

NATURAL FIT

Can Green Space and Biodiversity Increase Levels of Physical Activity?

A Report by Dr William Bird

for the Royal Society for the Protection of Birds



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About the Author:

Dr William Bird is a former GP at Sonning Common Health Centre in South Oxfordshire. He set up the first Health Walk scheme and Green Gym in the mid 90s and brought the Countryside Agency and British Heart Foundation together resulting in Walking the Way to Health. He was the medical adviser to The British Heart Foundation National Centre for Physical Activity and Health at Loughborough University when it was first established.

He is an independent member of the National Access Forum, which advises the Countryside Agency and Government on all aspects of the Countryside and Rights of Way Bill and other access issues. He is also a vice president of BTCV (British Trust for Conservation Volunteers).

He has held Honorary Research Posts at Oxford Brookes and Oxford University, but is now the full-time Clinical Director of Health Forecasting at the Met Office.

The Royal Society for the Protection of Birds

The RSPB is Europe's largest wildlife charity with over one million members. It manages one of the largest conservation estates in the UK with more than 180 nature reserves, covering more than 100,000 hectares. RSPB nature reserves provide a major recreational resource for people, as well as conserving biodiversity: over 1.1 million visits are made to RSPB reserves each year. Its reserve volunteering programme benefits the health of participants, as well as assisting land management for biodiversity. The RSPB advocates creation of more opportunities for people to enjoy the countryside in ways that do not harm the very resources people wish to enjoy, including wildlife.

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1

Executive Summary

- 1 Physical inactivity is a major preventable health risk, which affects about 60% of the population, and correcting this is a public health priority. There are clear Government guidelines on the amount of physical activity required for optimum health. The recommendation for adults of 30 minutes of moderate activity at least 5 days a week is still not as well understood as diet or smoking recommendations. The maximum benefits of physical activity are in the elderly who are currently the least active.
- 2 The benefits of physical activity can be achieved through moderate exercise, which includes brisk walking, cycling, swimming and nature conservation or gardening activities. Exercise through sport, gyms or aerobics appears not to add any further health benefits. Moderate exercise can be identified by an increase in pulse and breathing rate and a feeling of increased warmth.
- 3 It is now recognised that physical inactivity is adding a catastrophic burden to society, leading directly to chronic disease and lack of independence in the elderly. For children, inactivity is helping to create a future generation who are more likely to become inactive and obese adults. Moderate regular activity appears to maintain the vitality of the body and prevents heart disease, diabetes, strokes, cancers, disability, osteoporosis, depression, anxiety and sleep problems. Without regular exercise, there is a decline of function in virtually every system of the body, which will eventually require support from the NHS and social care.
- 4 The cost of physical inactivity to the economy is calculated to be £8.2 billion (£1.7 billion for the NHS, £5.4 billion for work absence and £1 billion for early mortality). If a group of 120 healthy individuals aged over 60 years become active, then over 10 years (compared to an inactive group) there will be about 20 fewer deaths, 7 less heart attacks, 3 less strokes, 2 less new diabetics, and 13 less people with osteoarthritis of the knee becoming disabled. In other words a walking group which includes 60 men or women over 60yrs could prevent 1 death a year assuming that they would otherwise have remained inactive.

- 5 Physical activity promotion should be close to where the patient lives and with an emphasis on walking. As recreational walking is one of the few activities that is increasing, this is a suitable activity to use to increase physical activity levels. It is also cheap to put into practice and is supported by substantial evidence. People who need more specific exercise treatment may have to start with an exercise referral scheme but move on to self-sustained physical activity. For most people attendance at a gym does not provide the best way of increasing and sustaining physical activity. Physical activity specialists in the NHS need to be aware of the potential of green space.
- 6 The rise in inactivity and obesity is now high on the Government agenda. There is growing recognition that natural green space can increase levels of physical activity. However, the huge potential that green space can offer is still not fully recognised. A better understanding of the relationship between exercise and wildlife-rich open space will help the Government reach targets to increase levels of physical activity, as well as provide a significant economic reason to maintain green space.
- 7 More than 5 billion day visits are made to the English countryside each year, and about 2.5 billion visits to urban parks. Despite the large population density in the UK, there is existing natural green space to support physical activity. The most important of this green space is near to large populations.
- 8 There is evidence that green space in an urban environment can improve life expectancy and decrease health complaints. Much of this is thought to be due to a favourable environment for people to exercise. Parks and tree-lined streets have a specific significant relationship with increased longevity. The psychological (and social outcomes, if the activities are shared) benefits may also increase motivation to exercise.
- 9 Local access to safe natural green space can help individuals sustain levels of physical activity. The motivation to continue physical activity schemes is more likely to be sustained through the natural environment. Activities in which exercise becomes secondary to environmental or social benefits (e.g. Gardening, Green Gym or walking in green space) appear to be more sustainable than activities in which exercise remains the primary driver. This may help unlock the

problem of maintaining change in physical activity levels and may explain why schemes that only concentrate on exercise tend to have a higher participant drop out rate. Children increase their physical activity levels when outdoors and are attracted to nature. Overall, physical activity levels increase where participants have convenient and close contact to green space.

