

Review

The benefits of physical activity for health and well-being

C3 Collaborating for Health*

June 2011

Contents

Overview	3
Part I: Evidence supporting the benefits of physical activity on health and well-being	4
1. The impact of physical activity on health	4
2. Literature review of the evidence	5
i) Major chronic diseases	5
ii) Mental health	6
iii) Whole-life benefits of physical activity	7
iv) Recommended levels of physical activity	7
v) Socioeconomic disparities	9
Part II: Evidence supporting interventions to encourage physical activity	10
1. The scale of the problem	10
2. An active environment?	10
3. Behaviour change	11
4. Selected interventions	12
Part III: Case studies	15
1. Introduction	15
2. What makes for best practice?	15
3. Case studies	16
Appendix 1: Selected literature on the health benefits of physical activity	21
Appendix 2: Physical activity interventions	24
Appendix 3: Evidence for the benefits of specific activities	27
Endnotes	28

Overview

The purpose of this review is to provide a snapshot of the scientific evidence of the benefits of physical activity on health and well-being, focusing particularly on the prevention of non-communicable diseases (NCDs – also often referred to as chronic diseases), and to present case studies of ‘what works’ in different settings and contexts.

Part I provides the evidence supporting the benefits of physical activity on health and well-being and, together with detailed tables in Appendix 1, forms a literature review focusing on evidence-based studies that address the benefits of physical activity on reducing the impact of non-communicable diseases (NCDs) such as cancer, heart disease, stroke and type 2 diabetes. This is an extremely well-documented area, and this review selects key texts covering research articles and reviews that are widely cited.

Part II and Appendix 2 together provide a short review of the evidence on physical activity interventions, including the benefits of creating a more health-promoting environment.

Part III presents a series of case studies that may serve as a guideline for individuals and/or organisations that are considering incorporating strategies to tackle the burden of NCDs in their local community. In addition to examples that are grounded in scientific evidence, a select group of case studies are presented that do not include detailed data, but can be seen as innovative and promising.

Evidence and examples of one of the cheapest and simplest of all physical activities – walking – are presented throughout the review (each instance is indicated by the footprint icon).



Almost every community around the world is faced with the challenge of combating NCDs, and we hope that this review and case studies will provide information that provides the rationale for action and ideas for tackling physical inactivity in many different settings.

Part I: Evidence supporting the benefits of physical activity on health and well-being

1. The impact of physical activity on health

Being physically active plays an essential role in ensuring health and well-being, and there is a large body of research investigating the benefits of exercise.¹ Physical activity benefits many parts of the body – the heart, skeletal muscles, bones, blood (for example, cholesterol levels), the immune system and the nervous system¹ – and can reduce many of the risk factors for NCDs. These risk factors include:

- reducing blood pressure;
- improving blood cholesterol levels;
- lowering body mass index (BMI).

The role physical activity plays in many diseases, such as type 2 diabetes, heart disease and many cancers, means that the World Health Organization (WHO) estimates that:

- physical inactivity is the fourth-leading risk factor for global mortality² (see Figure 1); and
- physical inactivity is responsible for 6% of deaths globally – around 3.2 million deaths per year, including 2.6 million in low- and middle-income countries, and 670,000 of these deaths are premature.³

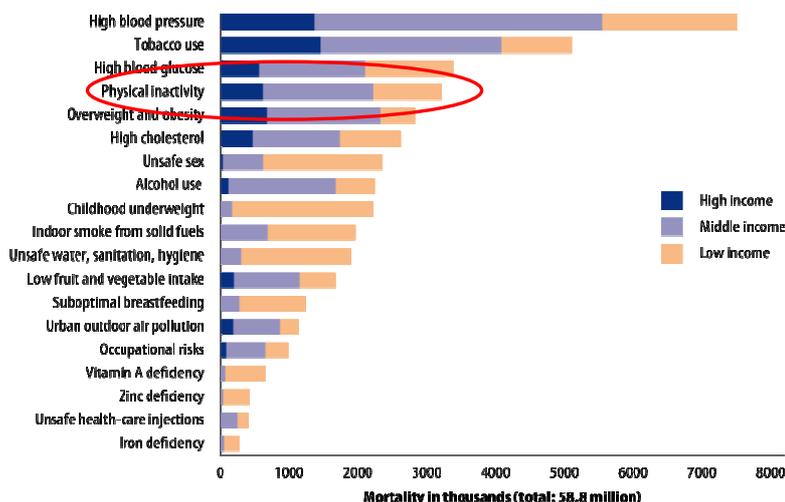


Figure 1: Deaths attributed to 19 leading factors, by country income level (2004)

Because of the many benefits for health of physical activity, recent analysis has suggested that reaching the recommended minimum level of physical activity compared with no activity was found to lead to a reduction in all-cause mortality of 19 per cent – and this rises to 24 per cent if an hour a day is spent in physical activity.⁴ In addition, there is a 31 per cent lower risk for all-cause mortality in active individuals.⁵ This demonstrates a positive dose-response – in other words, that the benefits of physical activity increase as the amount and intensity of the activity increases.

ⁱ For what constitutes sufficient physical activity, see Part I, section 2(iv) below.

An example: Walking

Walking is one of the best forms of physical activity – it is low impact (so does not put stress on the joints), weight-bearing (so it can improve bone density) and a 60kg individual walking briskly will burn about 300kcal an hour, so it can assist with weight loss. Additional benefits include stress reduction and improved sleep.



And the long-term health benefits of walking are startling. A large study of nurses⁶ found that regular walking halved the risk of developing type 2 diabetes – this is a similar level of protection to that found from undertaking the equivalent energy expenditure on a vigorous activity.

2. Literature review of the evidence

The evidence is resounding that physical activity improves health, and the studies referred to in this report cover a variety of different populations, research methodologies and physical activities.ⁱⁱ The tables in Appendix 1 cover research studies and/or reports that illustrate the benefits of physical activity on:

- overweight and obesity (Table 1a) – this is a major risk factor for NCDs;
- type 2 diabetes (Table 1b);
- cardiovascular disease (Table 2);
- coronary artery disease (Table 3); and
- cancer (Table 4).

In addition, Table 5 sets out evidence on the benefit of physical activity on mental health, including reducing stress and alleviating depression.

The improvements in physical activity are especially pronounced for high-risk individuals, for example those who are obese or have high blood pressure (hypertensive).⁷ Research has also shown that being physically active daily will reduce the chances of mortality associated with cardiovascular disease: 30 minutes of moderate intensity exercise on most days of the week, equivalent to 4.2 MJ (1000 kcal) a week, was enough to reduce cardiovascular-related mortality.⁸

i) Major chronic diseases

The four major NCDs⁹ – cardiovascular disease, type 2 diabetes, cancers and chronic lung disease – between them account for 59% of the 57 million deaths annually and 46% of the global burden of disease – double the number of deaths from all infectious diseases (including HIV/AIDS, TB and malaria), maternal and perinatal conditions, and nutritional deficiencies combined.¹⁰ They also kill at a younger age in less-developed countries: in low- and middle-income countries, 29% of NCD deaths occur among people under the age of 60, compared to 13% in high-income countries.¹¹

According to the World Health Organization, physical inactivity is the principal cause of approximately:

- 27% of **type 2 diabetes**;¹²
- 30% of **ischemic heart disease**.¹³

ⁱⁱ Readers are advised to refer to the individual reports for specifics.

As lifestyles change – becoming more sedentary, as well as rapidly changing diets – these diseases are becoming more common, and are striking at a younger age. For example, **diabetes prevalence** is rising fast – comparative rates among those aged 20–79 are as follows¹⁴:

- China: 4.2 per cent currently have diabetes, with projections of 5.0 per cent for 2030;
- India: 7.8 per cent currently have diabetes, with projections of 9.3 per cent for 2030;
- Mexico: 10.8 per cent currently have diabetes, with projections of 12.9 per cent for 2030;
- Saudi Arabia: 13.6 per cent currently have diabetes, with projections of 18.9 per cent for 2030.
- UK: 3.6 per cent currently have diabetes, with projections of 4.3 per cent for 2030.

But reversing the tide of physical inactivity can have striking impacts on many of the major NCDs – diabetes, many cancers and heart disease. Specific benefits include:

- a risk reduction for **breast cancer** of approximately 20–40 per cent for those who do vigorous physical activity for 30–60 minutes on five days each week;¹⁵
- the most active people are at 30 per cent lower risk of **colon cancer** than the least fit;¹⁶
- a 25–30 per cent reduction in **stroke** among active individuals;¹⁷
- physically inactive people can have as much as twice the risk of **coronary heart disease**.¹⁸

ii) Mental health

In addition to the benefits of physical activity on improving health and reducing risk factors for chronic disease, it has been shown to be effective in improving mental health, which is also a major cause of disability worldwide. Estimates made by the World Health Organization are that 154 million people globally suffer from depression, and mental illnesses affect and are affected by chronic conditions such as cancer, heart and other cardiovascular diseases, diabetes and HIV/AIDS.¹⁹

The evidence on the mental health benefits of physical activity is less well documented than for the physical effects – as the editors of the journal *Mental Health and Physical Activity* put it, in the journal's inaugural editorial: 'So many research questions come to mind in this field that have barely been considered.'²⁰ However, the body of evidence is growing fast, with many studies and clinical trials having shown specific benefits including: improved mood, reducing symptoms of stress, anger and depression,²¹ alleviating anxiety²² and slowing cognitive decline. Table 5 (see Appendix 1) presents select examples of the benefits and research studies that support each benefit.

Much research has focused on adults, but there is evidence that among adolescents increased leisure-time physical activity (i.e. outside structured school programmes) is significantly associated with fewer depressive symptoms over a two-year period.²³ Some studies also show that physical activity accelerates learning by increasing cognitive processes (e.g. memory functioning).²⁴

Among older people, physical activity can be of benefit to maintaining mental health, with one study of women aged 70–81 showing that those in the highest physical activity quintile to have a 20 per cent lower risk of cognitive decline (including tests of general cognition, verbal memory and attention).²⁵

The *World Alzheimer Report 2009* estimated that there are 35.6 million people living with dementia worldwide, with this figure set to increase to 65.7 million people by 2030 and 115.4 million by 2050.²⁶ There is also some evidence that physical activity may help to slow the progression of Alzheimer's²⁷ and reduce its risk through a number of mechanisms such as promoting vascular health by lowering blood pressure and reducing other risk factors that lead to the disease.²⁸ Research so far in this area is showing promising results²⁹ – but further studies need to be done.

