an evidence base of effective health improvement interventions. One of the topics chosen was physical activity, and this briefing joins many other topic-based papers on the HDA Evidence Base website ([www.hda.nhs.uk/evidence](http://www.hda.nhs.uk/evidence)). This briefing updates the first version published in February 2004.

The aims of this briefing are to:

- Identify all relevant systematic reviews and meta-analyses of exercise promotion that are limited to interventions that target individual-level change and measure changes in physical activity at the level of the individual
- Review these papers and highlight ‘what works’ to increase physical activity among adults, with particular reference to disadvantaged and vulnerable groups
- Highlight conflicting evidence, gaps in the evidence and provide a steer for future policy and research commissioning.

## The HDA Evidence Base

Decisions about policy and practice in the public sector are increasingly driven by consideration of the best available evidence. The process of drawing together, analysing and synthesising evidence from research is a central principle of evidence-based practice. Typically, the process of reviewing an area of practice or intervention will include the production of a systematic review of effectiveness, a meta-analysis or some other review-level synthesis and interpretation of evidence from research.

As more reviews and meta-analyses are carried out across the spectrum of public health, there is an increasing need to map the areas that they cover, assess their quality and

pull together any common findings about what works in particular areas to improve health and reduce health inequalities. The task of keeping abreast of such large amounts of information is now too difficult for any one person. Systematic reviews are able to condense this large amount of information, via a structured method, into summary documents.

The HDA has taken on the task of mapping and synthesising the best available review-level evidence for the effectiveness of interventions to improve health and reduce health inequalities across priority areas of public health. This evidence briefing is part of the first set of publications from the project. Mapping and synthesis of review-level data will enable practitioners and policy makers to view the aggregate strength of the evidence in key areas, see clearly where review-level evidence is lacking, and inform the development and commissioning of future research and reviews.

Evidence briefings are essentially reviews of reviews, analysing the strengths and weaknesses at this level in a topic’s evidence base, identifying gaps in the evidence, analysing future primary and secondary research needs, and discussing the implications of findings for policy and practice. Each briefing has a free-standing summary that is published separately. The briefings are also published on the HDA website ([www.hda.nhs.uk/evidence](http://www.hda.nhs.uk/evidence)). The HDA Evidence Base website contains the latest edition of this briefing and the authors recommend that readers refer to the website to ensure they have the current version. Access to the original reviews on which these briefings are based can also be found on the HDA Evidence Base website, if they are available.

Evidence briefings are designed to be accessed by a variety of users including those simply looking for headline findings, those wanting complete and detailed

syntheses and those who need to track back to the original primary and secondary sources.

Providing comprehensive, up-to-date syntheses of the literature available in reviews is the chosen first step in a process of building the public health evidence base. As our programme of work continues, we will turn our attention to bringing into our evidence briefings work that does not usually find its way into systematic reviews.

This briefing has been produced by the HDA and its Physical Activity Evidence and Guidance Collaborating Centre. This collaborating centre is a consortium of the British Heart Foundation Health Promotion Research Group at the University of Oxford, the British Heart Foundation National Centre for Physical Activity at Loughborough University and the South East Public Health Observatory.

The next stage in the process is for the collaborating centre to develop practice advice derived from the findings of the evidence briefings. Following the publication of this briefing, a process of mapping and synthesis, informed and reviewed by practitioner and research experts, will take place, leading to the production of a practice-based effective action briefing.

Evidence into practice requires gathering evidence from all sources and combining it with political and social information, mindful of resource constraints, to develop learning that is passed on to practitioners. The HDA has piloted this process of evidence into practice in two topic areas (physical activity and the prevention of accidental injuries) in 2002-03 (Kelly and Speller, 2003).

## Who is this briefing for?

This briefing is intended to inform policy and decision makers, NHS providers, public health physicians and other public health practitioners in the widest sense. The limitations of this briefing and the data on which it is based, and alternative sources of evidence that may be helpful to inform policy and practice, are set out below.

The main research question used in producing this briefing was: 'What evidence is there that physical activity can be increased in insufficiently active, non-institutionalised, free living adults?'

## Limitations of the briefing

This briefing is primarily a review of meta-analysis and systematic review-level evidence that maps out the current state of this level of evidence and judges the strength of that evidence. This process allows the gaps in the evidence base to be identified, particularly with regard to health inequalities, and so provides the basis on which to formulate research recommendations.

This review does not examine the unplanned consequences of interventions on increasing the risks of accidents as a result of becoming more active. However, the HDA has produced a more general evidence briefing on accidental injuries in children and older people (Millward et al., 2003).

At present, the systematic review might be perceived to be the most robust and reliable summary of effectiveness, closely followed by a well-designed meta-analysis. However, relying on this type and level of evidence to inform conclusions has some limitations, and it is important to consider them when making decisions about policy or practice. Reviews tend to focus on a relatively narrow spectrum of potential evidence that sits within traditional evidence hierarchies, while also being influenced by publication bias (ie articles with inconclusive or negative findings). Furthermore, public health priorities often do not 'fit' easily into these types of study designs.

This briefing provides a basis for developing practice guidelines using the reviews identified, as well as the individual studies identified within these reviews.

# Methodology

This updated briefing is based on findings from systematic reviews of public health interventions to increase physical activity. It is a 'review of reviews' and not a systematic review of individual intervention trials. In the identified HDA Evidence Base papers findings were typically derived from reviews of randomised controlled trials (RCTs).

An extensive and systematic search was conducted to identify the relevant literature. The search strategy was built on the earlier review's approach and included two new electronic databases (SIGLE and SportDiscus). Full details of the search strategies are shown in Appendix 1. Searches were conducted on the following electronic databases, websites and published sources:

- Clinical Evidence, Cochrane Library, DARE admin database, EMBASE, Health Evidence Bulletins Wales, HTA, National Guidelines Clearinghouse, National Research Register, NCCHTA website, NICE website, PsycINFO, ReFeR, SIGLE, SIGN, Sociological Abstracts, SportDiscus, TRIP, 'Wider Public Health' report.

SIGLE and SportDiscus were searched from 1996 to April 2004. All other databases were searched from November 2001 (the end point of searching for the first edition of this briefing) to April 2004. The searches of the databases listed above were downloaded into Reference Manager software.

Titles and abstracts of identified references were assessed for relevance. The following criteria were used:

- Systematic reviews and meta-analyses in English language only
- Adult populations (from 16 to 90+ years old)
- Human studies
- Systematic reviews and meta-analyses
- Public health and primary care interventions to increase physical activity.

Where no clear decision could be made on the basis of the title or abstract, studies were considered relevant. In addition, personal retrieval systems were also employed and the reference lists of existing reviews were searched. From this process a total of 15 papers thought to be relevant for the update of this briefing were ordered from the British Library and retrieved within the timescale of this review.

All papers were assessed independently by two reviewers and critically appraised in terms of transparency, systematicity and relevance according to HDA Evidence Base methodology (as detailed in the *HDA Evidence Base Process and Quality Standards Manual for Evidence Briefings* – [www.hda-nhs.uk/evidence/ebmanual\\_pqs.html](http://www.hda-nhs.uk/evidence/ebmanual_pqs.html)). There was no blinding of authorship of retrieved papers. A critical appraisal tool form was completed by each reviewer (Appendix 2) and a joint decision was made regarding whether the paper was of a suitable quality to be included in the HDA Evidence Base, whether it could be used in the briefing to inform discussion, or discarded. Disagreements were resolved through discussion or by recourse to a third reviewer.

This process identified six additional HDA Evidence Base review papers, which were compared and top-level findings collated. Any conflicting evidence was identified and gaps in the evidence concerning the reduction of health inequalities were charted. A set of evidence statements were derived from top-level findings. Any kind of quantitative summary, including an attempt to calculate pooled effect sizes, has not been undertaken due to the heterogeneous nature of the studies and the diversity of outcome measures employed.

# Reviews identified

The search strategy identified 15 reviews for possible inclusion in this update. Each of these were read by two authors and considered for inclusion by using the HDA's critical appraisal tool (Appendix 2). Papers were included in the review if they met the following criteria:

- Systematic review or meta-analysis
- Results reported for adults  $\geq 16$  years old
- Results reported for experimental/quasi-experimental studies
- Main outcome measure was self-reported physical activity
- Methods of conducting the review were clearly described
- Sufficient data from individual studies were reported to mediate between data and conclusions.

Six papers met the inclusion criteria and are presented in Table 1, together with the 10 papers included in the original evidence briefing, providing a total of 16 reviews. The six new review studies were all later than 2001. No new reviews were found by searching the SIGLE and SportsDiscus databases (1996-2004). Of the six new reviews, three covered healthcare (Eden et al., 2002; Petrella and Lattanzio, 2002; Smith et al., 2002); one review examined the workplace (Proper et al., 2003); and two reviews looked at older adults (Van der Bij et al., 2002; Conn et al., 2003).

The main reason for excluding studies was that they were not systematic reviews. Our search strategy did not identify reviews of interventions at the community, policy or environmental level but did identify reviews of individual-level interventions based in healthcare, community and workplace settings. The search strategy also identified reviews of interventions targeting older adults, adults from black and minority ethnic groups and adults with physical limitations.

The review conducted by Kahn et al. (2002), from the Centers for Disease Control and Prevention in the US, was not included in this review because it did not meet the inclusion criteria in that it included non-experimental studies such as uncontrolled 'before and after' studies. Kahn et al. (2002) also used a broader definition of effectiveness, pooled effects from different types of experimental studies and included children. These differences made it unsuitable to use as part of this briefing.

## Systematic reviews and meta-analyses identified (by publication date)

### Reviews included in first edition

Hillsdon, M. and Thorogood, M. (1996). A systematic review of physical activity promotion strategies. *British Journal of Sports Medicine* 30: 84-9.