- 10 The benefits from increased physical activity may be even greater in hospitals or residential care homes. Good design of wildlife-rich gardens can be used to increase physical activity in sedentary and vulnerable patients or residents.
- 11 Biodiversity can have a 'direct use' economic value for those engaging in physical activity. One measure of the attractiveness of a park is the amount of nature it can offer to the visitor. Exercise becomes simply a method of travelling to, and engaging with, the benefits of nature. Being in the countryside is an important motivator, but this is due to variety both by time (seasons) and space (biodiversity). The more wildlife-rich the more variety. People put a value on biodiversity and UK Government Plans include targets to conserve threatened species and habitats, which could be extended.
- 12 It is possible to estimate the economic benefits that green space can provide through provision of physical activity. The estimates are based on an urban park providing 20% of total local physical activity provision and a 3km footpath providing 16% of total local physical activity provision, and are dependent on the population (density) who can access the green space. Using this, a park in Portsmouth, for example, could, annually, save the economy £4.4 million, including £910,00 to the NHS. A 3 km footpath on the edge of Norwich would save the economy £1 million, including £210,00 to the NHS.
- 13 To increase physical activity levels in a green space, the space should be accessible (within 2 km of home), have a good surface with no obstructions such as stiles, but above all, it should feel safe. There is a need for imaginative ways to promote a wildlife-rich green space, and for it to be marketed to different age groups. The green space must appear attractive; being natural, but access routes and facilities must be well kept. It is possible to have sensitive wildlife-rich areas visible from smaller well kept areas, without promoting physical access to them, as the view of nature is a main motivator.

2 **Recommendations**

- 1 Both the short and long-term benefits of moderate exercise, and in particular walking, should be promoted to the public as many people still believe that health improving exercise means the gym or vigorous exercise.
- 2 For the NHS physical activity promotion specialists should work with local authorities to identify local green space and rights of way as a major resource to increase levels of physical activity.
- 3 In principle, biodiversity should be brought to people by developing areas of green space within villages, towns and cities. Large reserves and wildlife sites outside towns should continue to become more inclusive and less restrictive. It is recommended that access to these areas is both equitable and sustainable. This includes walking, cycling and public transport.
- 4 All green space, including nature reserves, should aim to fulfil people's physical activity needs. This should become a success criterion alongside environmental and educational objectives.
- 5 Each local authority needs to understand the current use of local green space for exercise and in particular the reasons why local people do not currently use open green space. The public should be consulted as to how local green space could be improved to become more inclusive particularly for those wanting informal exercise.
- 6 Conservationists, landscape designers, architects and NHS physical activity promotion specialists should work together to design diverse green space benefiting the health of both the environment and local population. This may include the use of buildings whose exercise facilities merge seamlessly into the natural environment.
- 7 New recommendations should be set up for a minimum quantity of green space that will provide enough opportunities for physical activity for a given population. Even small public gardens may act as destinations for a walk in cities with a high density population.

- 8 Schools and local communities should open up areas of safe, but wild green space rich in wildlife for children to explore learn and play freely. Children should be offered the chance to do conservation work or gardening instead of, or as well as, formal sport.
- 9 Green circular walks should be created within walking distance of every household (above a minimum population density) in the UK. This route will be of high quality and accessible to the disabled allowing regular short walks and where appropriate being part of a network linking several destinations.
- 10 Minimum levels of accessible green space and circular walks for every new housing development should be set. The circular walks and green space will be safe, accessible and designed to maximise levels of physical activity among the new residents.
- 11 All local authorities should adhere to the Green Flag and Green Pennant concept for all their public green space. Both these awards should be reviewed to ensure that the needs for physical activity are adequately addressed.
- 12 NHS Estates should encourage a more wildlife-rich environment on the land it owns in order to benefit patients, relatives and staff. The evidence that green space offers a restorative function for patients is strong, so even small wildlife-rich gardens can act as a destination for patients and encourage them to be active. Improving grounds and rights of way within or near to NHS administration buildings would set an example and encourage physical activity for staff.
- 13 This report would like to endorse the recommendations made by the Urban Task Force, chaired by Lord Rogers, to create green networks which encourage safe walking or cycling between two city destinations, but maintaining a natural backdrop.
- 14 New ways of managing public green space are needed to attract more local participation and ownership. This may include not for profit companies or charities that could gather income from the public, local business (for use by employees), local government, social services and the NHS.

- 15 The NHS should contribute to the upkeep of Green Space and circular walks, based on local authorities meeting certain success criteria, including a measurable increase in levels of physical activity.
- 16 The role of Local Access Forums should include recommending high quality rights of way that can help increase levels of physical activity through walking, cycling and horse riding. Each forum should include a representative from the local primary care trust or strategic health authority to advise on using the network to increase levels of physical activity.
- 17 Agencies and funding bodies that can target health and/or the environment should consider the recommendations of this report and review their funding policies and criteria to give support to the further development and expansion of natural green space for the benefit of public health.
- 18 The Policy Commission on the Future of Farming and Food in England supported the idea that public money should be used to pay for public goods. Given the major public benefit from increasing physical activity, there would be benefit in developing agricultural policies to assist access to green space. Allocating adequate resources to the new environmental stewardship schemes to support wildlife-rich and accessible farmland would help fulfil this objective.