Epidemiological studies suggest that exercise reduces the risk of Parkinson's disease, and regular physical activity is shown to improve the quality of life in Parkinson's disease patients and reduce their neurological symptoms. However, there is limited evidence on the exact cognitive processes and, again, further studies need to be done.³⁰

iii) Whole-life benefits of physical activity

The benefits of physical activity have been shown to be effective across the lifespan, among young and old alike. Physical activity has been shown to improve educational attainment in children as well as prevent obesity. Among older adults, engagement in routine exercise on a regular basis leads to improved functional abilities such as mobility, and is related to increased longevity. However, as Figure 2 shows for the UK,³¹ physical activity tends to decline substantially as we age.

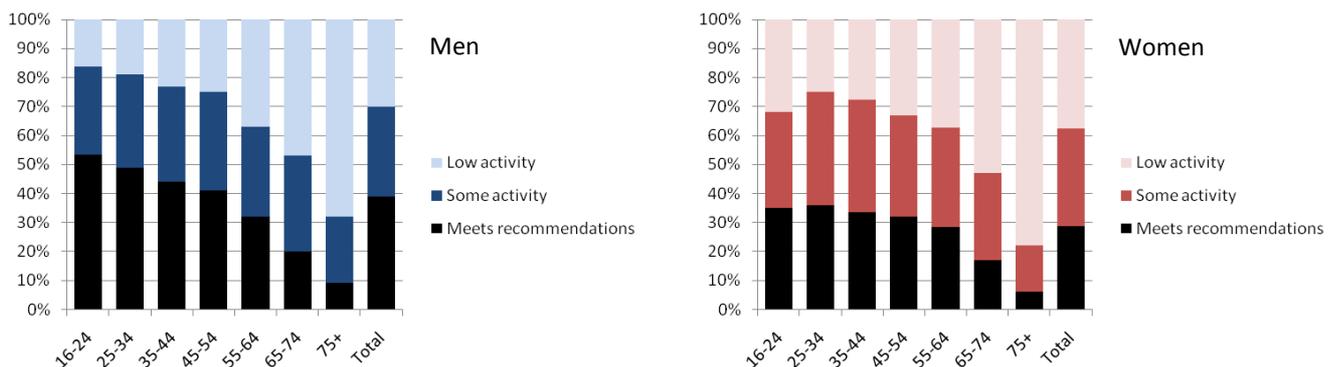


Figure 2: Levels of physical activity among adults in England (self-reported)

Table 6 in Appendix 1 presents a select sampling of studies that illustrate the benefit of physical activity across the lifespan.

iv) Recommended levels of physical activity

The recommended guidelines for the amount of physical activity that individuals should engage in on a routine basis in order to obtain and/or maintain health and wellness has been developed by leading national/international bodies and, although they may vary on specifics, the general features are all similar. The example presented below (p. 8) is taken from the American College of Sports Medicine and the American Heart Association guidelines and is widely used.³² The additional information for older adults is also from the ACSM and AHA and the information for children from the US CDC.³³

An easy rule of thumb (using wording from the US CDC) is the **talk test**: 'if you're doing moderate-intensity activity you can talk, but not sing, during the activity. If you're doing vigorous-intensity activity, you will not be able to say more than a few words without pausing for a breath.'ⁱⁱⁱ

Physical activity guidelines

- To promote and maintain good health, **adults aged 18–65 years** should maintain a physically active lifestyle.
- They should perform moderate-intensity aerobic (endurance) physical activity for a minimum of 30 minutes on five days each week or vigorous-intensity aerobic activity for a minimum of 20 minutes on three days each week.
- Combinations of moderate- and vigorous-intensity activity can be performed to meet this recommendation. For example, a person can meet the recommendation by walking briskly for 30 minutes twice during the week and then jogging for 20 minutes on two other days.
- These moderate- or vigorous intensity activities are in addition to the light intensity activities frequently performed during daily life (e.g. self care, washing dishes, using light tools at a desk) or activities of very short duration (e.g. taking out trash, walking to parking lot at store or office).
- Moderate-intensity aerobic activity, which is generally equivalent to a brisk walk and noticeably accelerates the heart rate, can be accumulated toward the 30-minute minimum by performing bouts each lasting 10 or more minutes.
- Vigorous-intensity activity is exemplified by jogging, and causes rapid breathing and a substantial increase in heart rate.
- In addition, at least twice each week adults will benefit by performing activities using the major muscles of the body that maintain or increase muscular strength and endurance.
- Because of the dose-response relation between physical activity and health, persons who wish to further improve their personal fitness, reduce their risk for chronic diseases and disabilities, or prevent unhealthy weight gain will likely benefit by exceeding the minimum recommended amount.

For **older adults** (over 65s, or those aged 50–64 with chronic conditions such as arthritis), the recommendation is the same, with balance exercises also recommended. It is also the case that goals below this threshold may be necessary for older adults who have physical impairments or functional limitations.

Children (aged 6–17) should do at least an hour of physical activity every day. This can include either moderate-intensity aerobic activity or vigorous-intensity activity (although the latter should be included on at least three days each week). Muscle-strengthening activities (such as gymnastics) and bone-strengthening activities (such as running or skipping rope) are also recommended on at least three days a week.

ⁱⁱⁱ <http://www.cdc.gov/physicalactivity/everyone/measuring/index.html>

An example: Walking

For good health, 10,000 steps a day is recommended – this is about 5 miles (8km), depending on stride length, and is the equivalent of walking briskly for about 90 minutes. This can be spread throughout the day. Brisk walking is an example of moderate-intensity activity; race walking becomes vigorous activity. Case Study 5 in Part III focuses particularly on walking, as it is cheap, easy and can be undertaken throughout the lifespan.



v) Socioeconomic disparities

There is a relationship between socioeconomic and physical activity in the United Kingdom, shown in Figure 3.³⁴ For men, there is little variation in the top four quintiles, with men in the lowest-income quintile (i.e. the least well-off) least likely to meet the targets. For women, the proportion meeting the target is highest in the top quintile, with little variation in the lowest four. In addition, the proportion of people getting the lowest amount of activity increases as income falls – 23 per cent of men in the highest quintile achieve only low levels of physical activity, compared with 46 per cent in the lowest quintile, and the equivalent for women is 28 per cent (highest quintile) and 45 per cent (lowest quintile).

There have been some studies into why patterns of physical activity vary between different socioeconomic groups – and there are certainly intuitive reasons why this may be so, even where strong empirical evidence is lacking. For example, the streets in poorer neighbourhoods are often less safe for walking or cycling because of traffic and a perceived fear of crime. The infrastructure for active living may also not be in place in such areas: one study in the United States found that ‘moving from a community with a 1% poverty rate to a 10% poverty rate is associated with a decreased prevalence of bike paths from 57% to 9% respectively’³⁵ – as the area got poorer, the availability of bike paths fell dramatically. In addition, access both to attractive, safe green space and to commercial resources for structured physical activity such as gyms³⁶ may be more limited in some more deprived areas.

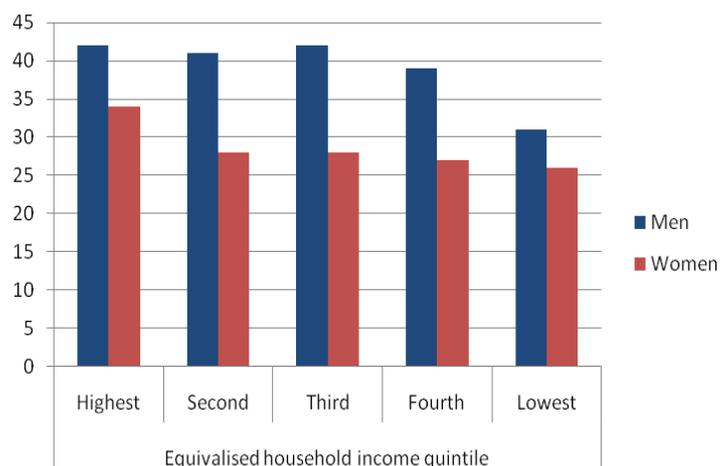


Figure 3: Proportion of people in England meeting the physical activity recommendations by equivalised household income and sex

It is an unfortunate fact that health-promotion messages are often adopted first by the more socially advantaged, with evidence indicating that health campaigns tend to have the dual impact of improving health on average across the population, but also widening health inequalities.³⁷ This makes creating opportunities for active living – making it easy to be physically active – particularly important in more deprived areas: campaigns to encourage ‘exercise’ will do little to increase activity levels among the least well-off unless they have the means to make the change.

Part II: Evidence supporting interventions to encourage physical activity

1. The scale of the problem

Despite the large body of evidence that support the benefits of being physically active, in developed countries the majority of adults do not meet the recommended level. Comparing physical activity levels between countries is challenging, because there are no common tools by which it is measured: the international tools such as the International Physical Activity Questionnaire and the WHO's Global Physical Activity Questionnaire are often not part of national surveys. However, it is clear that in developed countries only a minority of adults achieve the recommended levels of physical activity. In England, for example (as Figure 2 shows, above), only 39 per cent of adult men and 29 per cent of adult women meet the recommendations.

However, this lack of clear data should not stop efforts to increase physical activity, as the health benefits are evident (see Part I).

2. An active environment?

As the rates of NCDs continue to rise, recently greater efforts and resources are being invested in how to best encourage people to live a healthier lifestyle, including making better physical activity choices. Research over the past few decades has provided a greater understanding of the factors influencing whether or not an individual or community is physically active, and Figure 4 depicts a conceptual model of the multiple factors and influences involved in living a healthy physically active lifestyle. Interventions that take into consideration these multiple layers of influence are more likely to be effective than single interventions targeting a particular factor. Tackling these multiple factors is to encourage **active living**.