Ashenden, R., Silagy, C. and Weller, D. (1997). A systematic review of the effectiveness of promoting lifestyle change in general practice. *Family Practice* 14: 160-76.

Eaton, C. B. and Menard, L. M. (1998). A systematic review of physical activity promotion in primary care office settings. *British Journal of Sports Medicine* 32: 11-6.

King, A. C., Rejeski, W. J. and Buchner, D. M. (1998). Physical activity interventions targeting older adults. A critical review and recommendations. *American Journal of Preventive Medicine* 15: 316-33.

Taylor, W. C., Baranowski, T. and Young, D. R. (1998). Physical activity interventions in low-income, ethnic minority, and populations with disability. *American Journal of Preventive Medicine* 15: 334-43.

Dunn, A. L., Andersen, R. E. and Jakicic, J. M. (1998). Lifestyle physical activity interventions. History, short- and long-term effects, and recommendations. *American Journal of Preventive Medicine* 15: 398-412.

Dishman, R. K., Oldenburg, B., O'Neal, H. and Shephard, R. J. (1998). Worksite physical activity interventions. *American Journal of Preventive Medicine* 15: 344-61.

Simons-Morton, D. G., Calfas, K. J., Oldenburg, B. and Burton, N. W. (1998). Effects of interventions in health care settings on physical activity or cardiorespiratory fitness. *American Journal of Preventive Medicine* 15: 413-30.

Eakin, E. G., Glasgow, R. E. and Riley, K. M. (2000). Review of primary care-based physical activity intervention studies: effectiveness and implications for practice and future research. *Journal of Family Practice* 49: 158-68.

Lawlor, D. A. and Hanratty, B. (2001). The effect of physical activity advice given in routine primary care consultations: a systematic review. *Journal of Public Health Medicine* 23: 219-26.

### Additional reviews included in second edition

Eden, K. B., Orleans, T., Mulrow, C., Pender, N. J. and Teutsch, S. M. (2002). Does counselling by clinicians improve physical activity? A summary for the U.S. Prevention Services Task Force. *Annals of Internal Medicine* 137: 208-15.

Petrella, R. J. and Lattanzio, C. N. (2002). Does counselling help patients get active? Systematic review of the literature. *Canadian Family Physician* 48: 72-80.

Smith, B. J., Merom, D., Harris, P. and Bauman, A. E. (2002). *Do primary care interventions to promote physical activity work? A systematic review of the literature*. Sydney: NSW Centre for Physical Activity and Health.

Van der Bij, A. K., Laurant, M. G. and Wensing, M. (2002). Effectiveness of physical activity interventions for older adults: a review. *American Journal of Preventive Medicine* 22: 120-33.

Conn, V. S., Minor, M. A., Burks, K. J., Rantz, M. J. and Pomeroy, S. H. (2003). Integrative review of physical activity intervention research with aging adults. *Journal of the American Geriatrics Society* 51: 1159-68.

Proper, K. I., Koning, M., van der Beek, A. J., Hildebrandt, V. H., Bosscher, R. J and van Mechelen, W. (2003). The effectiveness of worksite physical activity programs on physical activity, physical fitness, and health. *Clinical Journal of Sports Medicine* 13: 106-17.

**Table 1: Systematic reviews of physical activity promotion**

| Authors                       | No. studies reviewed | Total subjects from RCTs (including controls) | Last year of searching |
|-------------------------------|----------------------|---|------------------------|
| Hillsdon and Thorogood (1996) | 12 studies/12 RCTs   | 1,699   | 1996                   |
| Ashenden et al. (1997)        | 6 studies/6 RCTs     | 22,643  | 1995                   |
| Eaton and Menard (1998)       | 8 studies/8 RCTs     | 14,181  | 1997                   |
| King et al. (1998)            | 29 studies/26 RCTs   | 3,602   | Not stated             |
| Taylor et al. (1998)          | 14 studies/5 RCTs    | 1,560   | 1997                   |
| Dunn et al. (1998)            | 14 studies/7 RCTs    | 3,248   | Not stated             |
| Dishman et al. (1998)         | 26 studies/9 RCTs    | 8,800   | 1997                   |
| Simons-Morton et al. (1998)   | 36 studies/29 RCTs   | 16,509  | 1997                   |
| Eakin et al. (2000)           | 15 studies/9 RCTs    | 9,084   | 1998                   |
| Lawlor and Hanratty (2001)    | 8 studies/2 RCTs     | 1,113   | 2000                   |
| Eden et al. (2002)            | 8 studies/7 RCTs     | 7,912   | 03/2003                |
| Petrella and Lattanzio (2002) | 13 studies/6 RCTs    | 11,032  | Not stated             |
| Smith et al. (2002)           | 20 studies/14 RCTs   | 20,782  | 2002                   |
| Van der Bij et al. (2002)     | 38 studies/38 RCTs   | 16,376  | 2000                   |
| Conn et al. (2003)            | 17studies/17 RCTs    | 6,391   | 2000                   |
| Proper et al. (2003)          | 26 studies/15 RCTs   | 4,747   | 2000                   |

| Authors                       | Population (people + age group etc)                               | Setting/target group                           |
|-------------------------------|---|--|
| Hillsdon and Thorogood (1996) | Healthy adults, 18-72 years                                       | Community                                      |
| Ashenden et al. (1997)        | Healthy and chronic CVD adults, 18-75 years                       | Healthcare                                     |
| Eaton and Menard (1998)       | Adults, 17-85+  | Healthcare                                     |
| King et al. (1998)            | Older adults healthy and chronic disease, 50+                     | Older adults                                   |
| Taylor et al. (1998)          | Adults from minority ethnic groups with disabilities, 18-81 years | Minority ethnic groups, low income, disability |
| Dunn et al. (1998)            | Healthy and chronic adults, 25-80+                                | Community                                      |
| Dishman et al. (1998)         | Manual and non-manual workers, 18-73 years                        | Workplace                                      |
| Simons-Morton et al. (1998)   | Healthy adults, 18-75+, adults with chronic disease 32-75 years   | Healthcare                                     |
| Eakin et al. (2000)           | Healthy and chronic CVD adults, 16-80 years                       | Healthcare                                     |
| Lawlor and Hanratty (2001)    | Sedentary healthy adults, 18+                                     | Healthcare                                     |
| Eden et al. (2002)            | Healthy adults, 18-75+  | Healthcare                                     |
| Petrella and Lattanzio (2002) | Healthy adults, 18-75+  | Healthcare                                     |
| Smith et al. (2002)           | Healthy adults, 18 to 65+ years                                   | Healthcare                                     |
| Van der Bij et al. (2002)     | Older adults, mean age 51 to 88                                   | Older adults                                   |
| Conn et al. (2003)            | Older adults, 65 to 90 years                                      | Older adults                                   |
| Proper et al. (2003)          | Manual and non-manual workers (age range not stated)              | Workplace                                      |

# Findings

This section highlights the key findings of the 16 reviews identified. The evidence statements were derived from top-level findings.

## Healthcare settings

Review-level evidence suggests:

- Brief advice from a health professional, supported by written materials, is likely to be effective in producing a modest, short-term (6-12 weeks) effect on physical activity
- Referral to an exercise specialist based in the community can lead to longer-term (>8 months) changes in physical activity
- Short-term effectiveness of primary prevention interventions is associated with single-factor interventions (physical activity only), which focus on the promotion of moderate-intensity physical activity (typically walking) in a sedentary population.

## Community settings

Review-level evidence suggests:

- Interventions targeting individuals in community settings are effective in producing short-term changes in physical activity, and are likely to be effective in producing mid- to long-term changes in physical activity
- Interventions based on theories of behavioural change, which teach behavioural skills and are tailored to individual needs, are associated with longer-term changes in behaviour than interventions without a theoretical base
- Interventions that promote moderate-intensity physical activity, particularly walking, and are not facility

dependent, are also associated with longer-term changes in behaviour

- Studies that incorporate regular contact with an exercise specialist tend to report sustained changes in physical activity.

## Workplace settings

Review-level evidence suggests:

- Findings from studies examining the effectiveness of workplace interventions are inconsistent in promoting changes in physical activity.

## Older adults (50+)

Review-level evidence suggests:

- Interventions restricted to adults aged 50 years and older are effective in producing short-term changes in physical activity and there is limited evidence that they can be effective in producing mid- to long-term changes in physical activity
- A range of intervention strategies are associated with increases in physical activity with no one approach consistently and significantly superior
- Interventions that used individual-based or group-based behavioural or cognitive approaches with a combination of group- and home-based exercise sessions are equally effective in producing changes in physical activity
- Interventions that promote moderate intensity and non-endurance physical activities (eg flexibility exercises) are associated with changes in physical activity
- Interventions that provide support and follow-up are also associated with changes in physical activity.

## Adults from black and minority ethnic groups

- Currently the review-level evidence does not provide evidence of effectiveness of interventions focusing on people from minority ethnic groups. Very few studies have been conducted with this target group.

## Adults with physical limitations

- Currently the review-level evidence does not provide evidence of effectiveness of interventions focusing on people with physical limitations (arthritis, low back pain, chronic obstructive pulmonary disease and cystic fibrosis).

# State of the evidence

The review-level evidence is presented in six categories, based on those identified by the original authors of the reviews. These categories cover three settings (healthcare, community and workplace) and three target groups (older adults, minority ethnic groups and adults with physical limitations – described in the original paper as adults with disabilities). The majority of the review evidence from the first edition of this briefing fell into the healthcare setting, where five reviews were identified. Only one review was found in each category for workplace and older adults, and one covered both minority ethnic groups and adults with physical limitations.