3

Introduction

This report, commissioned by the RSPB, looks at the evidence to support the theory that the availability of safe, accessible natural green space encourages the uptake and continuation of physical activity. It also looks at the role of biodiversity* in enhancing this relationship.

It is written for policy makers, those promoting physical activity and those involved with maintaining a wildlife-rich natural environment. But most of all it is written for those who believe that a healthy natural environment is also good for our health, but have needed evidence to substantiate this. Generations have intuitively understood this relationship better than us yet the evidence has been slow to arrive.

This is part of a wider debate about the health benefits of a wildlife-rich environment. Other types of outdoor space such as playing fields, water and sport facilities are important to the promotion of physical activity but lie outside the remit of this report.

I will take the introduction from an Australian review "Healthy Parks Healthy People" which summarises the vision of civic leaders three generations ago. It is worth noting that randomised control trials and systematic reviews were not available to these planners instead they acted in faith¹.

"When parks were first designed in the nineteenth century the officials had a strong belief in the possible health advantages that would result from open space². It was hoped that parks would reduce disease, crime and social unrest as well as providing 'green lungs' for the city and areas for recreation. It was also understood that exposure to nature fostered psychological well-being, reduced the stresses associated with city life and promoted physical health. On this basis, parks and other green space were set up in the cities, and woodland, down, heath and moor was preserved outside the cities for public use³."

* Biodiversity is the variety of life on earth.

There is a need to return to the original remit which helped set up so much green space and use improved physical and mental health as a driver to increase standards. What has happened since then is a major shift of emphasis towards their use as a venue for leisure and sport. ⁴

Three important health reports were published in 2004. The Wanless report, *Securing Good Health for the Whole Population*, from HM Treasury was published in February. The Chief Medical Officer commissioned a report on the main health effects of physical inactivity *At Least Five Times a Week*, which published in April and finally a public health white paper *Choosing Health* is due to be published by the end of the year. These reflect the Government's thinking in shifting the emphasis away from treating disease to a strategy of prevention, with physical activity promotion sharing centre stage along with other major risk factors such as diet and smoking.

Biodiverse green space is our own great outpatient department in urgent need of a refit. It requires careful maintenance and improved access. It should be welcoming and peaceful, and treat and prevent many illnesses without the need for doctors or nurses, appointments or medicines.

This report helps to draw together what is already known and set the direction towards a public health policy that includes our natural environment.

Dr William Bird, August 2004

PART A**THE BURDEN OF PHYSICAL ACTIVITY**

4

Physical Activity in the UKRecommendation

Current Department of Health recommendations are that adults should participate in 30 minutes of moderate physical activity on at least five days per week⁵ and that all young people should participate in physical activity of at least moderate intensity for one hour a day⁶. This may be divided into smaller bouts of 10 minutes⁷. The activity can be lifestyle activity (climbing stairs or brisk walking) or structured exercise or sport or a combination of these⁸.

Gender

In 1998, only 37% of men and 25% of women met this recommendation⁹.

Ethnicity

Men: The highest levels of physical activity are found in Black Caribbeans and Whites, followed by Indian, Chinese, Pakistani and Bangladeshi men. Black Caribbean men are more than twice as likely to reach the recommended level of activity as Bangladeshi men.

Women: There is a similar ethnic order of physical activity, but with a steeper gradient, so that Black Caribbean women are four times more likely to reach the recommended level of activity as Bangladeshi women¹⁰.

Social Groups

There is little change of total physical activity levels across the social group in women, but in men there is a significant increase in high levels of activity between social group 1 and 5 (31 to 50% respectively) due to work related exercise⁹.

However, for leisure walking it is the higher social groups that are more active, with an increase of 38% in men and 67% in women between the lowest and highest social groups¹¹.

Age

As men become older, they become less active with a steep decline after the normal retirement age of 65 years. In women, this steep decline starts in their early 50s. By the age of 75 only 7% of men and 4% of women are taking enough exercise to benefit their health⁹.

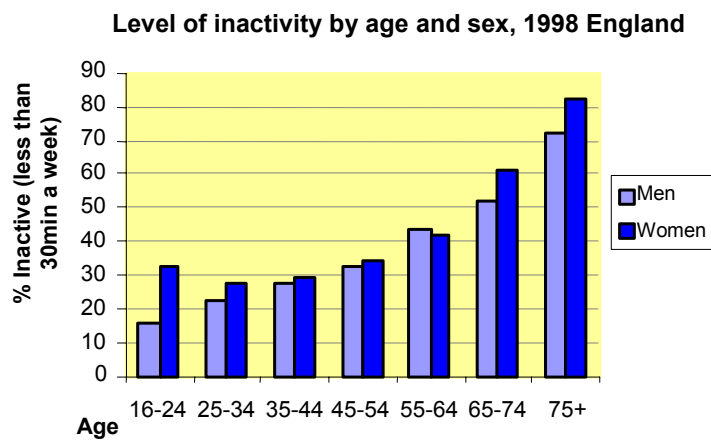


Figure 1. Level of inactivity in adults by age and sex⁹.