Figure 4: Layers of influence affecting engagement in physical activity³⁸

In recent years there has been shift away from encouraging individual behaviour change to an approach that addresses wider, population-level factors. Individualised behaviour change is often not sustainable or effective^{39 40} unless it becomes habit-forming. Changing the overall environment makes behaviour change more sustainable.

There are different levers that can be used at the population level to change both the social environment and the built environment, which together influence the health choices made by individuals. Factors in the social environments known to influence participation in physical activity are socioeconomic status, cultural beliefs, and opportunities to improve social cohesion in the neighbourhood, city and regions. Factors in the built environment that influence participation in physical activity are urban design, transport (traffic), availability of green space, and land-use patterns.

An example of creating an active environment: walking and cycling

Encouraging walking and cycling is a good way of increasing physical activity, and successful interventions to promote walking or cycling could address factors either in the built environment or social environment.



- Changing the **built environment** through improvements in the roads and pavements may be a feasible option for cities that are prioritising the alleviation of traffic congestion and reduction of the city's carbon footprint. In London, for example, cycling has been a stated priority for the mayor, and improvements to cycling infrastructure have resulted in an increase of 123 per cent in cycle trips between 2001 and 2009 (see Case Study 2).
- However, if the resources or political will is not yet in line to make major environmental changes, another strategy is to address the **social factors** to promote walking or cycling. Creating community walking or biking groups are simple ways to encourage people to walk and bike.

3. Behaviour change

In the United Kingdom, at least, the great majority of the population – almost 95 per cent – accept and know about the link between physical activity and health. However, the majority of us do not do not achieve the recommended amounts of activity (see Figure 2), a pattern seen across the developed world and, increasingly, among urban dwellers in lower-income countries.⁴¹ Fostering long-term behaviour change requires overcoming a number of perceived barriers that need to be overcome in order to take regular exercise, including a lack of motivation and a shortage of time – over a third claim that work commitments prevent them from taking physical activity, and a quarter use family commitments as an excuse.⁴² Finding ways to overcome these barriers is essential, through addressing individual determinants and the social environment – for example, promoting active living, rather than exercising in a gym, can help people to build exercise into the working day, as fitness goals can be achieved through 10-minute bouts of moderate physical activity.

The social aspects of physical activity (see, for example, Case Studies 5 and 6) can also act as a powerful incentive, and there is evidence that interventions that provide social support are effective in driving behaviour change, either through social networking or through peer-to-peer interactions.⁴³

Encouraging GPs to 'prescribe' walking and other physical activity has also been shown to be an effective behaviour-change intervention.⁴⁴ In Sweden, for example, a system of Physical Activity on Prescription (*Fysisk aktivitet på recept: FaR®*) is regularly used – the prescription is tailored to the health needs of the individual patient, and can be as simple as a written suggestion of an activity or a much more comprehensive solution, supported by an activity organiser such as volunteer or sports organisations.⁴⁵ In the United Kingdom, patients are



referred to a quality-assured system such as a leisure centre or walking group, with their GP retaining clinical control. Natural England's campaign for 'Our Natural Health Service' aims to highlight the link between outdoor activity in green space and health. It aims to increase the number of households within a five-minute walk of green space of at least two hectares, and to enable GPs and community nurses to signpost patients to an approved health walk or outdoor activity programme.

Motivational interviewing is one of the most common therapeutic strategies used to initiate behaviour change – it gauges a person's readiness to change their behaviour, and is used to help to prime people for the change. It is commonly used on people with addictive behaviours (such as tobacco use and alcohol), and is typically used in therapy environments – although physical activity could also make use of some of the same basic principles.

Carefully targeted interventions that are tailored to specific groups and individuals – for example, suggesting small, manageable, appropriate changes, or setting personal goals – can also help to encourage sustainable behaviour change. Wider campaigns such as the UK's Change4Life⁴⁶ – focused on improving diet and physical activity, and using mass media – can also have some effect, and has most recently spearheaded a walking campaign, Walk4Life.



walk4life

4. Selected interventions

Table 7 in Appendix 2 provides a select list of interventions that have been identified by the US Centers for Disease Control as being effective in promoting physical activity. The table includes the intervention components, outcomes and effect size (if available), and key implementation factors that are linked to the context and are important to consider in seeking to replicate the findings. The comprehensive review on which the table is based identified 94 studies that met its eligibility criteria for inclusion, and three main types of interventions for increasing physical activity:

- information-based;
- behavioural and social; and
- environmental and policy interventions.

The results of the review revealed strong and consistent evidence for the impact of community-wide education, community social support, individually tailored health behaviour-change programmes, and enhanced access to places for physical activity. There was sufficient evidence to demonstrate the effectiveness of point-of-decision prompts. However, there was only limited evidence for the efficacy of mass-media campaigns, and college-based health education.

Table 8 presents the results of another systematic review (unpublished). The review was completed during the preparatory phase of the Community Interventions for Health (CIH) project (www.cih.net, a programme of the Oxford Health Alliance), to identify effective interventions that promote physical activity. The review focused on evidence-based strategies; the table includes the governing bodies that endorsed the strategies.

As well as recommendations on community coalition-building and health education/media, most of the recommendations of the CIH review focus on structural changes, as there is a growing body of research that indicates such interventions are effective.⁴⁷ One of the major challenges in implementing structural change is the time and resources required to make different types of changes. Often in order to advocate for the changes that support physical activity, consensus-

building is required among a broad range of stakeholders, especially those related to urban planning.

Large-scale intervention projects such as Agita São Paulo (see Case Study 1, below) adopt the strategy of promoting active living. Its key message is about moving and being physically active during daily activities, and Agita has developed different materials to demonstrate how everyday activities (gardening, housework, walking etc.) count towards the physical activity total.

Although not as rigorously studied as the activities described above, there are some group activities which have shown some success in improving levels of physical activity, including **community gardening** and **dancing**. These types of activities often address several aspects of the social environment and individual determinants, as outlined in Figure 4. For example, community gardens have been shown to improve social cohesion in a community⁴⁸ and culturally appropriate forms of dancing can serve as an important facilitator for certain cultural groups, improving both physical and emotional well-being (for example, among African American and Latino groups in the United States – see Case Study 4, below).⁴⁹

Green exercise – physical activity such as walking/hiking in outdoor settings – has also been shown to be a good way to improve mental and physical health.⁵⁰ A UK report from 2004, *Natural Fit: Can Green Space and Biodiversity Increase Levels of Physical Activity?*, sets out the benefits of exercising in natural surroundings – for example, ‘green gyms’ (in which conservation work is used to increase physical activity) have found that although keeping fit was a primary reason for joining, the main reason for **continuing** participation was the chance to be in the countryside: being in the open air makes the physical activity more sustainable, and the physical activity become a by-product rather than the primary motivation⁵¹ (see Case Study 6, below). The ‘green gym’ approach has also been picked up, in England, by the government’s Change4Life initiative, part of which is ‘Muck In 4 Life’.⁵² One review of several studies found that there is the greatest mental-health benefit (in terms of self-esteem and mood) in the first few minutes, with longer periods in the environment showing diminishing but still positive returns. The effect was shown in every green environment, but is even greater in the presence of water.⁵³

Increasing physical activity

Leisure time activities are activities done in periods of time outside of work and essential domestic activities. The strategy is to encourage sport participation or different social groups which engage in physical activity (e.g. walking groups, cycling groups, dancing or community gardening).

Active transport refers to walking or biking as a means of transportation and not purely as a form of recreation. Encouraging walking or biking to work or school, or going about daily activities such as shopping are great ways to maintaining an active lifestyle.

Active living is a way of life in which exercise is fully integrated into daily activities. The goal is to accumulate 30 minutes of physical activity a day in 10-minute stints. This can be done in various ways: through leisure-time activity, active transport, household chores, taking the stairs, walking a dog, etc.



Ways to promote simple exercise initiatives: walking

Promoting walking as a form of active transport or as a leisure-time activity is a simple way to encourage physical activity. Aside from improving the built environment to encourage walking there are other strategies, which have been shown to be effective in promoting walking. They include:

- brief telephone prompts;⁵⁴
- prescribing walking (by health-care providers);⁵⁵
- using pedometers;⁵⁶
- mass-media campaign coupled with mediated interventions (face-to-face or telephone-prompt interventions);⁵⁷
- social interaction.⁵⁸

Part III: Case studies

1. Introduction

The purpose of these case studies is to provide information on the various types of activities/programmes that are currently under way and to spark ideas that can be further explored in local communities. This sampling of case studies was chosen to reflect geographic and cultural diversity as well as a combination of the different types of physical activities/programmes possible (e.g. leisure-time activities and active transport). One size does not fit all – any initiative must be adapted to suit the circumstances in which it is being established and the population at which it is aimed.

While health benefits of the initiatives in the case studies have been included where known (and the majority have evaluated at least some of the mental or physical health benefits), please note that many are not subject to rigorous scientific study (see Appendix 3). However, even if not formally assessed as part of a research study, the specific activities themselves may be evidence-based: for example, building on the evidence of the benefits of peer support in promoting physical activity, the benefits of walking and of the use of pedometers. There is ample evidence regarding the value of physical activity in maintaining and/or improving health.

Lack of evaluation – while, of course, in no way diminishing the effects of the initiative on those taking part – may make the value of the project less obvious to others, and make it less likely to be replicated elsewhere. To be a best-practice case study, any new initiatives should consider evaluating its participation rates and mental/physical health impacts.

2. What makes for best practice?

An additional reference to consider for the review of best practices/case studies may be found in a report, published by the World Health Organization, *Review of Best Practices in Interventions to Promote Physical Activity in Developing Countries* (2008), which is also highly relevant to developed countries.