The six additional reviews identified for the second edition fall into healthcare (three reviews), older people (two reviews) and workplace (one review).

## Healthcare settings

### *Summary*

This section includes reviews of studies that were based in healthcare settings such as general practice, hospital outpatient clinics or hospital exercise facilities. Interventions were delivered at the individual level either by medical staff and/or health educators or exercise specialists:

- There are eight reviews that examined the effectiveness of physical activity interventions in healthcare settings (Ashenden et al., 1997; Eaton and Menard, 1998; Simons-Morton et al., 1998; Eakin et al., 2000; Lawlor and Hanratty, 2001; Eden et al., 2002; Petrella and Lattanzio, 2002; Smith et al., 2002). The settings included general practice and hospital outpatient departments
- 56 quasi-experimental/experimental studies were reported
- Seven studies were from the UK.

Review-level evidence suggests:

- Brief advice from a health professional, supported by written materials, is likely to be effective in producing a modest, short-term (6-12 weeks) effect on physical activity
- Referral to an exercise specialist, based in the community, can lead to longer-term (>8 months) changes in physical activity
- Short-term effectiveness of primary prevention interventions is associated with single-factor interventions (physical activity only), which focus on the promotion of moderate intensity physical activity (typically walking) in a sedentary population.

Examples of interventions included in the reviews:

- Information and advice given by a nurse or general practitioner
- Written prescriptions for physical activity
- Self-help materials including brochures and tailored print material
- Telephone follow-up
- Referral to an exercise specialist
- Multiple risk factor counselling.

Intervention characteristics common to the six studies that focused on physical activity alone and produced positive short-term changes in physical activity include:

- Brief advice from a general practitioner
- Written information about physical activity.

The one study that produced longer-term changes in physical activity recruited participants from general practice lists and offered them two one-to-one appointments with an exercise specialist in the community. A personalised exercise plan was negotiated

and an offer of reduced cost exercise at local leisure centres was made (Stevens et al., 1998).

The multiple risk factor trials reporting positive changes in physical activity generally included a risk assessment with a health professional followed by discussion of the results along with advice about behaviour change. With multiple risk factor interventions it is not possible to determine the extent of the effort with which physical activity was addressed and therefore which element of the intervention had the effect on physical activity.

### *Strengths and challenges*

Five of the eight reviews (32 RCTs) concluded there is evidence to support the effectiveness of physical activity interventions in healthcare settings. However, these reviews tended to describe the effectiveness of these interventions as modest and short term. Common characteristics of these reviews were:

- They examined the effectiveness of interventions that aimed to change only physical activity behaviour rather than multiple behaviours such as in multiple risk factor interventions
- They included studies that examined the effectiveness of physical activity interventions delivered by a range of health and exercise professionals, as well as medical staff
- They based their conclusions about the effectiveness of interventions at time points under six months and up to two years
- They included a greater number of studies included in their reviews.

Three of the eight reviews (13 RCTs) were more cautious in their conclusions, suggesting that there is not clear evidence that physical activity interventions in healthcare settings are effective. Common characteristics of these reviews were:

- They included multiple risk factors intervention studies
- They examined studies that only tested the effectiveness of physical activity interventions delivered by medical staff
- They based their conclusions about effectiveness of the interventions at a minimum time point of at least four months (four RCTs), at six months (six RCTs) and at least 12 months (five RCTs)
- They included a small number of studies due to the inclusion criteria.

One review categorised studies into primary prevention (targeting the general patient population free of pre-existing disease) or secondary prevention (targeting patients with existing disease) (Simons-Morton et al., 1998). There were 14 primary prevention studies and eight secondary prevention studies.

Of the primary prevention studies, seven were single-factor interventions and seven were multiple risk factor interventions. Six of the seven single-factor interventions reported significant differences in physical activity between intervention and control groups at 4-12 weeks follow-up. Just one of seven reported a significant effect when the follow-up was greater than six months, with no studies reporting a significant effect after 12 months. Three of the seven were multiple risk factor interventions that reported a significant effect in the short term (up to six weeks), with one of seven reporting a significant effect in the longer term (after 12 months).

All eight of the hospital outpatient studies reviewed were part of multiple risk factor interventions and included follow-up periods greater than 12 months. Three of eight studies reported significant differences in physical activity between intervention and control groups.

Many of the studies included in these eight reviews contained methodological limitations. The main limitations were lack of blinding to the intervention in the person measuring the outcome, lack of intention-to-treat analyses and failure to report any potential harm that occurred during the study (eg muscular-skeletal injuries, cardiac events). Failure to assess or understand any possible harm that might occur may influence non-response bias.

### *Study design*

Limited information was available on how randomisation was conducted and whether it was concealed from the practitioner prior to randomisation. This may threaten the internal validity of the study, especially if the practitioner has a strong personal preference for one intervention over another. A number of studies used cluster randomisation without controlling for the effects of the clustering in the analysis. This could lead to an overestimate of the effect of the intervention.

Not all studies conducted their analysis on an intention-to-treat basis (ie not all randomised participants included in the trial/intervention were included in the analysis).

Participants who completed studies are likely to be different from those who were randomised and did not complete the study, leading to an exaggeration of results.

Few studies reported the potential modification of the effects of the study by factors such as gender or social position. Most studies relied on self-reported physical activity as their outcome and many did not report the validity and reliability of the method used. This is likely to lead to random misclassification of participants and therefore an underestimate of the true effect of the interventions.

### *Generalising results*

The recruitment of participants and health professionals and the choice of medical centre is likely to have produced significant selection bias. Very often, health professionals or medical centres were selected because of their willingness to comply with the study protocol. Therefore, it is possible that the health professionals in the studies are more motivated than the majority of professionals to deliver physical activity interventions. Similarly, study participants were generally volunteers who had completed a number of levels of recruitment prior to randomisation and as a consequence were probably more motivated to change their physical activity than people found in routine practice.

Study participants were generally well educated and white. Little is known about the effectiveness of healthcare-based physical activity interventions in non-white, less advantaged groups. Only four of the studies were UK based. It is not known how well studies conducted in the US and Australia could be transferred to UK settings.

Despite the popularity of primary care interventions in the UK, it is still not known whether individual advice from a person's usual general practitioner may lead to significant increases in physical activity that can be sustained beyond three months.

## Community settings

### *Summary*

This section includes reviews of studies that were based in the community rather than in a specific setting such as the workplace or general practice:

- No new reviews were found in this category. The two reviews from the first edition of this briefing examined the effectiveness of physical activity interventions based in the community (Dunn et al., 1998; Hillsdon and Thorogood, 1996). Community settings are those where participants are not recruited via a specific setting such as general practice, a hospital department or workplace etc.
- Settings included the home, fitness/leisure/sports facilities
- 13 experimental studies were reported
- No studies were from the UK.

Review-level evidence suggests:

- Interventions targeting individuals in community settings are effective in producing short-term changes in physical activity, and are likely to be effective in producing mid- to long-term changes in physical activity
- Interventions based on theories of behaviour change, which teach behavioural skills and are tailored to individual needs, are associated with longer-term changes in behaviour than interventions without a theoretical base
- Interventions that promote moderate-intensity physical activity, particularly walking, and are not facility dependent, are also associated with longer-term changes in behaviour
- Studies that incorporate regular contact with an exercise specialist tend to report sustained changes in physical activity.

Examples of interventions included in the reviews:

- Weekly group exercise 'counselling'
- Mailed self-help materials
- Stage-of-change written materials
- Exercise testing and prescription
- Telephone education, advice and support
- Supervised, facility based exercise
- Behaviour modification
  - Self-monitoring
  - Reinforcement
  - Relapse prevention.

The effective interventions in the two reviews reported here included the following:

- Recruitment via advertisement in the local press or random phone survey
- Encouragement of exercise that can be taken from the home (ie walking)
- Written materials sent by post that provide education and guidance on starting and maintaining an exercise programme
- Self-monitoring via logbooks
- On-going support via the telephone.

The studies generally adopted a system of 'home-based supervised' physical activity programmes. The 'supervision' was usually delivered by telephone and supported with printed material.

### *Strengths and challenges*

Thirteen randomised controlled trials were included in these reviews, eight of which reported statistically significant differences in physical activity between intervention and control groups. Follow-up periods ranged from five weeks to two years. Three studies reported significant differences in physical activity between intervention and control groups at two-year follow-up. All three studies promoted moderate-intensity physical activity that typically focused on walking. One of the three studies has since reported that increased walking levels, following the intervention, can be sustained for up to 10 years. All three studies also included comprehensive pre-exercise assessment and personally tailored programmes. Participants were taught how to incorporate physical activity into their lifestyles and received regular support over the early months of the study.

A number of methodological limitations were present in the studies.

### *Study design*

Not all studies conducted their analysis on the basis of an intention to treat. Participants who completed studies are likely to be different from those who were randomised and did not complete the study. A number of studies did not include 'no-intervention control groups' but comparison groups. This prevents the dismissal of regression to the mean as a possible explanation for the results. Most studies relied on self-reported physical activity as their outcome and many did not report the validity and reliability of the method used. This risks non-

differential misclassification of participants and therefore an underestimate of the true effect of the interventions. A number did, however, use validated measures and also backed up self-reports with motion sensor data and cardiorespiratory fitness tests.

### *Generalising results*

The recruitment of participants often involved extensive screening and testing prior to randomisation. This is likely to have resulted in highly motivated study participants. The staff delivering the interventions were typically part of a university research team with undergraduate degrees in exercise science or from the behavioural sciences. If the interventions were to be replicated in normal practice, the professionals responsible for delivering them would have to be identified, as would the resources to pay for them. A number of the studies involved participants who were university staff, and likely to be more compliant than the general population.