In 1997, 61% of boys and 42% of girls aged 7-18 were active at this level in the UK¹².

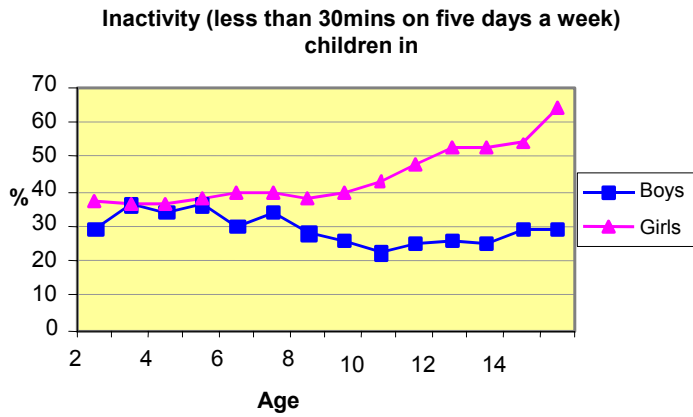


Figure 2. Levels of inactivity in children by age and sex¹².

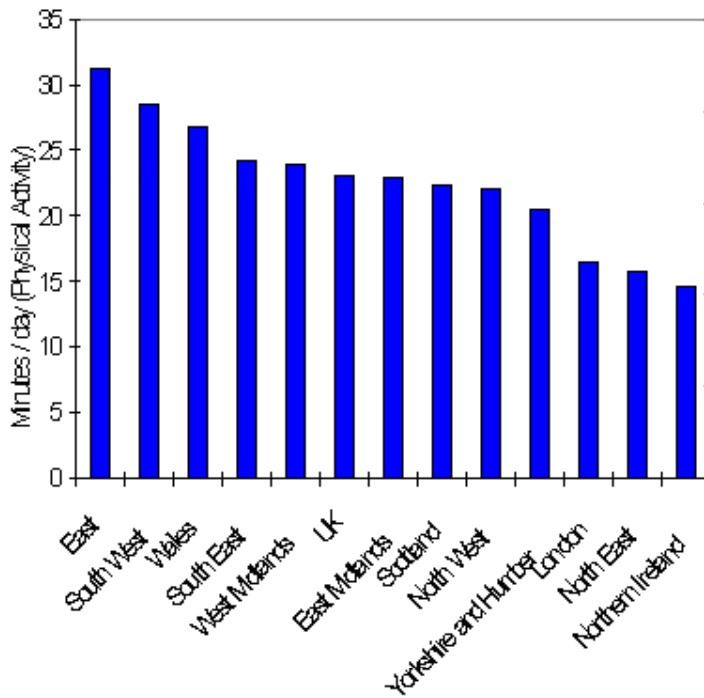


Figure 3. Total physical activity by region by average number of minutes per day¹².

EU Country	% No physical activity
Finland	10
Sweden	12
Ireland	14
Austria	16
Netherlands	19
Luxembourg	20
Denmark	24
UK	24
Germany	31
EU Average	32
France	36
Spain	37
Italy	39
Greece	40
Belgium	42
Portugal	61

Table 1: Percentage of adults aged 15 and over who do no physical activity in a typical week, 1997, European countries¹³.

Summary

There are clear Government guidelines as to the amount of physical activity required for optimum health. Along with many other western countries, the UK has a low level of physical activity in all age groups and correcting this is a public health priority. The maximum benefits of physical activity are in the elderly who are currently the least active.

5

What is Moderate Exercise?

Moderate exercise includes walking, cycling, swimming, gardening, horse riding and conservation work (if possible in the context of a wildlife-rich environment). This level of activity is enough to raise the pulse to over 60% of the maximum heart rate⁸, which is the threshold to improve cardiovascular health.

CALCULATING MODERATE EXERCISE USING HEART RATE

The maximum heart rate can be roughly calculated as 220 minus your age. If you are 40 years old then your maximum heart rate would be $220-40=180$. To calculate 60% of 180 is:

$180 \times 60/100 = 102$. This is the pulse rate that indicates you are undertaking moderate exercise. However, you are undertaking the correct level of moderate exercise if your breathing rate increases but you are able to continue a conversation and feel an increased warmth.⁸

A consensus is now emerging that low to moderate intensity physical activity may reduce the risk of cardio-vascular disease (CVD) without having any notable influence on fitness¹⁴. Walking is now known to be equally effective in providing health benefits as more vigorous forms of activity particularly in over 60 year olds¹⁵. It can therefore be safely assumed that brisk walking provides the important benefits of physical activity without the hazards associated with contact sports or more vigorous activity.