The WHO noted that the following features of an intervention should be in place if it is to be seen as an example of best practice:

- reach a **large proportion of the population**, or of a defined population group;
- have mid- to long-term experience/sustainability (at least 1–3 years);
- are targeted to the **whole population as well as specific population groups** (e.g. adults, children, senior citizens, employees, disabled people, women);
- define **clear objectives** (e.g. raising awareness on the importance/health benefits of physical activity, increasing population levels of physical activity);
- have political commitment or a **guiding policy**;
- have a **coordinating team** (e.g. programme coordination, delivery, administration, research/evaluation, dissemination);
- receive **support from stakeholders** (e.g. ministries, private sector organisations, NGOs, sports associations, schools, employers, parents, local community groups);

- provide a **clear identity** (e.g. name, logo, mascot, branding);
- are **implemented within the 'local reality'** (sources, infrastructure, cultural groups);
- **distributed** the intervention components using various channels (e.g. print media, electronic media, events, powerful individuals, advocates);
- include some clear **evaluation** of the programme or its elements.

3. Case studies

Case study 1: Brazil – Agita

Agita São Paulo is an ongoing, community-wide and very successful intervention to promote physical activity. It was originally implemented in São Paulo, Brazil, a state with 34 million inhabitants, and was launched in 1996 by the Centre for Laboratory Studies on Physical Fitness of São Caetano do Sul (CELAFISCS). What started as a grass-roots initiative, with volunteer participation of exercise scientists and physicians, has spread and become a model for similar programmes across the country and in the Americas more widely, including Argentina, Colombia, and Mexico. A worldwide NGO (Agita Mundo) initially developed the annual Move for Health initiative, launched by the WHO on World Health Day 2002. (See also www.agitasp.org.)



Agita aims to increase knowledge and awareness of the benefits of an active lifestyle, and enhance physical activity participation, particularly through encouraging 30 minutes of physical activity. The original mascot of the campaign, the 'half-hour man', has now been supplemented with other mascots such as the 'half-hour woman' and 'half-hour cowboy' and others, to adapt to gender and regional cultures in an appealing way. The focus is more on 'active living' and 'physical activity for health' than on 'sport' and 'fitness', so every-day, lifelong physical activities (such as walking, gardening, home chores and active transport) are the most recommended activities – and, as Brazilians love to dance, the recommendations for leisure activity largely focus on dancing.

The whole population is targeted, with a particular emphasis on students, workers and older adults, and the campaign takes a holistic approach, focusing not only on the individual, but also on their environment (family, teachers, peer groups, community values and media).

Health impacts

There are clear positive impacts of the Agita programme. Awareness of the programme and its messages is high (80 per cent of children in state schools in the area know the recommendations on physical activity, for example), and inhabitants are 54 per cent less likely to be sedentary if they have heard of the programme.



Physical activity has increased – for example, in the over-50s, those who are 'irregularly active' fell 60 per cent between 1999 and 2004, while those who are 'active' rose 61 per cent. Overall, the proportion of people doing less than 150 minutes a week of physical activity in the state of São Paulo fell by over 71 per cent between 2002 and 2008.

The benefits of the increase in physical activity are also having an impact on physical health. In Sorocaba, the mayor and local administration saw the value of the programme, and implemented

changes in infrastructure (such as better pavements), and the health impact was striking: hospitalisation from diabetes fell by 57 per cent between 2000 and 2004, and hospitalisation for stroke fell by 50 per cent. The World Bank has estimated that Agita represents a cost saving to the health system of US\$310 million each year.⁵⁹

Case study 2: England – Encouraging cycling

In England, the need for ‘active travel’ to be included in strategies to tackle obesity and NCDs is explicitly recognised by the government: the 2010 White Paper on public health states that ‘active travel and physical activity need to become the norm in communities’.⁶⁰ And opportunities for cycling are multiplying in the UK, through the work of organisations such as Sustrans, an NGO which has invested £500 million since its establishment in 1977, and which co-ordinates partnerships with local transport authorities and public-health teams, NGOs and over 3,000 regular volunteers.

Sustrans’ National Cycle Network consists of over 20,000km of dedicated bike paths and traffic-calmed roads, and aims to increase the proportion of journeys under five miles that are cycled from its current level of around 2 per cent to 20 per cent. Sustrans’ Bike It initiative encourages more schoolchildren to cycle to school, and in Bike It schools trips by bike have more than trebled to around 10 per cent.

In particular, there been significant increases in cycling in London: the number of people entering central London by bicycle during the weekday morning peak grew by 123 per cent between 2001 and 2009 – and by 15 per cent in 2008–09 alone. Despite this rise, by the end of 2009 fatalities and serious injuries to cyclists had fallen 24 per cent from the rate in 1994–98 – and by 3 per cent in 2009.⁶¹ This increase is due to a variety of factors, including the introduction of a Congestion Charge for motor vehicles, improvements to cycling infrastructure and the recent establishment by Transport for London and Barclays Bank of a fleet of 5,000 hire bicycles (3 million journeys were made on the bikes in the first eight months of operation).



Health benefits

Since 2000, Sustrans has been evaluating the benefits of its projects⁶²: 407 million journeys were made on the National Cycle Network in 2009 (6 per cent up on 2008), with an estimated health benefit from cycling of £288 million. This cost-benefit of improving cycling infrastructure is estimated as being nearly 4:1 over just 10 years, mainly derived from improved health due to the increase in physical activity.⁶³ The environmental impact, too, is significant: the use of the National Cycle Network is already estimated to reduce CO₂ emissions by over 600,000 tonnes a year, compared to each journey instead being taken by car.

Case study 3: Global – The Global Corporate Challenge

The Global Corporate Challenge is an annual, three-month walking challenge for employees, which was set up in 2004 in Australia and is now in 55 countries, with over 100,000 participants in 2011. Workplaces enter teams of seven people, each of whom are issued with a starter pack (including a pedometer), with the aim of achieving at least 10,000 steps each day. The hope is that physical activity levels will increase for the period of the Challenge, but that the length



of time for which the Challenge runs will mean that it is habit-forming, i.e. that participants will continue to do greater amounts of physical activity following the end of the four months.

Each participant adds their daily step count to a website, which both tracks the progress of the individual and also calculates the distance travelled by the team as a whole, plotting a course 'around the world' showing the team's progress on a map. The website also contains nutritional and health information. The cost in 2011 was £49 per head in the United Kingdom. In 2010 the average number of steps taken per participant in the GCC was 12,693 (this equates to walking a total of over 8km per day and burns off over 500 kcal). From 2010, each company's support of the GCC has also sponsored a team of children aged 8–12 years to enter a free 50-day Global Children's Challenge,⁶⁴ encouraging children both to be physically active and to use physical activity to learn about health and (through the website) geography and social science: in its first year, over 90,000 children took part.



Health benefits

The average office worker is estimated to walk only 3,000 steps per day, so the 12,000 steps a day averaged in 2010 is a four-fold increase significant increase in daily physical activity. This, coupled with advice on better nutrition, has a lasting impact on the health and well-being of GCC participants. Independent health screening by Monash University for the Foundation for Chronic Disease Prevention has verified significant reductions in participant waist measurements as well as both systolic and diastolic blood pressure.⁶⁵ A survey of GCC participants found that 94 per cent of those who took part said that they would continue the same higher level of physical activity after the conclusion of the Challenge: a long-lasting lifestyle change with the potential for significant and long-term health benefits.

Case study 4: United States and Mexico – Lift Off / Pausa Para Tu Salud (Break for your health)

Also aimed at encouraging health in the workplace, Lift Off is a Los Angeles-based study⁶⁶ of 449 employees, predominantly sedentary, overweight, middle-aged women of colour, who met over 26 sessions. The intervention integrated short, 10-minute bouts of exercise into the working day, involving moderate intensity, low-impact aerobic dance and calisthenic movements to music. More than 90% of meeting attendees participated in the exercises. The same model has now been expanded to other settings such as community-based health and social-service organisations serving African American and/or Latinos in California and South Carolina.

In a similar programme, *Pausa Para Tu Salud* (Break for your Health) took place in the Mexican Ministry of Health from January 2003 to January 2004.⁶⁷ Each exercise break, or *pausa*, was scheduled at a specific time (11–11:30am), and all office employees were encouraged to take part. The sessions began as 10 minutes of light stretching and dance movements, and then increased in intensity as the employees became fitter. Music selections were suggested by employees, and the routines varied to include strength, flexibility and aerobic conditioning. The project also made use of stair prompts and written materials, and senior staff encouraged employees to take part in physical activity outside the workplace.



The photograph is of Dr Toni Yancey, leading proponent of the intervention, at a Lift Off class.

Health benefits

Among completely sedentary individuals in Lift Off, intervention participants' self-perceived health-status ratings were significantly lower than those of the control group. Among the completely sedentary, control participants reported significantly higher levels of energy than did intervention participants.

In the Mexican initiative, male employees lost an average of 1.01kg in weight (women did not see a significant weight reduction), and waist circumference for both sexes decreased significantly (by 1.9cm for men and 1.4cm for women). There was also a significant decrease in women's diastolic blood pressure.

Case study 5: Uganda – football league in Gulu

The Gum Marom Kids League is a football (soccer) league in Gulu, Northern Uganda – a region that has only recently emerged from over 20 years of civil war, during which time one in three of all boys and one in six of all girls are thought to have been abducted, many of whom were forced to serve as child soldiers.⁶⁸ The league was established to engage the local community, build a more robust peace, and improve the physical and mental health of 10–14-year-olds. In its first season (September–November 2010), 32 teams were formed, reaching 240 local boys and 160 girls, with 32 adults trained as football coaches and peace-building educators. League and tournament games took place each Saturday, with training after school on at least one evening a week. Peace-building activities were organised around each game or training session, including conflict management and health awareness, presented through a range of genres including poetry, role-play and debate. The project was promoted on local radio and in schools, and proved so popular that it could not accommodate all the children who wanted to take part.



At a cost of USh25,000,000 (US\$10,400) for the first season, it is a partnership between the local community-based Youth Coalition for Peace and with funding from Canada-based NGO OA Projects⁶⁹ and some support from The Kids League, a Kampala-based NGO. Schools and local government were involved in designing the project to ensure maximum local support.

The project is designed to be sustainable – local staff are planning to launch the next season with minimal external management support, and OA Projects (while continuing to fund the project in 2011) is working towards complete local ownership.