Study participants were generally well educated and white although a few studies included participants from minority ethnic groups. No studies were found from the UK. It is not known whether the findings from these US studies would be applicable to the UK.

## **Workplace settings**

### *Summary*

The two reviews covered interventions delivered in the workplace at the individual level:

- The reviews examined the effectiveness of physical activity interventions for adults in the workplace (Dishman et al., 1998; Proper et al., 2003)
- 49 quasi-experimental/experimental studies were reported
- Only two studies were from the UK.

Review-level evidence suggests:

- Findings from studies examining the effectiveness of workplace interventions are inconsistent in promoting changes in physical activity.

Examples of interventions included in the review:

- Exercise testing and prescription in workplace fitness facilities

- Individual exercise prescription, goal setting, reinforcement, relapse prevention.

Characteristics of studies that reported a positive increase in physical activity at six months follow-up included:

- Health screening and counselling
- Follow-up and re-assessment of progress
- Encouragement to self-select moderate physical activities
- Opportunities to participate in supervised and unsupervised programmes of physical activities including aerobics, walking and cycling.

### *Strengths and challenges*

In an earlier review (Dishman et al., 1998) no statistically significant increases in physical activity or fitness were found between intervention and control groups. In a recent review, Proper et al. (2003) reported that there was 'strong evidence' of the effectiveness of workplace interventions aiming to improve physical activity. In the Proper review eight studies examined the effectiveness of a workplace physical activity programme on self-reported levels of physical activity. Two of the five studies that reported a positive effect on physical activity were described as high quality randomised controlled trials.

The differences in the findings of these two reviews are likely to be due to different methods in conducting the review. The earlier review conducted a quantitative analysis, controlling for a measure of study quality, whereas the later review was qualitative. The inclusion criteria of the two reviews, although appearing to be similar, resulted in a different set of studies for each one. Due to the heterogeneity of the individual studies, it is difficult to attribute the difference in the reviews' conclusions to specific elements of the interventions.

### *Study design*

Both Dishman et al. (1998) and Proper et al. (2003) commented upon the difficulty of conducting randomised controlled studies within a workplace setting. Particular problems were observed with sampling bias (recruitment of participants in studies, eg volunteers), selection bias (the selection of participants into studies resulting in systematic differences in comparison groups) and attrition bias (systematic differences between the comparison groups in the loss of participants from the study). Poor outcome measurements were also observed, and there were no attempts to standardise results (at baseline or

follow-up) for any physical activity performed outside of the workplace. Few studies conducted an intention-to-treat analysis or used objective measures of physical activity.

### *Generalising results*

The heterogeneity of workplaces means the generalising of these interventions is very limited. The interventions adopted similar behavioural approaches, eg health education, behaviour modification and incentives to interventions in healthcare settings. A broad range of workplaces were used in studies reporting an increase in physical activity including four trials conducted with manufacturing workers. The majority of workplaces were US-based, large-scale employers, not typical of UK workplaces. Two studies from the UK, targeting ambulance workers and factory workers respectively, showed no significant effects on physical activity.

## **Older adults (50+)**

### *Summary*

Interventions were limited to adults aged 50 years and older:

- The three reviews examined the effectiveness of physical activity interventions for older people (King et al., 1998; Van der Bij et al., 2002; Conn et al., 2003)
- 78 quasi-experimental/experimental studies were reported
- Eight studies were from the UK.

Review-level evidence suggests:

- Interventions restricted to adults aged 50 years and older are effective in producing short-term changes in physical activity and there is limited evidence that they can be effective in producing mid- to long-term changes in physical activity
- A range of intervention strategies are associated with increases in physical activity, with no one approach consistently and significantly superior
- Interventions that used individual-based or group-based behavioural or cognitive approaches with a combination of group- and home-based exercise sessions are equally effective in producing changes in physical activity
- Interventions that promote moderate intensity and non-endurance physical activities (eg flexibility

exercises) are associated with changes in physical activity

- Interventions that provide support and follow-up are also associated with changes in physical activity.

Examples of interventions included in the review:

- Community based exercise classes
- Mixture of community classes supplemented by supervised home-based exercise
- Use of behavioural strategies such as goal setting, reinforcement, self-monitoring, problem solving, feedback, relapse prevention and social support.

The successful interventions included:

- Exercise counselling and instruction
- Structured class or group-based physical activity sessions
- Home-based physical activities, particularly walking
- Telephone and written contact and support
- Computer-generated feedback and messages
- Informal group meetings and events
- Exercise log books.

The one study (Kriska et al., 1986) that produced longer-term changes in physical activity used formal group-based exercise classes for the first three months. Participants were then encouraged to adopt more independent physical activities by using 'exercise buddies', informal small walking groups and individual self-sustaining strategies, eg self-reinforcement. Another study followed face-to-face counselling with telephone follow-up and monthly education and social meetings to encourage home-based physical activity, again reducing the amount of support and professional contact over time.

### *Strengths and challenges*

Seventy eight randomised controlled trials were included in this section, 18 of which reported statistically significant differences in physical activity between intervention and control groups. Follow-up periods ranged from a few weeks up to 48 months. Seven studies reported physical activity outcomes at two-year follow-up, with four studies reporting significant differences in physical activity or fitness outcomes. The studies used a range of interventions including individual-based counselling, home- and group-based moderate-intensity physical activity sessions, incentives, social events and written and phone follow-up and

support. Participation rates decline consistently over time within studies.

Most of the studies had methodological limitations.

### *Study design*

Selection bias was evident as studies recruited volunteers from community groups. Randomisation methods were not described. A number of studies used cluster randomisation without taking this into account in the analysis, which risks overestimating the effect of the intervention. Intention-to-treat analysis was not applied to most studies, which may also lead to an overestimate of the true effect. A number of studies included in the reviews compared adherence to the programme between intervention and control groups as a primary outcome of the intervention and not differences in physical activity.

### *Generalising results*

Studies did not recruit older adults from important sub-groups – low income, minority ethnic groups, and those 75 years and over. Although eight studies were found from the UK, only one study reported significant effects between intervention and control groups. Few studies addressed other types of physical activities that would be beneficial to this target group, eg activities that developed and maintained flexibility, balance and strength.

## **Adults from black and minority ethnic groups**

### *Summary*

No new reviews were found in this category, and no UK studies were found. All the studies were from the US, and so the ethnic groups included Mexican-Hispanic, Mexican-American, African-American, Latino, Asian and Pacific Islanders. The studies were delivered at the individual level:

- One review examined the effectiveness of physical activity interventions for adults from ethnic groups (Taylor et al., 1998)
- Five experimental/quasi-experimental studies were reported
- There were no UK-based studies
- Settings included churches, schools, medical clinics and leisure centres.

Review-level evidence suggests:

- Currently the review-level evidence does not provide evidence of effectiveness of interventions focusing on people from minority ethnic groups. Very few studies have been conducted with this target group.

Examples of interventions included in the review:

- Supervised exercise classes
- Telephone supervised, home-based walking programmes
- Written materials
- Use of behavioural strategies such as goal setting, reinforcement, self-monitoring and social support.

### *Strengths and challenges*

Five randomised trials showed no effect on the number of exercise sessions, energy expenditure, self-reported walking or fitness. Studies had considerable methodological limitations.

### *Study design*

Only two studies randomised individuals, with the other three randomising families into intervention or control groups. This could be an advantage if the social effects of the intervention are deemed important, but this type of clustering must be controlled for in the analysis. Selection bias was evident as some studies would only allow participation if the whole family agreed to take part. One study reported over 80% loss to follow-up and poor participation rates in the experimental group. Physical activity measures were not tested for reliability and validity with sample populations.

### *Generalising results*

The ethnic groups who participated in these studies were Mexican-Hispanic, Mexican-American, African-American, Latino, Asian, Pacific Islander and mixed ethnic origin. Very few men were recruited to the interventions. The heterogeneity of these studies makes their findings difficult to generalise to the UK.

## **Adults with physical limitations**

### *Summary*

No new reviews were found in this category. Although the one existing review aimed to include studies of people with disabilities, it was limited to participants with

the following conditions: arthritis, low back pain, chronic obstructive pulmonary disease and cystic fibrosis:

- The review examined the effectiveness of physical activity interventions for adults with physical limitations (Taylor et al., 1998)
- Three experimental/quasi-experimental studies were reported
- There were no UK-based studies.

Review-level evidence suggests:

- Currently the review-level evidence does not provide evidence of the effectiveness of interventions focusing on people with physical limitations.

Examples of interventions included in the review:

- Individual counselling
- Outpatient physiotherapy fitness classes
- Individually tailored home-based programmes.

### *Strengths and challenges*

Effective interventions still need to be identified. No studies reported changes in physical activity as outcomes, instead using disability or pain scales, or exercise tolerance tests.

### *Study design*

There was evidence of selection bias in studies, as case definitions for disabilities were not presented in the review, eg chronic back pain or knee osteoarthritis. Results were not adjusted for baseline scores.

### *Generalising results*

These studies focused on adults with chronic disease rather than adults with mental or physical disabilities, eg people with quadriplegia, paraplegia, mental health, learning disabilities, multiple sclerosis or poliomyelitis, visual and hearing impairments.

# Gaps in the evidence

The existing research into the effectiveness of exercise promotion interventions, as identified in this evidence briefing, is mainly limited to middle class Caucasians. Also, much of the research has been conducted in the US and it is not known whether interventions demonstrated to be effective there could work in the UK. Insufficient evidence was available for the reviews to examine the unplanned consequences of interventions on increasing the risks of accidents as a result of becoming more active. These outcomes should be considered when studying all target groups.