Gardening and conservation work offer a range of activities of moderate activity that can suit any level of fitness. Compared with walking and cycling they also involve upper body strength.

Level of activity	Activity	Intensity METS*	Kilocal/hour
Walking and Running			
Light	Walking slow (2mph)	2.5	75
Moderate	Walking average (3mph)	3.3	99
Moderate	Walking brisk (4mph)	5.0	150
Moderate	Hiking cross country	6.0	180
Vigorous	Running (6mph)	10	300
Vigorous	Running (7mph)	11.5	345
Cycling			
Moderate	Cycling (less than 10mph)	4.0	120
Vigorous	Cycling (10-12mph)	6.0	180
Vigorous	Cycling (12-14mph)	8.0	240
Horse Riding			
Light	Horse riding walking	2.5	75
Moderate	Horse grooming	6.0	180
Vigorous	Horse riding trotting	6.5	195
Vigorous	Horse riding galloping	8.0	240
Water Activities			
Moderate	Treading water in pool	4.0	120
Moderate	Swimming leisure, ocean or lake	6.0	180
Vigorous	Swimming crawl slow	8.0	240
Vigorous	Swimming breaststroke	10.0	300
Moderate	Canoeing for leisure	4.0	120
Moderate	Sailing	3.0	90
Conservation work and Gardening			
Moderate	Mowing lawn (power mower)	4.5	135
Moderate	Mowing lawn (hand mower)	6.0	180
Moderate	Planting seeds, shrubs	4.0	120
Moderate	Planting trees	4.5	135
Moderate	Raking lawn	4.0	120
Moderate	Weeding, cultivating garden	4.5	135
Moderate	Digging, spading	5.0	150
Moderate	Clearing land, hauling branches	5.0	150
Moderate	Hoeing	5.0	150
Moderate	Chopping wood	6.0	180

Table 2. METS* and calories per hour for outside activities in a natural environment¹⁶.

* A MET is a metabolic equivalent and is a multiple of your resting metabolic rate, which equals one MET. At a MET of 2 you use up twice the energy consumption as when resting a MET of 3 is three times etc.

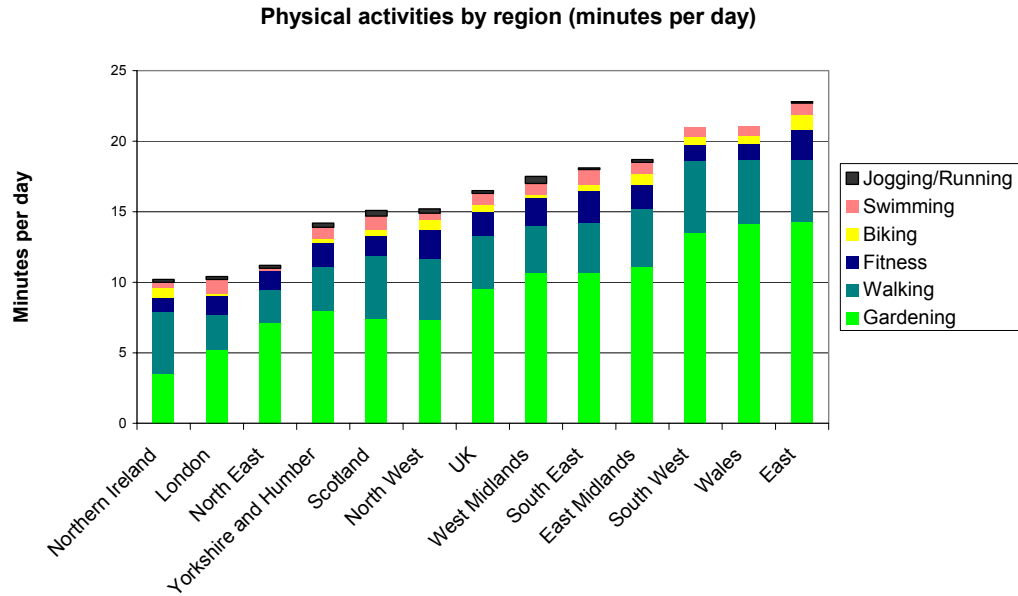


Figure 4: Physical activities by region. (This excludes 'other' physical activities, which add about 5 mins to Northern Ireland and 9 mins to the East)¹⁷.

Summary

The benefits of physical activity can be achieved through moderate exercise, which includes brisk walking, cycling, swimming and conservation or gardening activities. Despite popular belief, sport, gyms or aerobics do not appear to add any further health benefits. Most of these health benefits can still be gained without any notable increase in fitness levels and with less risk of injury compared with more vigorous activities. Moderate exercise can be identified by an increase in pulse and breathing rate and a feeling of increased warmth.