Health benefits

Evaluation of the mental and physical health of the children, and the impact of the peace-building and gender-equity aspects, was a key component of the project. The evaluation was carried out by a research team that worked with local schools. Mental health was measured using a locally developed tool, and physical health using a 'beep' test, standing jump and BMI-for-age. Preliminary analysis of baseline data suggests normal growth patterns, but identified a population-wide deficit in physical fitness and persistent mental-health challenges. Final results describing the impact of the intervention are due in summer 2011, and will be posted on the OA Projects website.

Case study 6: UK – Green Gym at Hereward GP Practice, Bourne

The final case study is an example of physical activity that is prescribed by GPs, and delivered through a 'Green Gym' – a scheme in which participants are given the opportunity to tackle physical jobs in the outdoors, improving strength, practical skills and confidence, and benefiting the local natural environment. Bourne Green Gym⁷⁰ was launched in mid-2009 – it now has over 50 members. It is the only Green Gym in the country to be funded by the NHS and run from a GP surgery, and is also supported by the British Trust Conservation Volunteers (BTCV). Patients are referred or encouraged to join by their GP, who gives advice on the correct level of exercise. It is promoted with posters in the surgery's waiting room. Projects take place in community gardens and there are also some conservation efforts in Abbey Lawns, The Wellhead and Bourne Woods.

Health benefits

The latest results (assessed after six months) are drawn from a self-perception questionnaire issued to members (80 per cent of whom had specific heart problems, such as heart conditions, diabetes etc.). There were clear physical- and mental-health benefits as, in addition to the pleasure felt in learning new skills and making new friends:

- 70 per cent felt that their energy levels had improved;
- 90 per cent reported improved emotional well-being;
- 80 per cent felt that their physical capabilities had improved; and
- 50 per cent had achieved weight loss (of up to half a stone – around 3kg).



Appendix 1: Selected literature on the health benefits of physical activity

Tables 1–4 provide select examples of key research studies and/or reports that support the impact of physical activity on the prevention and control of, in particular, three major NCDs: cardiovascular disease, type 2 diabetes and many cancers. Table 5 provides information on the mental-health benefits of physical activity, and Table 6 the advantages conferred throughout life.

Table 1a: Prevention of overweight and obesity

Haskell, W.L., I.M. Lee, R.R. Pate, K.E. Powell, S.N. Blair, B.A. Franklin, C.A. Macera, G.W. Heath, P.D. Thompson and A. Bauman, 'Physical activity and public health: updated recommendation for adults from American College of Sports Medicine and the American Heart Association', *Med Sci Sports Exerc* 2007, 39(8): 1423–34:

<http://circ.ahajournals.org/cgi/content/abstract/CIRCULATIONAHA.107.185649v1>

Penedo, F.J. and J.R. Dahn, 'Exercise and well-being: a review of mental and physical health benefits associated with physical activity', *Cur Opin Psychiatry* 2005, 18: 189–193: <http://www.ncbi.nlm.nih.gov/pubmed/16639173>

US Department of Health and Human Services, *Physical Activity and Health: A Report of the Surgeon General* (Atlanta, GA: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion), 1996: <http://www.fitness.gov/execsum/execsum.htm>

Warburton, D.E.R., S. Charlesworth, A. Ivey, L. Nettlefold and S.S.D. Bredin, 'A systematic review of the evidence of Canada's Physical Activity Guidelines for Adults', *Int J Behav Nutr Phys Act* 2010, 7: 39:

<http://www.ncbi.nlm.nih.gov/pubmed/20459783>

Table 1b: Prevention of type 2 diabetes

Burchfiel, C.M., D.S. Sharp, J.D. Curb, B.L. Rodriguez, L.J. Hwang, E.B. Marcus and K. Yano, 'Physical activity and incidence of diabetes: the Honolulu Heart Program', *Am J Epidemiol* 1995, 41: 360–8:

<http://aje.oxfordjournals.org/content/141/4/360.short>

Dziura, J., S.V. Kasl and L. DiPietro, 'Physical activity reduces type 2 diabetes risk in aging independent of body weight change', *J Phys Activity Health* 2004, 1: 19–28: <http://journals.humankinetics.com/jpah-back-issues/jpahvolume1issue1january/physicalactivityreducestype2diabetesriskinagingindependentofbodyweightchange>

Hu, F.B., R.J. Sigal, J.W. Rich-Edwards, G.A. Colditz, C.G. Solomon, W.C. Willett, F.E. Speizer and J.E. Manson, 'Walking compared with vigorous physical activity and risk of type 2 diabetes in women: a prospective study', *JAMA* 1999, 282: 1433–9: <http://jama.ama-assn.org/content/282/15/1433.abstract>

Hu, F.B., M.F. Leitzmann, M.J. Stampfer, G.A. Colditz, W.C. Willett and E.B. Rimm, 'Physical activity and television watching in relation to risk for type 2 diabetes mellitus in men', *Arch Intern Med* 2001, 161: 1542–8:

<http://www.ncbi.nlm.nih.gov/pubmed/11427103>

Rana, J.S., T.Y. Li, J.E. Manson and F.B. Hu, 'Adiposity compared with physical inactivity and risk of type 2 diabetes in women', *Diabetes Care* 2007, 30: 53–8: <http://www.ncbi.nlm.nih.gov/pubmed/17192333>

Sawada, S.S., I.M. Lee, T. Muto, K. Matuszaki and S.N. Blair, 'Cardiorespiratory fitness and the incidence of type 2 diabetes: prospective study of Japanese men', *Diabetes Care* 2003, 26: 2918–22:

<http://www.ncbi.nlm.nih.gov/pubmed/14514602>

Weinstein, A.R., H.D. Sesso, I.M. Lee, N.R. Cook, J.E. Manson, J.E. Buring and J.M. Gaziano, 'Relationship of physical activity vs body mass index with type 2 diabetes in women', *JAMA* 2004, 292: 1188–94:

<http://www.ncbi.nlm.nih.gov/pubmed/15353531>

Table 2: Prevention of cardiovascular disease

Alevizos, A., J. Lentzas, S. Kokkoris, A. Mariolis and P. Korantzopoulos, 'Physical activity and stroke risk', *Int J Clin Pract* 2005, 59(8): 922–30: <http://www.ncbi.nlm.nih.gov/pubmed/16033614>

Blair, S.N., H.W. Kohl III, C.E. Barlow, R.S. Paffenbarger Jr, L.W. Gibbons and C.A. Macera, 'Changes in physical fitness and all-cause mortality: a prospective study of healthy and unhealthy men', *JAMA* 1995, 273: 1093–8: <http://www.ncbi.nlm.nih.gov/pubmed/7707596>

Haskell, W.L., I.M. Lee, R.R. Pate, K.E. Powell, S.N. Blair, B.A. Franklin, C.A. Macera, G.W. Heath, P.D. Thompson and A. Bauman, 'Physical activity and public health: updated recommendation for adults from American College of Sports Medicine and the American Heart Association', *Med Sci Sports Exerc* 2007, 39(8): 1423–34: <http://circ.ahajournals.org/cgi/content/abstract/CIRCULATIONAHA.107.185649v1>

Myers, J., A. Kaykha, S. George, J. Abella, N. Zaheer, S. Lear, T. Yamazaki and V. Froelicher V: 'Fitness versus physical activity patterns in predicting mortality in men', *Am J Med* 2004, 117: 912–18: <http://www.ncbi.nlm.nih.gov/pubmed/15629729>

Penedo, F.J. and J.R. Dahn, 'Exercise and well-being: a review of mental and physical health benefits associated with physical activity', *Cur Opin Psychiatry* 2005, 18: 189–93: <http://www.ncbi.nlm.nih.gov/pubmed/16639173>

Paffenbarger, R.S. Jr, R.T. Hyde, A.L. Wing and C.C. Hsieh, 'Physical activity, all-cause mortality, and longevity of college alumni', *N Engl J Med* 1986, 314: 605–13: <http://www.ncbi.nlm.nih.gov/pubmed/3945246>

US Department of Health and Human Services, *Physical Activity and Health: A Report of the Surgeon General* (Atlanta, GA: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion), 1996: <http://www.fitness.gov/execsum/execsum.htm>

Warburton, D.E.R., S. Charlesworth, A. Ivey, L. Nettlefold and S.S.D. Bredin, 'A systematic review of the evidence of Canada's Physical Activity Guidelines for Adults', *Int J Behav Nutr Phys Act* 2010, 7: 39: <http://www.ncbi.nlm.nih.gov/pubmed/20459783>

Table 3: Prevention of coronary artery disease

Specific benefits:

- Reductions in systolic and diastolic blood pressure
- Decreases in total and low-density lipoprotein (LDL) cholesterol
- Increases in high-density lipoprotein (HDL) cholesterol

Haskell, W.L., I.M. Lee, R.R. Pate, K.E. Powell, S.N. Blair, B.A. Franklin, C.A. Macera, G.W. Heath, P.D. Thompson and A. Bauman, 'Physical activity and public health: updated recommendation for adults from American College of Sports Medicine and the American Heart Association', *Med Sci Sports Exerc* 2007, 39(8): 1423–34: <http://circ.ahajournals.org/cgi/content/abstract/CIRCULATIONAHA.107.185649v1>

Miller, T.D., G.J. Balady and G.F. Fletcher, 'Exercise and its role in the prevention and rehabilitation of cardiovascular disease', *Ann Behav Med* 1997, 19(3): 220–9: <http://www.ncbi.nlm.nih.gov/pubmed/9603697>

Penedo, F.J. and J.R. Dahn, 'Exercise and well-being: a review of mental and physical health benefits associated with physical activity', *Cur Opin Psychiatry* 2005, 18: 189–93: <http://www.ncbi.nlm.nih.gov/pubmed/16639173>

US Department of Health and Human Services, *Physical Activity and Health: A Report of the Surgeon General* (Atlanta, GA: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion), 1996: <http://www.fitness.gov/execsum/execsum.htm>