By far the majority of intervention studies identified in this briefing have been targeted at the individual level and limited to a specific setting. This type of intervention, at very best, will have a limited impact on population levels of physical activity. Examples of population-based approaches to promoting physical activity may include using legislation or the physical and social environment. These potential correlates of physical activity require further evaluation and research to understand how they interact and impact upon different types of physical activity behaviour for different target groups.

At present, no review-level evidence of the effectiveness of interventions aimed at changing policy or the environment on physical activity is available. This briefing was limited to experimental or quasi-experimental study designs, so excluding a substantial amount of literature from consideration. This observation highlights the important point that if this evidence briefing has uncovered no review-level evidence to support a certain intervention or programme, it does not mean there is absolutely no evidence of its effectiveness, just that no evidence was found from systematic reviews that met the inclusion criteria.

There is currently particular interest in the potential of multiple daily bouts of physical rather than one longer bout. It has been proposed that accumulating physical activity in this way may make it easier for people to meet public health guidelines compared to having to do physical activity in one go. At present there is no review-level evidence on the effectiveness of interventions that promote so-called 'bite sized chunks' of exercise versus less frequent but longer duration exercise. Such studies would require precise measures of physical activity.

The reviews reported here highlight some key limitations in the measurement of physical activity. First, virtually all studies of physical activity promotion rely on self-reported physical activity as the main outcome measure. Such self-reports are typically retrospective and therefore risk recall bias. There is also the risk of socially desirable responses occurring (ie the respondent may give the reply/answer they think the interviewer will want to hear). This is more likely when the follow-up period is short.

While these potential biases are likely to lead to some misclassification of physical activity, there is no evidence that any misclassification would be systematically different between intervention and control groups. Therefore, the most likely outcome is an underestimate of the true effect of an intervention. Any misclassification makes the interpretation of results more difficult, particularly in terms of the clinical importance of the outcomes.

While a number of studies have been able to report a statistically significant change in physical activity between intervention and control groups, such change appears to be small and may not be clinically meaningful or at a level equivalent to current public health recommendations. The precision of this observation is limited by the quality of the measure. As measures vary across studies,

comparisons between studies are limited as the degree of misclassification is likely to vary between measures and therefore studies.

The reporting of outcomes also makes comparisons between studies difficult. Self-reported physical activity is expressed in a variety of ways including:

- Total energy expenditure
- Proportion of participants meeting current public health recommendations
- Proportion of participants meeting a predetermined threshold of physical activity different from current public health recommendations
- Hours per week of different intensity physical activity.

The classification of physical activity using self-report measures may also lead to misclassification in terms of who is offered an intervention. Most studies have a measure of 'inactivity' and only offer intervention to participants classified as such. While this may lead to some people who would benefit from the intervention not being offered it (and vice versa), this is not likely to vary systematically between experimental groups.

At present, a 'gold standard' measure of physical activity is not available. However, future studies would benefit from more precise measures that have been shown to be valid and reliable in the population to be studied. It would be of particular benefit to develop and collate a set of standardised and validated behavioural questions and indicators for use in intervention studies with physical activity as the main outcome.

## Inequalities

None of the 16 reviews presented in this evidence briefing specifically explored the effectiveness of physical activity interventions in disadvantaged groups. Population surveys have reported that the prevalence of physical inactivity is higher in some black and minority ethnic groups, in people in low-income households, in lower social classes and in people with low levels of education. Therefore, it is imperative that future exercise promotion research is carried out in these groups.

Ethnicity, income, social class and education are interrelated and it will be necessary to examine the independent association between these factors and

physical activity to inform appropriate intervention study designs. Formative research will almost certainly be required to better understand the particular needs of different disadvantaged groups.

# Research and policy recommendations

The evidence presented in this briefing is limited to interventions that target individuals, as opposed to those targeting whole communities. Review evidence of effectiveness does not exist in other areas such as environmental, community, policy or fiscal interventions. Physical activity will require interventions at all of these levels as it is performed within a social and physical environment. How best to combine interventions at different levels, to diverse populations, in different settings, requires further exploration.

Reviews into broader aspects of evidence will help our understanding of effectiveness. Reviewing interventions at community, policy or environmental levels will first require criteria on the level of evidence of effectiveness that is being sought. While the randomised controlled trial is often referred to as the 'gold standard' it is not appropriate for all research questions.

## Healthcare settings

### *Research recommendations*

Future research needs to address the methodological issues described above. There is an urgent need for well-conducted studies in the UK that focus on people from lower socio-economic and minority ethnic groups. In particular, studies need to determine the long-term efficacy of primary care-based interventions, targeting apparently healthy adults and adults with disease. This is likely to require more intensive interventions than the one or two contact, time-limited interventions investigated to date. While these types of interventions have been shown to produce short-term effects, they do not lead to sustained changes in behaviour.

Having said that, no UK study known to the authors has yet assessed the effectiveness of direct advice and

encouragement to increase physical activity from a person's general practitioner. Such a brief intervention has been evaluated for smoking cessation and is accepted as usual practice. Factors associated with higher quit rates, such as ongoing support from other health professionals and behaviour modification from specially trained nurses (Thorogood et al., 2001), also warrant investigation.

In the UK 'exercise referral schemes' are increasingly common yet remain under-evaluated (Department of Health, 2001c). Much time, effort and resources are being invested in such programmes and therefore it is imperative that their effectiveness is evaluated through rigorous studies.

A further concern for future primary care studies are the competing time demands of health promotion activities such as smoking cessation, nutrition advice and adherence to medication. Cost-effective methods for helping practitioners deal with multiple health behaviours are needed. Only one study from the reviews included here presented any cost-effectiveness data (Stevens et al., 1998).

As the focus of most primary care physical activity interventions is a change in physical activity behaviour, future studies need to select carefully a measure of physical activity that has published validity and reliability data on a population similar to that being considered for the intervention. As any changes achieved are likely to be small, physical activity measures need to be sensitive enough to detect them.

### *Policy recommendations*

The existing reviews provide insufficient evidence about the effectiveness of healthcare-based interventions to provide policy recommendations with any confidence.

It is possible that initial expectations about the effectiveness of brief advice and encouragement from a health professional were too high. Modifications in intra-individual factors such as attitude, knowledge and motivation may be insufficient to overcome an environment that is 'hostile' to the behaviours being promoted. Multi-level interventions that have intrapersonal, interpersonal and environmental factors may be required to achieve sustainable changes in physical activity behaviour at a level that would lead to health benefits.

There is enough evidence, including UK evidence, to suggest that a brief intervention in primary care will lead to at least a short-term change in physical activity in previously sedentary people. If supported by other professionals, including leisure professionals, it may be possible to maintain the short-term changes achieved, although there is only limited evidence for this. Training should be developed in partnership with health and leisure professionals based on strategies identified in this briefing.

## Community settings

### *Research recommendations*

More studies should be carried out in the UK and should include participants who are non-white and from lower socio-economic groups. Research is also needed to test the dissemination of the effective interventions from the US. Issues to be addressed include methods of recruitment, identification of appropriate personnel to deliver the interventions, and sustainability. More needs to be understood about environmental factors that may support people who have received face-to-face behavioural interventions. Longitudinal studies are required with follow-up periods greater than two years to understand the sustainability of interventions.

More complex, multi-level interventions are required to reach a greater proportion of the physically inactive population. The studies reported in the community section (see p15) required intensive interventions to reach a relatively small number of people. None of the reviews included studies of the cost effectiveness of community interventions, which clearly needs to be addressed. Many sports and physical activity development officers are employed by local authorities and have good links with churches, community centres and other local groups. This is an entirely unevaluated approach to recruiting people

into interventions in the UK that may have a wide-reaching impact.

### *Policy recommendations*

Since many of these studies were organised and delivered via universities, alternative models of delivery will be required away from that setting and appropriate for the UK. Also, recruiting via local advertisements is unlikely to reach disadvantaged groups.

As mentioned earlier, a high number of programmes exist around the country that involve general practitioners referring selected patients to leisure centres for low or no cost physical activity (Department of Health, 2001c). The efficacy of this approach is yet to be established and appears to require a relatively large effort to intervene with a small number of people. However, the leisure sector may be well placed to supplement this approach with broader recruitment strategies that allow for self-referral. Community physical activity development officers could carry out targeted recruitment in areas of need. No obvious model exists for providing ongoing support and it is not clear whether the success of telephone support experienced in the US will transfer to the UK.

## Workplace settings

### *Research recommendations*

Review-level evidence was found to provide limited support for workplace interventions targeting individuals. It is unclear if the intervention strategies would transfer into UK workplaces. Future research should evaluate interventions that focus on organisational and policy aspects of the workplace as well as individual-level factors such as motivation, attitude, knowledge etc. The relationship between changes in physical activity performed in the workplace and leisure-time physical activity is unknown. Other research, not included in this briefing, has focused on commuting to and from work rather than physical activity in the workplace (Vuori et al., 1994). Further workplace studies investigating the potential to increase physically active commuting warrant further investigation through primary research.

### *Policy recommendations*

There is sufficient review-level evidence for effective workplace physical activity interventions to encourage UK organisations to assist their employees to become more active. Travel to work incentives that encourage walking

or cycling plus the use of public transport rather than car use are part of existing national policy (Department for Transport, 2002). The impact of financial incentives for companies that provide exercise and recreational facilities warrants further investigation. A number of large employers are developing and implementing 'green travel plans' but as yet these schemes remain largely unevaluated. A green travel plan is typically a package of practical measures to encourage staff to choose alternatives to single-occupancy car use, and to reduce the need to travel at all for their work.