6 **What Are The Health Benefits of Moderate Exercise?**

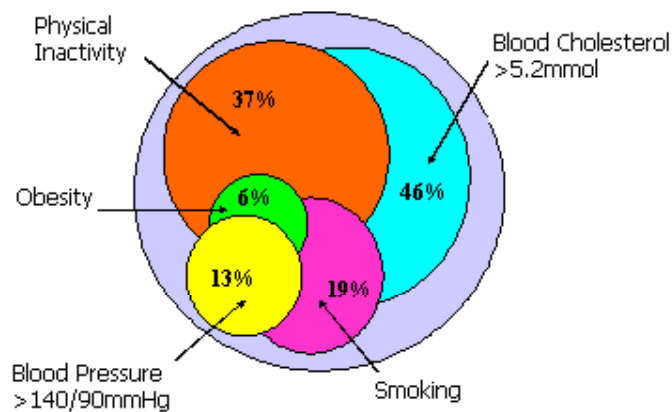
Mortality

Adults who are physically active have a 20-30% reduced mortality risk compared to those who are inactive¹⁸.

For men and women over the age of 60 there is a 50% reduction in mortality. For example a group of 60 men and 60 women over the age of 60 who did no activity would expect 4 deaths a year compared to just two deaths a year for a similar but active group^{19 20}.

Coronary Heart Disease (CHD)

Coronary heart disease includes angina and heart attacks, resulting in associated pathology such as heart failure (a condition where the heart muscle is weakened leading to breathlessness caused by retention of fluid in the lungs or legs) and atrial fibrillation. (A condition when the heart beats irregularly causing it to be less efficient).



Attributable Risk of Coronary Heart Disease.
Deaths under 75yrs in the UK.
Britton A, McPherson K National Heart Forum 2000

Coronary heart disease causes 117,000 deaths and results in 387,000 hospital admissions. These cost the NHS £1.6 billion, with a burden of 85,000 heart attacks each year in the UK²¹. Up to 37% of deaths from CHD in the UK are due to a lack of physical activity²². For those that have had a heart attack, physical activity through cardiac rehabilitation, is associated with a 38% reduction in mortality²³.

Recreational activity of four hours or more per weekend, moderate or heavy gardening and regular walking are all associated with reduced coronary heart disease. Burning 1,500 kilo calories per week (3.5 hours of brisk walking) in leisure time activity may slow down the build up of atheroma (deposits in the coronary artery). Burning 2,200 kilo calories per week (5 hours of brisk walking) may slowly reverse the formation of existing atheroma²⁴. Physical activity reduces blood pressure in people with high blood pressure which itself results in 13% of deaths from CHD²⁵.

The annual cost of angina due to physical inactivity is £215 million to the NHS and £455 million due to lost earnings.

The annual cost of heart attacks due to physical inactivity is £89 million to the NHS, and £194 million due to lost earnings.

In addition, there are 44,000 CHD deaths due to inactivity costing approximately £900 million in lost years²⁶.

Stroke

There are 68,400 strokes each year in the UK, causing 55,000 deaths and costing the NHS £1.36 billion each year. A large study has shown that regular walking in women reduced the risk of stroke by about 30%²⁷. Most studies agree that vigorous activity adds no further benefit than moderate activity in the protection from stroke.

The annual cost of strokes due to physical inactivity is £59.8 million to the NHS and £118 million in lost earnings. In addition, there are 14,000 stroke deaths due to physical inactivity costing £260 million in lost years²⁶.

Diabetes

Diabetes comprises a group of disorders characterised by a raised blood glucose level. About 1.3 million people in the UK have diagnosed diabetes and a further 1

million have undiagnosed diabetes. This equates to up to 3,000 diabetics in a population of 100,000 including one in 20 people over the age of 65 and one in 5 over the age of 85.

The most deprived 20% of the population have a 50% increased risk of Type 2 diabetes²⁸. Mortality rates from coronary heart disease are up to five times higher for people with diabetes while the risk of a stroke is up to three times higher. Diabetes is the leading cause of kidney failure, the second commonest cause of lower limb amputation and the leading cause of blindness in people of working age.

Up to 9% of the entire NHS budget and 10% of all hospital in-patient resources are used for the care of people with diabetes. This represents a total of approximately £5.2 billion a year²⁹.

Moderate physical activity and weight loss can reduce the risk of developing diabetes by about 60% in patients who are already at high risk of developing diabetes and by up to 50% in an average population. This is a greater effect than the preventative use of the anti-diabetic drug Metformin, which reduced the incidence by 31%³⁰. Similar studies have shown that physical activity on its own can reduce the incidence of diabetes by 46%³¹.

A large study following up a population of nurses showed that regular walking halved the risk of developing diabetes, which was similar protection to those women who undertook vigorous exercise³².

The annual cost of diabetes due to physical inactivity is £56.5 million to the NHS and £204 million in lost earnings²⁶.

Cancer

Exercise is associated with a reduced cancer risk, particularly cancer of the colon³³ (40-50% reduction) and to a lesser extent that of breast (30% reduction)^{34 35}. Exercise can improve physical function in cancer patients and may have other beneficial effects, such as reducing fatigue and nausea. The positive effect on psychological well-being can reduce the level of cancer pain. Exercise appears to be a safe and tolerable intervention for cancer patients³⁶.