Warburton, D.E.R., S. Charlesworth, A. Ivey, L. Nettlefold and S.S.D. Bredin, 'A systematic review of the evidence of Canada's Physical Activity Guidelines for Adults', *Int J Behav Nutr Phys Act* 2010, 7: 39: <http://www.ncbi.nlm.nih.gov/pubmed/20459783>

Table 4: Prevention of cancer

Warburton, D.E.R., S. Charlesworth, A. Ivey, L. Nettlefold and S.S.D. Bredin, 'A systematic review of the evidence of Canada's Physical Activity Guidelines for Adults', *Int J Behav Nutr Phys Act* 2010, 7: 39:

<http://www.ncbi.nlm.nih.gov/pubmed/20459783>

World Cancer Research Fund / American Institute for Cancer Research, *Food, Nutrition, Physical Activity, and the Prevention of Cancer: a Global Perspective* (Washington DC: AICR), 2010: <http://www.dietandcancerreport.org/>

Table 5: Benefits of physical activity on mental health

Penedo, F.J. and J.R. Dahn, 'Exercise and well-being: a review of mental and physical health benefits associated with physical activity', *Cur Opin Psychiatry* 2005, 18: 189–93: <http://www.ncbi.nlm.nih.gov/pubmed/16639173>

Taylor, B., J.F. Sallis and R. Needle, 'The relationship of physical activity and exercise to mental health', *Pub Health Rpts* 1985 100(2): 195–201: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1424736/>

Warburton, D.E.R., S. Charlesworth, A. Ivey, L. Nettlefold and S.S.D. Bredin, 'A systematic review of the evidence of Canada's Physical Activity Guidelines for Adults', *Int J Behav Nutr Phys Act* 2010, 7: 39:

<http://www.ncbi.nlm.nih.gov/pubmed/20459783>

Table 6: Benefits of physical activity across the lifespan

Children	Improve educational attainment	Centers for Disease Control and Prevention, <i>The Association between School-based Physical Activity, including Physical Education, and Academic Performance</i> (Atlanta, GA: US Department of Health and Human Services), 2010: http://www.cdc.gov/healthyyouth/health_and_academics/pdf/pa-pe_paper.pdf
	Prevent obesity	Janseen, I. and A. LeBlanc, 'Systematic review of the health benefits of physical activity and fitness in school-aged children and youth', <i>Int J Behav Nutr Phys Act</i> 2010, 7: 40: http://www.ncbi.nlm.nih.gov/pubmed/20459784
Elderly adults	Increase in functional ability	Allison, M. and C. Keller, 'Physical activity in the elderly: benefits and interventions strategies', <i>Nurse Pract</i> 1997, 8: 53–4: http://www.ncbi.nlm.nih.gov/pubmed/9279845 Stessman, J., R. Hammerman-Rozenberg, A. Cohen, E. Ein-Mor and J.M. Jacobs, 'Physical activity, function and longevity among the very old', <i>Arch Inter Med</i> 2009 ,169: 1476–83: http://www.ncbi.nlm.nih.gov/pubmed/19752405
	Improve longevity	Stessman, J., R. Hammerman-Rozenberg, A. Cohen, E. Ein-Mor and J.M. Jacobs, 'Physical activity, function and longevity among the very old', <i>Arch Inter Med</i> 2009 ,169: 1476–83: http://www.ncbi.nlm.nih.gov/pubmed/19752405

Appendix 2: Physical activity interventions

The systematic review presented in Table 7 is available on www.thecommunityguide.org, and parts have been published in the *American Journal of Preventive Medicine* 2002, 22(4S): 73–107 as well as by the US Department of Human Services, *Increasing Physical Activity: a Report on the Recommendations of the Task Force on Community Preventive Services* (2001). The review focused on studies that were available for review in English, were either RCTs or non-RCTs with concurrent control group, and included baseline and post-intervention measures of outcomes. Multiple electronic databases covering research worldwide were examined over a 20-year period (1980–2000).

Table 7: Physical activity interventions

Intervention type	Components	Outcomes/effect size	Implementation factors
Social marketing: Community-wide Campaigns	<ul style="list-style-type: none"> Media campaigns (print, electronic, advertising, press/publicity) Community participation through self-help groups Education and counselling at worksites, schools, community groups, community events Advocacy for environmental change 	<ul style="list-style-type: none"> 4.2% median increase in physical activity (range 2.9–9.4%) 16.3% median increase in energy expenditure (range 7.6–21.4%) 	<p>Studies included all socio-economic groups, urban and rural, minorities in the USA and elsewhere (Sweden, Denmark, Scotland, Wales, Australia)</p> <p>Community participation led to social-capital build-up and greater cohesion</p> <p>Careful planning, coordination, well-trained staff, sufficient resources required</p>
Health education and skill development – individually adapted behaviour change in group setting	<ul style="list-style-type: none"> Programmes tailored to individuals’ readiness for change, specific interests and preferences Programmes include goal-setting and self-monitoring; social support; reinforcement; structured problem-solving; and relapse prevention Delivered in group settings or by mail, telephone or direct media 	<ul style="list-style-type: none"> Increases in physical activity – median 35.4% (range 16.7–83.3%) Increases in energy expenditure – median 64.3% (range 31–85.5%) 	<p>Primarily US-based studies</p> <p>Volunteer samples limit generalisability</p>
Community participation – social support interventions in community settings	<ul style="list-style-type: none"> Focus on building, strengthening and maintaining social networks including creating new social networks or building on existing networks outside of the family such as the workplace. Examples include: <ul style="list-style-type: none"> Setting up buddy system Contracting with another person to meet 	<ul style="list-style-type: none"> Increases in time spent in physical activity – median 44.4% (range 19.9–45.6%) Increase in frequency of physical activity – median 19.6% (range 14.6–57.6%) Decreased adiposity – median 7.3% (range 6.8–8.1%) 	

	goals <ul style="list-style-type: none"> • Establishing walking groups • Reinforced by phone calls and discussion groups 		
Policy and environments: active transport –increasing physical activity as a means of transport	<ul style="list-style-type: none"> • Telephone marketing • Information and access maps • Travel diaries • Workplace facilities and incentives for active transport • Green transport promotion campaigns and events (e.g. ride-to-work) 	<ul style="list-style-type: none"> • 16% increase in walking trips • 10% decrease in single-person car trips • 27% increase in public transport use 	Primarily studied in Australia with three international studies. Evidence is limited but is promising.

Table 8: Intervention framework for promotion of physical activity (CIH programme)

Intervention	Recommended by
Community coalition building^{iv}	
<ul style="list-style-type: none"> • Advocate for policy and structural change • Collaborate with relevant stakeholders • Support links between settings and community programmes that support physical activity to encourage individual health-behaviour change • Work within existing networks • Rapid monitoring and feedback to the community, to keep the community informed of developments and maintain their interest in specific interventions 	CIH Evaluation Team CDC CDC / COMPASS COMPASS
Structural changes	
Create, support and implement policies and practices to encourage physical activity	
<ul style="list-style-type: none"> • Create and implement transportation policy and environmental design: <ul style="list-style-type: none"> • Limit the role of automobiles^v 	CDC / COMPASS / DCP2 / DPAS / NICE

iv For more information about the effectiveness of Community Coalitions, please see A. Hill et al., 'From program to policy: expanding the role of community coalitions' and K. Hanni et al., 'A methodology for evaluating organizational change in community-based chronic disease interventions', both from CDC: *Preventing Chronic Disease* 2007, 4(4).

v For example, using an automobile is twice as costly in Europe as in the United States (due to parking costs, petrol costs, congestion fees in urban areas, among other things); partly as a result of these costs, Europeans walk or bicycle more and use their cars approximately 50% less than Americans: *Priorities in Health* (World Bank, 2006), p. 100. In Curitiba, Brazil, city planners used strategies that reduced car use while increasing use of public transportation, virtually eliminating the need for cars: DCP2, ch. 44, p. 839.

<ul style="list-style-type: none"> Promote walking and bicycle riding^{vi} Design streets/communities to promote physical activity <ul style="list-style-type: none"> Provide physical education (60 minutes or more at least five times per week) for schoolchildren Create or enhance access to places for physical activity combined with informational outreach activities Create stairwells that are safe and appealing Use point-of-decision prompts Use national physical activity guidelines and encourage development and update guidelines if necessary 	<p>CDC / DCP2 / DPAS / NICE</p> <p>CDC / NICE</p> <p>CDC / DPAS / NICE (together with POD prompts)</p> <p>CDC / NICE</p> <p>CDC / DPAS</p>
Institutionalising the encouragement of healthy lifestyle behaviour	
<ul style="list-style-type: none"> Provide support groups for increasing physical activity Provide incentives to encourage physical activity in various settings^{vii} 	
Institutionalise the identification of unhealthy risk behaviour and support behaviour change	
<ul style="list-style-type: none"> Develop protocol to address physical inactivity. <ul style="list-style-type: none"> Healthy screening revise intake assessment forms Treatment Care Provide annual health screening that address physical activity 	<p>CIH Evaluation Team</p> <p>CDC (for tobacco) / NICE</p>
Health education / media	
<ul style="list-style-type: none"> Train health care professionals to prescribe exercise Provide community-sponsored programme addressing physical activity Provide health screenings that address physical activity and secondary prevention for those found at risk as part of a health campaign. Use health education materials with clear, simplified messages ('increase physical activity') Use media and community-wide campaigns aimed at increasing PA (in conjunction with other structural changes) 	<p>DCP2</p> <p>CDC</p> <p>COMPASS / DCP2 / DPAS</p> <p>CDC / COMPASS / DPAS</p>

Definition of abbreviations:

- DPAS: the WHO Global Strategy on Diet and Physical Activity
- CDC: the US Centers for Disease Control and Prevention's *The Community Guide*
- COMPASS: the Protocol for the WHO Study of the Effectiveness of Community-Based Programmes for NCD Prevention and Control
- DCP2: the World Bank's Disease Control Priorities for Developing Countries

vi Interventions that work include Cyclovia, Agita São Paulo (Case Study 1) and the Safe Routes to School programme.

vii May not be sustainable.