## Older adults (50+)

### *Research recommendations*

Research is needed to establish whether the successful interventions from the US can be replicated in the UK. In particular the interventions will need to assess the individual needs of the older person and offer safe and appropriate exercise prescriptions that can be achieved through home- or group-based activities. As the functional capacities of adults aged 50 years and over vary so widely, interventions will need to be tailored to these capacities rather than simply chronological age. Little is understood about the recruitment of older people to physical activity programmes or the appropriateness of current physical activity recommendations for older populations. The studies reported in this category were intensive and only reached a small number of older people. Further research is needed to reach the increasing number of sedentary older people, the largest proportion of the inactive population. No cost-effectiveness data of these interventions has been established.

### *Policy recommendations*

Identifying and recruiting older adults suitable for participation in exercise programmes represents a significant challenge. Establishing the safety of exercise prior to participation is likely to require the input of medical personnel. Also, the exercise prescription will require suitably qualified personnel (Department of Health, 2001c). These concerns, along with providing appropriate classes and the necessary support and maintenance, will require a combination of statutory and voluntary organisations. The training and resources needed for appropriate exercise personnel to deliver group and encourage home-based programmes is unknown and warrants further exploration. The efficiency of present provision and the impact of existing physical

activity programmes for older people remain unevaluated and unexplored.

## Adults from black and minority ethnic groups

### *Research recommendations*

As the effectiveness of interventions aimed at adults from black and minority ethnic groups (due to a lack of data/ interventions) remains unclear, future research should focus on developing a better understanding of the particular needs of each ethnic group. Primary research is required to develop appropriate opportunities for physical activity that are culturally sensitive. We urgently need UK-based research on physical activity in our main ethnic groups (ie south Asian, African-Caribbean and Chinese populations).

### *Policy recommendations*

Present policy encourages physical activity providers and programmes to be inclusive of minority ethnic groups. Many sports and physical activity development officers and local health development workers have good links with local minority ethnic groups. The process and impact of their work in recruiting men and women for physical activity remains unexplored. Resources and training for current leisure providers in working with minority ethnic groups should be sustained and encouraged.

## Adults with physical limitations

### *Research recommendations*

Each of the groups identified with physical limitations (arthritis, low back pain, chronic obstructive pulmonary disease and cystic fibrosis) are different and need appropriate individualised exercise prescriptions. Future research should cover a range of physical activity interventions including physical activity as a treatment option for chronic conditions to physical activity as a lifestyle intervention.

### *Policy recommendations*

Providing opportunities for physical activity in the community for people with physical limitations should remain a priority. Access to buildings should include transport to the building as well as physical access. Resources and training for current leisure providers in working with people with physical limitations should be sustained and encouraged (Department of Health, 2001c).

# Conclusions

An important finding from this review is that relatively brief interventions, typically consisting of one short occasion of tailored advice with some follow-up, can lead to at least short-term changes in physical activity. Less is known about how to help people maintain changes in physical activity that might lead to future health benefits.

Within each of the included reviews there are a considerable number of individual studies with positive effects. The wide diversity of the interventions employed in these positive studies along with differences in populations, the intensity of the intervention and the duration of the study make consistent and generalised advice on policy difficult. However, the effective interventions share a number of common attributes:

- Providing individually tailored advice about behaviour change delivered verbally with written support
- Setting goals for behaviour change
- Encouraging self-monitoring
- Exploring cognitive and behavioural factors associated with behaviour change including beliefs about the costs and benefits of physical activity, reinforcement of changes in physical activity, perception of the health risks of physical inactivity, confidence to engage in physical activity
- Providing ongoing verbal support
- Providing occasional reviews of progress after the completion of the intervention
- Promoting moderate intensity activity such as walking
- Not requiring attendance at a facility.

The evidence base for policy recommendations in the UK is still sparse. There is an urgent need to conduct research into the effectiveness of interventions, particularly within socially excluded sectors of the population who have the highest prevalence of physical inactivity.

# References

- Ashenden, R., Silagy, C. and Weller, D. (1997). A systematic review of the effectiveness of promoting lifestyle change in general practice. *Family Practice* 14: 160-76.
- Conn, V. S., Minor, M. A., Burks, K. J., Rantz, M. J. and Pomeroy, S. H. (2003). Integrative review of physical activity intervention research with aging adults. *Journal of the American Geriatrics Society* 51: 1159-68.
- Department for Transport (1998). *A new deal for transport: better for everyone*. London: Stationery Office.
- Department for Transport (2002). *Making travel plans work: case study summaries*. Wetherby: DfT Publications.
- Department for Transport (2004a). *The future of transport: a Network for 2030*. London: Stationery Office.
- Department for Transport (2004b). *Walking and cycling: an action plan*. London: Department for Transport.
- Department of Health (1996). *Strategy statement on physical activity*. London: Department of Health.
- Department of Health (2000a). *Health Survey for England 1998*. London: Stationery Office.
- Department of Health (2000b). *National Service Framework for Coronary Heart Disease*. London: Department of Health.
- Department of Health (2000c). *The NHS Cancer Plan*. London: Stationery Office.
- Department of Health (2001a). *The NHS Plan: a plan for investment, a plan for reform*. London: Stationery Office.
- Department of Health (2001b). *National Service Framework for Diabetes*. London: Stationery Office.
- Department of Health (2001c). *Exercise referral systems: a national quality assurance framework*. London: Department of Health.
- Department of Health (2004a). *At least five a week: evidence on the impact of physical activity and its relationship to health*. A report from the Chief Medical Officer. London: Department of Health.
- Department of Health (2004b). *National standards, local action: health and social care standards and planning framework 2005/06-2007/08*. London: Department of Health.
- Department of Health (2004c). *Choosing health. Making healthy choices easier*. London: Stationery Office.
- Dishman, R. K., Oldenburg, B., O'Neal, H. and Shephard, R. J. (1998). Worksite physical activity interventions. *American Journal of Preventive Medicine* 15: 344-61.
- Dunn, A. L., Andersen, R. E. and Jakicic, J. M. (1998). Lifestyle physical activity interventions. History, short- and long-term effects, and recommendations. *American Journal of Preventive Medicine* 15: 398-412.
- Eakin, E. G., Glasgow, R. E. and Riley, K. M. (2000). Review of primary care-based physical activity intervention studies: effectiveness and implications for practice and future research. *Journal of Family Practice* 49: 158-68.
- Eaton, C. B. and Menard, L. M. (1998). A systematic review of physical activity promotion in primary care office settings. *British Journal of Sports Medicine* 32: 11-6.

- Eden, K. B., Orleans, T., Mulrow, C., Pender, N. J. and Teutsch, S. M. (2002). Does counselling by clinicians improve physical activity? A summary for the US Prevention Services Task Force. *Annals of Internal Medicine* 137: 208-15.
- Hillsdon, M. and Thorogood, M. (1996). A systematic review of physical activity promotion strategies. *British Journal of Sports Medicine* 30: 84-9.
- Kahn, E. B., Ramsey, L. T., Brownson, R. C., Heath, G. W., Howze, E. H., Powell, K. E., Stone, E. J., Rajab, M. W., Corso, P. and the Task Force on Community Preventive Services (2002). The effectiveness of interventions to increase physical activity: a systematic review. *American Journal of Preventive Medicine* 22: 73-107.
- Kelly, M. P. and Speller, V. (2003). *Moving towards evidence based practice: the work of the Health Development Agency*. London: Health Development Agency. [www.hda.nhs.uk/evidence/EIP\\_Jan03.pdf](http://www.hda.nhs.uk/evidence/EIP_Jan03.pdf)
- King, A. C., Rejeski, W. J. and Buchner, D. M. (1998). Physical activity interventions targeting older adults. A critical review and recommendations. *American Journal of Preventive Medicine* 15: 316-33.
- Kriska, A. M., Bayles, C., Cauley J. A., LaPate, R. E., Sandler, R. B., Pambianco, G. A. (1986). A randomized exercise trial in older women: increased activity over two years and the factors associated with compliance. *Medicine and Science in Sports and Exercise* 18 (5): 557-62.
- Lawlor, D. A. and Hanratty, B. (2001). The effect of physical activity advice given in routine primary care consultations: a systematic review. *Journal of Public Health Medicine* 23: 219-26.
- Millward, L. M., Morgan, A. and Kelly, M. P. (2003). *Prevention and reduction of accidental injury in children and older people. Evidence briefing*. London: Health Development Agency.
- Petrella, R. J. and Lattanzio, C. N. (2002). Does counselling help patients get active? Systematic review of the literature. *Canadian Family Physician* 48: 72-80.
- Proper, K. I., Koning, M., van der Beek, A. J., Hildebrandt, V. H., Bosscher, R. J and van Mechelen, W. (2003). The effectiveness of worksite physical activity programs on physical activity, physical fitness, and health. *Clinical Journal of Sports Medicine* 13: 106-17.
- Simons-Morton, D. G., Calfas, K. J., Oldenburg, B. and Burton, N. W. (1998). Effects of interventions in health care settings on physical activity or cardiorespiratory fitness. *American Journal of Preventive Medicine* 15: 413-30.
- Smith, B. J., Merom, D., Harris, P. and Bauman, A. E. (2002). *Do primary care interventions to promote physical activity work? A systematic review of the literature*. Sydney: NSW Centre for Physical Activity and Health.
- Stevens, W., Hillsdon, M., Thorogood, M. and McArdle, D. (1998). Cost-effectiveness of a primary care based physical activity intervention in 45-74 year old men and women: a randomised controlled trial. *British Journal of Sports Medicine* 32: 236-41.
- Taylor, W. C., Baranowski, T. and Young, D. R. (1998). Physical activity interventions in low-income, ethnic minority, and populations with disability. *American Journal of Preventive Medicine* 15: 334-43.
- Thorogood, M., Hillsdon, M. and Summerbell, C. (2001). Changing behaviour. In: *Clinical Evidence: a compendium of the best available evidence for effective health care* 6: 31-49. London: British Medical Journal Publishing Group.
- US Department of Health and Human Services (1996). *Physical activity and health: a report of the Surgeon General*. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion.
- Van der Bij, A.K., Laurant, M. G. and Wensing, M. (2002). Effectiveness of physical activity interventions for older adults: a review. *American Journal of Preventive Medicine* 22: 120-33.
- Vuori, I. M., Oja, P. and Paronen, O. (1994). Physically active commuting to work: testing its potential for exercise promotion. *Medicine and Science in Sports and Exercise* 26: 844-50.