There is some evidence that physical activity may reduce the risk of lung, prostate, testicular and endometrial cancer⁸.

The annual cost of colon cancer due to physical inactivity is £7.7 million to the NHS and £37.4 million in lost earnings with 2,500 colon cancer deaths per year attributable to inactivity²⁶.

Arthritis

In the UK, 8% of men and 18% of women over 65 have osteoarthritis (OA) of the knee. 500,000 people have moderate to severe changes on x-ray of their knee leading to 35,000 knee replacements each year. Although there is no evidence that physical activity prevents osteoarthritis, there is evidence that moderate exercise can prevent pain, stiffness and disability in patients with existing disease³⁷.

In a major US trial, adults with OA of the knee who undertook an 18 month programme of regular walking (three sessions of 40 minutes a week) reported less disability and pain, scored better on tests of activities of daily living, performed better on tests of walking, stair climbing and lifting and carrying than a comparison groups who received only health education. The more the participants walked the greater the improvements in disability pain and performance scores³⁸.

Another study showed that regular walking reduced disability in adults over 60 with OA of the knee by 43% over 8 years³⁹.

The annual cost of osteoarthritis is £675 million⁴⁰ to the NHS and 36 million working days lost costing £3.2 billion in lost earnings⁴¹. If inactivity contributes to 30% of the cost of treatment and disability then this is £202 million for NHS costs and £960 million in lost earnings.

Obesity

Obesity is a consequence of physical inactivity. The UK is experiencing an epidemic of obesity with 22% of men and 23% of women being obese⁴². This means that one adult in five is obese, which is three times as many 20 years ago⁴³.

16% of children aged between 2 and 15 are obese. There has also been a 50% increase in obesity in children over the last 10 years and up to 60% of fat children

become fat adults⁴⁴. This increase in prevalence is apparent at a young age, with obesity in 2-4 yr old children almost doubling from 5% to 9% between 1989 and 1998⁴².

The annual cost to the NHS due to obesity is £480 million, of which £9.5 million is the direct cost of treating obesity itself⁴⁵. It is predicted that if the present trend continues, the annual cost to the economy in 2010 will be £3.6 billion⁴⁶.

Depression

Mixed anxiety and depression is the most common form of mental illness in the UK, and increased from 7.8% of the population in 1993 to 9.2% in 2000¹⁶. An inactive lifestyle over five years can lead to clinical depression. Physical activity has a significantly large anti-depressant effect in depressed older adults⁴⁷.

Several studies have indicated that physical activity is at least as effective for treating depression as psychotherapy^{48 49}. Two studies have shown that physical activity can be as successful at treating depression as medication. One study showed that after 16 weeks, exercise equalled the effect of a standard anti-depressant drug and after 6 months, those who continued to exercise were more likely to recover than those solely on medication^{50 51}.

The annual cost of adult depression to the NHS is £370 million. There were 109.7 million working days lost and 2,615 deaths leading to a total cost to the UK economy of over £9.0 billion⁵². If physical inactivity contributes to between 10% and 15% of depression then this would be £37 million for the NHS and about £1billion to the UK economy.

Well-being, Stress and Sleep

People who are physically active feel happier and more satisfied with life in all ages. Even a single bout of physical activity can result in improved mood and energy. Activity programmes can result in general improvements in well-being over several weeks.

Physical activity can also make people feel better about themselves, particularly in those with initially low self-esteem⁵³. There is a positive effect on anxiety with single

exercise sessions immediately reducing levels of anxiety. Physical activity can also help people cope with the impact of stress as measured by blood pressure or muscle tension⁵⁴.

People who are regularly active fall asleep faster, and sleep longer and more deeply than those who are inactive. There is also a protection against sleep disorders in those who are regularly active⁵⁵.

Many of these benefits are primarily due to the release of serotonin, endorphins and noradrenalin (which are natural chemicals found in the nervous system that make us feel much better) but effects of increased blood flow to the brain and the confidence created by a sense of achievement are also important.

Osteoporosis and Hip Fractures

Osteoporosis is a degenerative bone disease that is characterised by low bone mass and which is therefore more likely to fracture. There are 14 000 deaths from about 60,000 hip fractures each year in UK which is estimated to increase to 120,000 by 2015⁵⁶. After a fracture, 50% of people can no longer live independently.

Physical activity that physically stresses the bone such as running, jumping and skipping can increase bone density in adolescents, maintain it in young adults, and slow its decline in old age. Sustained physical activity into the mid-20's maximises peak bone mass. Activity continues to be an important factor in reducing bone loss in old age. Increased amounts of walking has also been associated with a 40% reduction in hip fractures in Asian women⁵⁷ and by 30% in white women⁵⁸.

When treating hip fractures the cost of social care is twice that of NHS treatment⁵⁹. The health and social care costs of osteoporosis in the UK amounts to £1.7 billion, up to 85% of which are due to hip fractures⁶⁰.

If physical inactivity contributes to about 30% of hip fractures then this produces costs of £140 million to the NHS and £290 million for social care.