Appendix 3: Evidence for the benefits of specific activities

Despite the extensive body of research linking physical activity and health benefits, there is relatively little scientific evidence on specific types of activities (see Box, below). There are far fewer Level 1 and Level 2 studies (which are costly and time consuming), compared to Level 3 studies. However, this does not cast doubt on the veracity of the overwhelming evidence on the benefits of physical activity, which is why major national and international authorities responsible for health and well-being have unanimously endorsed the benefits of physical activity in reducing risk factors associated with NCDs.

Levels of scientific evidence	
Level 1	<ul style="list-style-type: none">• Randomised control trials without important limitations
Level 2	<ul style="list-style-type: none">• Randomised control trials with important limitations• Observational studies (non-randomised clinical trials or cohort studies) with overwhelming evidence
Level 3	<ul style="list-style-type: none">• Other observational studies (prospective cohort studies, case-control studies, case series)
Level 4	<ul style="list-style-type: none">• Inadequate or no data in population of interest• Anecdotal evidence or clinical experience

Source: Warburton, D.E.R., S. Charlesworth, A. Ivey, L. Nettlefold and S.S.D. Bredin, 'A systematic review of the evidence of Canada's Physical Activity Guidelines for Adults', *Int J Behav Nutr Phys Act* 2010, 7: 39.

Case studies are particularly important when the basic science (i.e. on the benefits of physical activity) is known, but there have not been RCTs on the specific activities on which a community, workplace or school wishes to embark. Case studies can provide ideas, novel ways of encouraging physical activity and anecdotal evidence, even though data on specific health benefits may not have been rigorously gathered.

Endnotes

* **Acknowledgement:** Katy Cooper and Christine Hancock (C3 Collaborating for Health) would like to thank Fiona Wong and Denise Stevens at MATRIX Public Health Solutions Inc. for their assistance in writing and compiling this report. C3 also thanks Bupa for funding an earlier version of this review.

¹ For a comprehensive overview of the benefits of physical activity on the body, see Professional Associations for Physical Activity, *Physical Activity in the Prevention and Treatment of Disease* (2nd edition, Swedish National Institute of Public Health), 2010, chapter 1: <http://www.fhi.se/en/Publications/All-publications-in-english/Physical-Activity-in-the-Prevention-and-Treatment-of-Disease/>

² Figure 1 is from the World Health Organization slide set, 'Global Health Risks: Selected figures and tables': www.who.int/entity/healthinfo/global_burden_disease/global_health_risks_report_figures.ppt

³ World Health Organization, *Global Recommendations on Physical Activity for Health* (WHO, 2011): http://whqlibdoc.who.int/publications/2010/9789241599979_eng.pdf

⁴ Woodcock, J., O.H. Franco, N. Orsini and I. Roberts, 'Non-vigorous physical activity and all-cause mortality: systematic review and meta-analysis of cohort studies', *Int J Epidemiol* 2011, 40(1): 121–38: <http://www.ncbi.nlm.nih.gov/pubmed/20630992>

⁵ Warburton, D.E.R., S. Charlesworth, A. Ivey, L. Nettlefold and S.S.D. Bredin, 'A systematic review of the evidence of Canada's Physical Activity Guidelines for Adults', *Int J Behav Nutr Phys Act* 2010, 7: 39: <http://www.biomedcentral.com/content/pdf/1479-5868-7-39.pdf>

⁶ Hu, F.B., R.J. Sigal, J.W. Rich-Edwards, G.A. Colditz, C.G. Solomon, W.C. Willett, F.E. Speizer and J.E. Manson, 'Walking compared with vigorous physical activity and risk of type 2 diabetes in women: a prospective study', *JAMA* 1999, 282: 1433–9: <http://jama.ama-assn.org/content/282/15/1433.abstract>

⁷ Warburton et al.: 'Systematic review', *op cit*.

⁸ Paffenbarger, R.S. Jr, R.T. Hyde, A.L. Wing and C.C. Hsieh, 'Physical activity, all-cause mortality, and longevity of college alumni', *N Engl J Med* 1986, 314: 605–13: <http://www.ncbi.nlm.nih.gov/pubmed/3945246>; J. Myers, A. Kaykha, S. George, J. Abella, N. Zaheer, S. Lear, T. Yamazaki and V. Froelicher, 'Fitness versus physical activity patterns in predicting mortality in men', *Am J Med* 2004, 117: 912–18: <http://www.ncbi.nlm.nih.gov/pubmed/15629729>

⁹ This follows the World Health Organization categorisation.

¹⁰ World Health Organization, *Preventing Chronic Disease: A Vital Investment* (2005), p. 2: http://www.who.int/chp/chronic_disease_report/en/index.html

¹¹ World Health Organization, *Global Status Report on Noncommunicable Diseases 2010* (WHO, 2011), Executive Summary, p. 1: http://www.who.int/nmh/publications/ncd_report_summary_en.pdf

¹² World Health Organization: *Global Health Risks: Mortality and Burden of Disease attributable to Selected Major Risks* (Geneva, World Health Organization), 2009: http://www.who.int/healthinfo/global_burden_disease/GlobalHealthRisks_report_full.pdf

¹³ WHO, *Global Health Risks*, *ibid*.

¹⁴ International Diabetes Federation, *Diabetes Atlas* (4th edition): <http://www.diabetesatlas.org/map>

¹⁵ Lee, I.M., 'Physical activity and cancer prevention – data from epidemiological studies', *Med Sci Sports Exerc* 2003, 35:1823–7: <http://www.ncbi.nlm.nih.gov/pubmed/14600545>

¹⁶ Warburton et al.: 'Systematic review', *op cit*.

¹⁷ Physical Activity Guidelines Advisory Committee, *Physical Activity Guidelines Advisory Committee Report* (Washington, DC: US Department of Health and Human Services), 2008, p. 683: <http://www.health.gov/PAGuidelines/committeereport.aspx>. See also J.R. Sattelmair, T. Kurth, J.E. Buring and I.M.

Lee, 'Physical activity and risk of stroke in women', *Stroke: Journal of the American Heart Association* 2010, 41: 1243: <http://stroke.ahajournals.org/cgi/content/short/STROKEAHA.110.584300v1>

¹⁸ Press, V., I. Freestone and C.F. George, 'Physical activity: the evidence of benefit in the prevention of coronary heart disease', *QJM* 2003, 96:4 245–51: <http://qjmed.oxfordjournals.org/content/96/4/245.full>. This study states that 'in men without pre-existing CHD those participating in moderate or moderately vigorous activities had a 50% reduction in risk, compared to those who were inactive'.

¹⁹ For more on mental health, see the WHO's website: http://www.who.int/mental_health/en/

²⁰ Taylor, A. and G. Faulkner, 'Inaugural editorial', *Mental Health and Physical Activity* 2008, 1: 1–8: <http://www.sciencedirect.com/science/article/pii/S1755296607000026>

²¹ Taylor, B., J.F. Sallis and R. Needle, 'The relationship of physical activity and exercise to mental health', *Pub Health Rpts* 1985 100(2): 195–201: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1424736/>; M. Babyak, J. Blumenthal and S. Herman, 'Exercise treatment for major depression: maintenance of therapeutic benefit at 10 months', *Psychosom Med* 2000, 62(5): 633–8: <http://www.ncbi.nlm.nih.gov/pubmed/11020092>

²² Taylor et al., *ibid.*

²³ Motl, R., A. Birbaum, M. Kubik et al., 'Naturally occurring changes in physical activity are inversely related to depressive symptoms during early adolescence', *Psychosom Med* 2004, 66(3): 336–42: <http://www.ncbi.nlm.nih.gov/pubmed/15184692>

²⁴ Deslandes et al.: 'Exercise and mental health', *op cit.*

²⁵ Weuve, J., J. Kang and J. Manson et al., 'Physical activity, including walking, and cognitive function in older women', *JAMA* 2004, 292(12): 1454–61: <http://www.ncbi.nlm.nih.gov/pubmed/15383516>

²⁶ Alzheimer's Disease International, *World Alzheimer's Report 2009*: <http://www.alz.co.uk/research/worldreport/>

²⁷ Deslandes et al., 'Exercise and mental health', *op cit.*

²⁸ Hamer, M. and Y. Chida, 'Physical activity and risk of neurodegenerative disease: a systematic review of prospective evidence', *Psychol Med* 2009 39(1): 3–11: <http://www.ncbi.nlm.nih.gov/pubmed/18570697>; J. Burns et al., 'Cardiorespiratory fitness and brain atrophy in early Alzheimer disease', *Neurology* 2008 71: 210–16: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2657657/>

²⁹ Erikson, K.I., C.A. Raji, O.L. Lopez, J.T. Becker, C. Rosano, A.B. Newman, H.M. Gach, P.M. Thompson, A.J. Ho and L.H. Kuller, 'Physical activity predicts gray matter volume in late adulthood', *Neurology* 2010, 75: 1415–22: <http://www.ncbi.nlm.nih.gov/pubmed/20944075>

³⁰ Deslandes et al., 'Exercise and mental health', *op cit.*

³¹ Table 2.1, Self-reported summary activity levels (participation in at least moderate intensity activity), by age and sex, from the *Health Survey for England 2008: Volume 1 – Physical Activity and Fitness*: http://www.ic.nhs.uk/webfiles/publications/HSE/HSE08/Volume_1_Physical_activity_and_fitness_revised.pdf

³² Haskell, W.L., I.M. Lee, R.R. Pate, K.E. Powell, S.N. Blair, B.A. Franklin, C.A. Macera, G.W. Heath, P.D. Thompson and A. Bauman, 'Physical activity and public health: updated recommendation for adults from American College of Sports Medicine and the American Heart Association', *Med Sci Sports Exercise* 2007, 39(8): 1423–34: <http://circ.ahajournals.org/cgi/content/abstract/CIRCULATIONAHA.107.185649v1>. See also WHO, *Global Recommendations on Physical Activity for Health*, *op cit.*

³³ For older adults, see http://www.acsm.org/AM/Template.cfm?Section=Home_Page&TEMPLATE=CM/HTMLDisplay.cfm&CONTENTID=7764 and for children see <http://www.cdc.gov/physicalactivity/everyone/guidelines/children.html>