# APPENDIX 1

## Search strategy

October 2001

### Interventions to encourage physical activity

#### Limits

English language only

1996 to date

Human

NOT developing countries

#### Database checklist

|                                   | Version      |
|-----------------------------------|--------------|
| Cochrane Library                  | 2004/3       |
| DARE admin database               | 01/05/04     |
| 'Wider Public Health' report      | 01/05/04     |
| TRIP                              | 01/05/04     |
| HTA database                      | 01/05/04     |
| SIGN                              | 01/05/04     |
| Health Evidence Bulletins Wales   | 01/05/04     |
| National Guidelines Clearinghouse | 01/05/04     |
| NCCHTA website                    | 01/05/04     |
| NICE web pages                    | 01/05/04     |
| REFER                             | 01/05/04     |
| National Research Register        | Issue 2004/3 |
| Clinical Evidence                 | Issue 11     |
| EMBASE (last five years)          | 01/05/04     |
| PsycINFO (2001)                   | 01/05/04     |
| Sociological Abstracts            | 01/05/04     |
| SportDiscus                       | 01/05/04     |
| SIGLE                             | 01/05/04     |

#### Search terms

##### Searching notes:

This search has not looked systematically for reviews on the effectiveness of physical activity as an intervention for overall health and specific health problems. However, some reviews that cover those topics but may also have some treatment of the issue of encouragement and maintenance of activity have been included.

### 1 Cochrane Library (2004/3) (searched 01/05/04)

1. ((((((PROMOT\* or UPTAKE) or ENCOURAG\*) or INCREAS\*) or START) NEAR (PHYSICAL next ACTIVITY))
2. ((((((PROMOT\* or UPTAKE) or ENCOURAG\*) or INCREAS\*) or START) near EXERCISE)
3. ((((((PROMOT\* or UPTAKE) or ENCOURAG\*) or INCREAS\*) or START) near (((AEROBICS or CIRCUITS) or SWIMMING) or AQUA\*))
4. ((((((PROMOT\* or UPTAKE) or ENCOURAG\*) or INCREAS\*) or START) near ((JOGGING or RUNNING) or CYCLING))
5. ((((((PROMOT\* or UPTAKE) or ENCOURAG\*) or INCREAS\*) or START) NEAR (((KEEP next FIT) OR (FITNESS NEXT CLASS\*)) OR YOGA))
6. ((((((PROMOT\* or UPTAKE) or ENCOURAG\*) or INCREAS\*) or START) near WALKING)
7. ((((((IMPROV\* or PROMOT\*) or ENCOURAG\*) or INCREAS\*) or ENHANCE\*) near FITNESS)
8. ((((((#1 or #2) or #3) or #4) or #5) or #6) or #7)
9. ((((((PROMOT\* or UPTAKE) or ENCOURAG\*) or INCREAS\*) or START) near SPORT\*)
10. (((DECREAS\* or REDUC\*) or DISCOURAG\*) near (SEDENTARY or DESKBOUND))
11. EXERCISE\*:ME
12. PHYSICAL-FITNESS\*:ME
13. HEALTH-PROMOTION\*:ME
14. HEALTH-EDUCATION\*:ME
15. (#12 or #13)
16. (#14 or #15)
17. (#16 and #17)
18. (#11 or #18)

42 new records found.

### 2 DARE admin database (<http://agatha.york.ac.uk/faq2.htm>) (searched 01/05/04)

s physical(w)activity or exercise or aerobics or circuits  
s swimming or aqua\$ or jogging or running or cycling  
s keep(w)fit or fitness(w)class\$ or yoga or walking  
s fitness or sport or sports or sedentary or deskbound  
s s1 or s2 or s3 or s4

62 new records found.

**3 'Wider Public Health Review' (searched 01/05/04)  
www.york.ac.uk/inst/crd/wph.htm**

No new records found.

**4 TRIP (www.tripdatabase.com) (searched 26/10/01)**

physical activity  
exercise  
aerobics or circuits or swimming or aqua  
jogging or running or cycling or fitness or yoga  
walking or sport or sedentary or deskbound

No new records found.

**5 HTA database (http://nhscrd.york.ac.uk/) (searched  
26/10/01)**

physical activity or exercise or aerobics or circuits or swimming  
or aqua  
jogging or running or cycling or fitness or yoga or walking or  
sport or sedentary or deskbound

92 new records found.

**6 SIGN (www.sign.ac.uk/guidelines/published/  
index.html) (searched 26/10/01)**

No new records found.

**7 Health Evidence Bulletin Wales  
(searched 26/10/01)**

No new records found.

**8 National Guidelines Clearinghouse  
(www.guideline.gov/index.asp)**

'physical activity'  
exercise  
fitness  
sedentary  
housebound  
aerobics or circuits or swimming or aqua or jogging or running  
or cycling or fitness or yoga or walking or sport

No new records found.

**9 NCCHTA (www.hta.nhsweb.nhs.uk) (searched  
26/10/01)**

No new records found.

**10 NICE (www.nice.org.uk/nice-web) (searched  
26/10/01)**

exercise  
physical activity  
sport  
sedentary or deskbound  
aerobics or circuits or swimming or aqua or jogging or running  
or cycling or fitness or yoga or walking or sport

No records retrieved. Note: obesity review underway.

**11 REFER (www.doh.gov.uk/research/rd3/  
information/findings.htm#refer) (searched 26/10/01)**

1 new record found.

**12 National Research Register (Issue 2001/3)**

((((EXERCISE or AEROBICS) or CIRCUITS) or SWIMMING) or  
AQUA\*)  
((JOGGING or RUNNING) or CYCLING)  
(((FITNESS or YOGA) or WALKING) OR (KEEP next FIT))  
(PHYSICAL next ACTIVITY)  
((SPORT or SEDENTARY) or DESKBOUND)  
(((#1 or #2) or #3) or #4) or #5)  
EXERCISE\*:ME  
PHYSICAL-FITNESS\*:ME  
(HEALTH-EDUCATION\*:ME or HEALTH-PROMOTION\*:ME)  
(#7 or #8)  
(#9 and #10)  
(#6 or #11)  
(((REVIEW or OVERVIEW) or META-ANALY\*) or METAANALY\*)  
OR (META next ANALY\*)  
(#12 and #13)

No new records found.

### 13 Clinical Evidence (Issue 4)

No new records found.

### 14 EMBASE (searched on Datastar, 26/10/01)

1. ((PROMOT\$ OR UPTAKE OR ENCOURAG\$ OR INCREAS\$ OR START) NEAR (PHYSICAL ADJ ACTIVITY))
2. (PROMOT\$ OR UPTAKE OR ENCOURAG\$ OR INCREAS\$ OR START) NEAR EXERCISE
3. (PROMOT\$ OR UPTAKE OR ENCOURAG\$ OR INCREAS\$ OR START) NEAR (AEROBICS OR CIRCUITS OR SWIMMING OR AQUA\$)
4. (PROMOT\$ OR UPTAKE OR ENCOURAG\$ OR INCREAS\$ OR START) NEAR (JOGGING OR RUNNING OR CYCLING)
5. (PROMOT\$ OR UPTAKE OR ENCOURAG\$ OR INCREAS\$ OR START) NEAR ((KEEP ADJ FIT) OR (FITNESS ADJ CLASS\$) OR YOGA)
6. (PROMOT\$ OR UPTAKE OR ENCOURAG\$ OR INCREAS\$ OR START) NEAR WALKING
7. (PROMOT\$ OR UPTAKE OR ENCOURAG\$ OR INCREAS\$ OR START) NEAR SPORT\$
8. (DECREAS\$ OR REDUC\$ OR DISCOURAG\$) NEAR (SEDENTARY OR DESKBOUND)
9. 1 2 3 4 5 6 7 8
10. PHYSICAL-ACTIVITY#.DE.
11. EXERCISE#.DE.
12. HEALTH-EDUCATION#.DE.
13. (10 or 11) and 12
14. 9 or 13
15. META-ANALYSIS
16. METAANALYS\$.TI,AB.
17. META-ANALYS\$.TI,AB.
18. META ADJ ANALYS\$.TI,AB.
19. COCHRANE.TI,AB.
20. (REVIEW\$ OR OVERVIEW\$).TI.
21. PT=REVIEW
22. (SYNTHES\$ WITH (LITERATURE\$ OR RESEARCH\$ OR STUDIES OR DATA)).TI,AB.
23. (POOLED ADJ ANALYS\$).TI,AB.
24. (MEDLINE OR MEDLARS OR EMBASE OR CINAHL OR SCISEARCH OR PSYCHINFO OR PSYCINFO OR PSYCHLIT OR PSYCLIT).TI,AB.
25. ((HAND OR MANUAL OR DATABASE\$ OR COMPUTER\$) WITH SEARCH\$).TI,AB.
26. ((ELECTRONIC OR BIBLIOGRAPHIC\$) WITH (DATABASE\$ OR DATA BASE\$)).TI,AB.
27. ((REVIEW\$ OR OVERVIEW\$) WITH (SYSTEMATIC\$ OR METHODOLOGIC\$ OR QUANTITATIV\$ OR RESEARCH OR

LITERATURE\$ OR STUDIES OR TRIAL\$ OR EFFECTIVE OR EFFECTIVENESS)).AB.