³⁴ Table 2.3, Self-reported summary activity levels (age-standardised), by equivalised household income and sex, from *Health Survey for England 2008: Volume 1*, *op cit.*

³⁵ Powell, L.M., S. Slater and F.J. Chaloupka, 'The relationship between community physical activity settings and race, ethnicity and socioeconomic status', *Evidence Based Preventive Medicine* 2004 1(2): 135–44: <http://www.rwjf.org/pr/product.jsp?id=14654>

- ³⁶ Powell, L.M. et al., 'Availability of physical activity-related facilities and neighbourhood demographic and socioeconomic characteristics: a national study', *American Public Health Assoc* 2006, 96(9): 1676–80: <http://www.ncbi.nlm.nih.gov/pubmed/16873753>
- ³⁷ Capewell, S. and H. Graham, 'Will cardiovascular disease prevention widen health inequalities?', *PLoS Med* 2010, 7(8): <http://www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.1000320>
- ³⁸ Edwards, P. and A. Tsouros, *Promoting Physical Activity and Active Living in Urban Environments: The Role of Local Governments* (Copenhagen, WHO Regional Office for Europe), 2006: http://www.euro.who.int/_data/assets/pdf_file/0009/98424/E89498.pdf
- ³⁹ Sha, E. and G.D. Smith, 'Exporting failures? Coronary heart disease and stroke in developing countries', *International Journal of Epidemiology* 2001, 30: 201–5: <http://www.ncbi.nlm.nih.gov/pubmed/11369713>
- ⁴⁰ Katan, M.B., 'Weight-loss diets for the prevention and treatment of obesity', *N Engl J Med* 2009, 360(9): 923–5: <http://dcsce.net/katan-editorial-on-sacks-2009-nejm.pdf>
- ⁴¹ WHO, *Global Status Report on NCDs 2010, op cit.*, chapter 2, 'NCDs and development'.
- ⁴² Statistics from Deloitte, *Health of the Nation: An In-depth Report into UK Consumer Attitudes to Physical Exercise* (2006): http://www.deloitte.com/assets/Dcom-UnitedKingdom/Local%20Assets/Documents/UK_HealthofNationReport_ExecSummary_March06.pdf
- ⁴³ Webel, A.R., J. Okonsky, J. Trompeta and W.L. Holzemer, 'Systematic review of the effectiveness of peer-based interventions on health-related behavior in adults', *Am J Pub Health* 2010, 100(2): 247–53: <http://www.ncbi.nlm.nih.gov/pubmed/20019321>
- ⁴⁴ Williams, D.M., C. Matthews, C. Rutt, M.A. Napolitano and B.H. Marcus, 'Interventions to increase walking behavior', *Med Sci Sport Exercise* 2008, 40 (S7): S567–73: <http://www.ncbi.nlm.nih.gov/pubmed/18562974>
- ⁴⁵ See Professional Associations for Physical Activity, *Physical Activity in the Prevention and Treatment of Disease, op cit.*, pp. 51ff.
- ⁴⁶ Change4Life: <http://www.nhs.uk/change4life>.
- ⁴⁷ Sallis, J.F., 'Measuring physical activity environments: a brief history', *American Journal of Preventative Medicine* 2009, 36(S4): S86–92: <http://www.ncbi.nlm.nih.gov/pubmed/19285214>; *A Framework to Monitor and Evaluate Implementation: WHO Global Strategy on Diet, Physical Activity and Health. Guideline* (Geneva: WHO Press), 2008: <http://www.who.int/dietphysicalactivity/Indicators%20English.pdf>; S.L. Mercer, L.W. Green, A.C. Rosental, C.G. Husten, L.K. Khan and W.H. Dietz, 'Possible lessons from tobacco experience for obesity control', *American Journal of Clinical Nutrition* 2003 (77 Supplemental): 1073S–82S: <http://www.ncbi.nlm.nih.gov/pubmed/12663321>; S.A. French, M. Story and R.W. Jeffery, 'Environmental influence on eating and physical activity', *Annual Reviews Public Health* 2001, 22: 309–35: <http://www.ncbi.nlm.nih.gov/pubmed/11274524>; P. James, N. Rigby, R. Leach and I.O.T. Force, 'The obesity epidemic, metabolic syndrome and future prevention strategies', *European Journal of Cardiovascular Prevention & Rehabilitation*, 2004, 11(1): 3–8: <http://www.ncbi.nlm.nih.gov/pubmed/15167200>
- ⁴⁸ Twiss, J., J. Dickinson, S. Duma, T. Kleinman, H. Paulsen and L. Rilverla L, 'Community gardens: lessons learned from California Healthy Cities and Communities', *AJPH* 2003, 93(9): 1435–8: <http://www.ncbi.nlm.nih.gov/pubmed/12948958>
- ⁴⁹ Yancey, A.K., M.G. Ory and S.M. Davis, 'Dissemination of physical activity promotion interventions in underserved populations', *Am J Prev Med* 2006, 31 (4S): <http://www.ncbi.nlm.nih.gov/pubmed/16979472>
- ⁵⁰ Pretty, J., M. Griffin, J. Peacock, R. Hine, M. Sellens and N. South, 'A countryside for health and wellbeing: the physical and mental health benefits of green exercise' (Countryside Recreation Network, Sheffield), 2005: <http://www.countrysiderecreation.org.uk/pdf/CRN%20exec%20summary.pdf>
- ⁵¹ Bird, W, *Natural Fit: Can Green Space and Biodiversity Increase Levels of Physical Activity?* (2004): http://www.rspb.org.uk/Images/natural_fit_full_version_tcm9-133055.pdf; see p. 51 for Green Gyms.
- ⁵² <http://muckin4life.direct.gov.uk/index.html>.

- ⁵³ Pretty, J. and J. Barton, 'What is the best dose of nature and green exercise for improving mental health? A multi-study analysis', *Environmental Science and Technology* 2010, 44(10): 3947–55: <http://www.ncbi.nlm.nih.gov/pubmed/20337470>
- ⁵⁴ Williams et al., 'Interventions to increase walking behavior', *op cit.*
- ⁵⁵ *Ibid.*
- ⁵⁶ Brevata, D.M., C. Smith-Spangler, S. Vandana, A.L. Grienger, N. Lin, R. Lewis, C.D. Stave, I. Olkin and J.R. Sirard, 'Using pedometers to Increase physical activity and improve health: a systematic review', *JAMA* 2007, 298 (19): 2296–304: <http://www.ncbi.nlm.nih.gov/pubmed/18029834>
- ⁵⁷ Williams et al., 'Interventions to increase walking behavior', *op cit.*
- ⁵⁸ For the benefits of social interaction during physical activity, see many examples in Pretty et al., 'A countryside for health and wellbeing', *op cit.*
- ⁵⁹ For a presentation by Professor Victor Matsudo (Agita Mundo and Chairman of the Physical Activity Network for the Americas) detailing all these benefits, see <http://www.3four50.com/v2/?page=summit10-vid4>
- ⁶⁰ *Healthy Lives, Healthy People White Paper: Our Strategy for Public Health in England* (Department of Health, 2010), para. 3.32: <http://www.dh.gov.uk/en/PublicHealth/Healthyliveshealthypeople/index.htm>.
- ⁶¹ Transport for London statistics – see also *Travel in London: Report 3* (2011), chapter on 'Spotlight on the year of cycling': <http://www.tfl.gov.uk/assets/downloads/corporate/travel-in-london-report-3.pdf>.
- ⁶² Statistics drawn from Sustrans, *Moving Forward: A Year of Delivering Smarter Travel Choice* (2010): <http://www.sustrans.org.uk/assets/files/rmu/Moving%20forward%20Sustrans%20Monitoring%20Report%20to%20end%202009%20September%202010.pdf>.
- ⁶³ The World Health Organization, with Sustrans and others, has developed a Health Economics Assessment Tool, HEAT, to estimate the economic savings from reduced mortality: <http://www.euro.who.int/en/what-we-do/health-topics/environmental-health/Transport-and-health/activities/promotion-of-safe-walking-and-cycling-in-urban-areas/quantifying-the-positive-health-effects-of-cycling-and-walking/health-economic-assessment-tool-heat-for-cycling>. See also N. Cavill and A. Davis (for Cycling England), *Cycling and Health: What's the Evidence?* (2007) <http://www.dft.gov.uk/cyclingengland/health-fitness/health-benefits-of-cycling/>.
- ⁶⁴ <http://www.gccjunior.org>
- ⁶⁵ 'Evaluation of a four-month low-impact physical activity workplace intervention – 2008': <http://chronicdiseaseprevention.org/research/monash.html>.
- ⁶⁶ Yancey, A.K., W.J. McCarthy, W.C. Taylor, A. Merlo, C. Gewa, M.D. Weber and J.E. Fielding, 'The Los Angeles Lift Off: a sociocultural environmental change intervention to integrate physical activity into the workplace', *Prev. Med.* 2004, 38(6): 848–56: <http://www.ncbi.nlm.nih.gov/pubmed/15193908>
- ⁶⁷ Lara, A., A.K. Yancey, R. Tapia-Conyer, Y. Flores, P. Kuri-Moralies, R. Mistry, E. Subirats and W.J. McCarthy, 'Pausa para tu Salud: reduction of weight and waistlines by integrating exercise breaks into workplace organisational routine', *Preventing Chronic Disease* 2008, 5(1): <http://www.ncbi.nlm.nih.gov/pubmed/18082001>
- ⁶⁸ C. Blattman, 'SWAY Research Brief 1: The abduction and return experiences of youth', in *The Survey of War Affected Youth (SWAY)* (2006): <http://chrisblattman.com/documents/policy/sway/SWAY.RB1.pdf>.
- ⁶⁹ <http://oaprojects.org/>
- ⁷⁰ See <http://www2.btcv.org.uk/Green-Prescriptions.pdf>. There is also a short video about the Bourne project at: <http://www.youtube.com/watch?v=9F9fcn7Tpw&feature=related>.