28. 15 16 17 18 19 20 21 22 23 24 25 26 27
29. 14 and 28
30. ..limit/lg=en
31. africa#.de.
32. asia#.de.
33. south-america#.de.
34. 31 32 33
35. 30 not 34

2,668 new records found.

### 15 Sociological Abstracts (searched on Datastar, 26/10/01)

1. ((PROMOT\$ OR UPTAKE OR ENCOURAG\$ OR INCREAS\$ OR START) NEAR (PHYSICAL ADJ ACTIVITY))
2. (PROMOT\$ OR UPTAKE OR ENCOURAG\$ OR INCREAS\$ OR START) NEAR EXERCISE
3. (PROMOT\$ OR UPTAKE OR ENCOURAG\$ OR INCREAS\$ OR START) NEAR (AEROBICS OR CIRCUITS OR SWIMMING OR AQUA\$)
4. (PROMOT\$ OR UPTAKE OR ENCOURAG\$ OR INCREAS\$ OR START) NEAR (JOGGING OR RUNNING OR CYCLING)
5. (PROMOT\$ OR UPTAKE OR ENCOURAG\$ OR INCREAS\$ OR START) NEAR ((KEEP ADJ FIT) OR (FITNESS ADJ CLASS\$) OR YOGA)
6. (PROMOT\$ OR UPTAKE OR ENCOURAG\$ OR INCREAS\$ OR START) NEAR WALKING
7. (PROMOT\$ OR UPTAKE OR ENCOURAG\$ OR INCREAS\$ OR START) NEAR SPORT\$
8. (DECREAS\$ OR REDUC\$ OR DISCOURAG\$) NEAR (SEDENTARY OR DESKBOUND)
9. PHYSICAL-FITNESS.DE.
10. HEALTH-EDUCATION.DE.
11. 1 2 3 4 5 6 7 8
12. 9 AND 10
13. 11 OR 12
14. ..LIMIT YEAR >1995
15. ..LIMIT LG=EN

93 new records found.

## 16 PsycInfo

"Physical-Fitness" in DE  
explode "Exercise"  
#1 or #2  
"Health-Promotion" in DE  
"Lifestyle-Changes" in DE  
explode "Health-Education"  
#4 or #5 or #6  
#3 and #7  
((promot\* or uptake or encourag\* or increas\* or start) with (physical activity)) in ti,ab  
((promot\* or uptake or encourag\* or increas\* or start) with (exercise)) in ti,ab  
((promot\* or uptake or encourag\* or increas\* or start) with (aerobics or circuits or swimming or aqua\*)) in ti,ab  
((promot\* or uptake or encourag\* or increas\* or start) with (jogging or running or cycling)) in ti,ab  
((promot\* or uptake or encourag\* or increas\* or start) with (keep fit or fitness class\*)) in ti,ab  
((promot\* or uptake or encourag\* or increas\* or start) with (yoga or walking or fitness)) in ti,ab  
((promot\* or uptake or encourag\* or increas\* or start) with (sport)) in ti,ab  
(decreas\* or reduc\* or discourag\*) with (sedentary or deskbound)  
#9 or #10 or #11 or #12 or #13 or #14 or #15 or #16  
#8 or #17  
#18 and (LA = "ENGLISH")  
#19 and (UD > "20001227")  
meta analy\* in ti,ab  
metaanaly\* in ti,ab  
(synthes\* with (literature\* or research\* or studies or data)) in ti,ab  
(review or overview) in ti  
(review or overview) in ab  
(systematic\* or methodologic\* or quantitative or research\* or literature\* or studies or trial\* or effective\*) in ab  
(medline or medlars or embase or scisearch) in ab  
pooled analys\*  
(data with pool with studies) in ti,ab  
(hand or manual or computer or electronic or database) and search\*) in ti,ab  
((electronic\* or bibliographic\*) with database) in ti,ab  
(peto or der simonian or dersimonian or fixed effect\*) in ti,ab  
"Literature-Review" in DE  
"Meta-Analysis" in DE  
exact{LITERATURE-REVIEW-RESEARCH-REVIEW} in PT  
exact{META-ANALYSIS} in PT  
#21 or #22 or #23 or #24 or #25 or #26 or #27 or #28 or #29

or #30 or #31 or #32 or #33 or #34 or #35 or #36  
#20 and #37  
#38 and (PO = "HUMAN")

514 new records found.

## 17 SportDiscus (Searched from 1996 to 2004/4)

'physical activity'  
exercise  
fitness  
sedentary  
housebound  
aerobics or circuits or swimming or aqua or jogging or running or cycling or fitness or yoga or walking or sport

730 new records found.

## 18 SIGLE

Exertion  
Physical fitness  
Physical education and training  
sports  
sport  
dancing  
exercise therapy  
(physical\$ adj5 (fit\$ or train\$ or activ\$ or endur\$)).tw.  
(exercis\$ adj5 (train\$ or physical\$ or activ\$)).tw.  
sport\$.tw.  
walk\$.tw.  
bicycle\$.tw.  
(exercise\$ adj aerobic\$).tw.  
(('lifestyle' or life-style) adj5 activ\$).tw.  
(('lifestyle' or life-style) adj5 physical\$).tw.  
(Exertion) or (Physical fitness) or (Physical education and training) or (sports) or (sport) or (dancing) or (exercise therapy) or ((physical\$ adj5 (fit\$ or train\$ or activ\$ or endur\$)).tw.) or (exercise\$) or (aerobic\$) or ('lifestyle') or (activ\$) or ('lifestyle') or (life-style) or (physical\$)

37 new records found.

## APPENDIX 2

### HDA Evidence Base – critical appraisal tool

Authors: \_\_\_\_\_

Title: \_\_\_\_\_

Source: \_\_\_\_\_

| <b>Relevance to topic</b>   |     |    |        |
|---|-----|----|--------|
| Does this paper address your topic area?                                | Yes | No | Unsure |
| Circle the type of paper:   |     |    |        |
| • Systematic review   |     |    |        |
| • Meta-analysis   |     |    |        |
| • Synthesis   |     |    |        |
| • Literature review   |     |    |        |
| • Other review (please specify)   |     |    |        |
| Does it address (circle as appropriate)?                                |     |    |        |
| • Effectiveness (interventions and treatments)                          |     |    |        |
| • Causation   |     |    |        |
| • Monitoring and surveillance trends                                    |     |    |        |
| • Cost  |     |    |        |
| • Other (please specify)  |     |    |        |
| <b>Transparency</b>   |     |    |        |
| Does the paper have a clearly focused aim or research question?         | Yes | No | Unsure |
| Consider whether the following are discussed:                           |     |    |        |
| • The population studied  | Yes | No | Unsure |
| • The interventions given   | Yes | No | Unsure |
| • The outcomes considered   | Yes | No | Unsure |
| • Inequalities  | Yes | No | Unsure |
| <b>Systematicity</b>  |     |    |        |
| Do the reviewers try to identify all relevant English language studies? | Yes | No | Unsure |
| Consider whether details are given for:                                 |     |    |        |
| • Databases searched  | Yes | No | Unsure |
| • Years searched  | Yes | No | Unsure |
| • References followed up  | Yes | No | Unsure |
| • Experts consulted   | Yes | No | Unsure |
| • Grey literature searched  | Yes | No | Unsure |
| • Search terms specified  | Yes | No | Unsure |
| • Inclusion criteria described  | Yes | No | Unsure |
| Is it worth continuing?   | Yes | No |        |
| Why/why not?  |     |    |        |

| <b>Quality</b>   |     |    |                         |
|--|-----|----|-------------------------|
| Do the authors address the quality (rigour) of the included studies?<br>Consider whether the following are used:   | Yes | No | Unsure                  |
| • A rating system  | Yes | No | Unsure                  |
| • More than one assessor   | Yes | No | Unsure                  |
| If study results have been combined, was it reasonable to do so?<br>Consider whether the following are true:   | Yes | No | Unsure                  |
| • Are the results of included studies clearly displayed?   | Yes | No | Unsure                  |
| • Are the studies addressing similar research questions?   | Yes | No | Unsure                  |
| • Are the studies sufficiently similar in design?  | Yes | No | Unsure                  |
| • Are the results similar from study to study (test of heterogeneity)?   | Yes | No | Unsure                  |
| • Are the reasons for any variation in the results discussed?  | Yes | No | Unsure                  |
| What is the overall finding of the review? Consider:<br>• How the results are expressed (numeric – relative risks, etc)<br>• Whether the results could be due to chance ( <i>p</i> -values and confidence intervals) |     |    |                         |
| Are sufficient data from individual studies included to mediate<br>between data and interpretation/conclusions?  | Yes | No | Unsure                  |
| Does this paper cover all appropriate interventions and approaches<br>for this field (within the aims of the study)?<br>If no, what?   | Yes | No | Unsure                  |
| <b>Relevance to UK</b>   |     |    |                         |
| Can the results be applied/are generalisable to a<br>UK population/population group?   | Yes | No | Unsure                  |
| • Are there cultural differences from the UK?  | Yes | No | Unsure                  |
| • Are there differences in healthcare provision with the UK?   | Yes | No | Unsure                  |
| • Is the paper focused on a particular target group<br>(age, sex, population sub-group etc)?   | Yes | No | Unsure                  |
| <b>Accept for inclusion onto HDA Evidence Base?</b>  | Yes | No | Refer to<br>third party |
| <b>Additional comments</b>   |     |    |                         |

Notes