Children

There is a link between inactivity and obesity: less active children are more likely to have excess fat. Also activity programmes have resulted in clinically significant

decreases in body fat and body mass index in obese children⁶¹. Schoolwork may be improved by physical activity. A major review found that there is a positive relationship between physical activity and cognitive functioning that includes concentration, memory and language⁶².

There is strong evidence to show that by the time children leave secondary school their attitude to exercise is highly predictive of whether they will be physically active as adults. The strongest relationship is between the quality of exercise they have experienced as opposed to the quantity of exercise⁸.

The Elderly

Several studies have identified the importance of physical activity to the health of the elderly:

'The greatest risk for older adults is sedentary living'.⁶³

'The dominant effect of fitness over the other risk factors, and its apparent effect as an antidote for other risk factors, makes physical fitness perhaps the single most important thing an older adult can do to remain healthy'.⁶⁴

'Physical activity is the crux of successful aging regardless of other factors'.⁶⁴

Physical activity improves functional capacity and maintains independent living. It improves well-being leading to an improved quality of life and the inclusion of older people in society⁶⁵.

As people get older, there is a decline in performance of concentration, language and memory, known as cognitive decline. There is evidence from a large trial that for every 1 mile walked per day there is a 13% reduced risk of cognitive decline⁶⁶. There is also some evidence that a lifetime of physical activity can protect against Alzheimer's disease^{67 68}.

Summary

It is now recognised that physical inactivity is adding a catastrophic burden to society leading directly to chronic disease and lack of independence in the elderly. For children, inactivity is helping to create a future generation who are more likely to become inactive adults. Moderate regular activity appears to maintain the vitality of

the body and prevents heart disease, diabetes, strokes, cancers, disability, osteoporosis, depression, anxiety and sleep problems. Without regular exercise, there is a decline of function in virtually every system of the body eventually requiring support from the NHS and social care.

7 *What is the Cost of Physical Inactivity?*

Economic Costs

The health economics model from the Cabinet Office calculates that inactivity in England costs £8.2 billion (£1.7 billion for the NHS, £5.4 billion for work absence and £1 billion for early mortality)²⁶.

The Scottish Office calculated that if there were a 1% decrease of inactive Scots then 157 deaths would be prevented each year, saving £85 million in lost years. Hospital admissions would fall by 2,231 cases each year, saving £3.5 million⁶⁹.

It has been calculated in the US that every \$1 invested in physical activity leads to \$3.2 in medical cost saving. There is an annual saving of \$330 for each person that has become active. The total cost of physical inactivity on healthcare in the US is about \$76 billion in year 2000 dollars⁷⁰.

Health Costs

The effects of inactivity can be summarised by comparing a group of 60 men and women who are fully active, with a group of 60 men and women who are inactive, to give the health benefits of activity that accrue over 10 years (Table 3a and 3b).

The tables show the 10 yr incidence of medical conditions in a group of 60 people over the age of 60.

Condition (References included in report)	For group of 60 males aged over 60 during 10 years			
	Number in inactive group	Reduction of incidence due to activity	Number in active group (walking 2 or more miles a day)	Reduction of number with condition
Death	20	50%	10	10
Heart Attack	11	50%	6	5
Stroke	6	30%	4	2
Disability due to knee arthritis	16	40%	9	7
Diabetes	2	50%	1	1

Table 3a. The health benefits over 10 yrs for a group of 60 men aged over 60 years who walk on average 2 miles 5 days a week, compared to an inactive group.

Condition (References included in report)	For group of 60 females aged over 60 during 10 years			
	Number in inactive group	Reduction of incidence due to activity	Number in active group (walking 2 or more miles a day)	Reduction of number with condition
Death	20	50%	10	10
Heart Attack	5	50%	3	2
Stroke	3	30%	2	1
Fractured Hip	2	30%	1	<1
Disability due to knee arthritis	15	40%	9	6
Diabetes	2	50%	1	1

Table 3b. The health benefits over 10 yrs for a group of 60 women aged over 60 years who walk on average 2 miles 5 days a week, compared to an inactive group.

Summary

The cost of physical inactivity to the economy in England is calculated to be £8.2 billion (£1.7 billion for the NHS, £5.4 billion for work absence and £1 billion for early mortality). That is equivalent to £164,000 per 1,000 people for the economy, including £34,000 per 1,000 people for the NHS. If a group of 120 healthy individuals aged over 60 years started to walk 2 miles per day, then over 10 years there will be approximately 20 less deaths, 7 less heart attacks, 3 less strokes, 2 less new diabetics, and 13 less people with some disability from osteoarthritis of the knee when compared to an inactive group. In other words two lives are saved a year.

8

How Can Physical Activity be Promoted?

The Health Development Agency has examined physical activity promotion at a national, regional and local level⁷¹. Other references have been added to this structure.

National

The evidence shows that incentives to encourage walking and cycling to school are effective and should be introduced. There should also be the introduction of physical activity facilitators in primary care to promote exercise in communities.

Regional

Incentives must be introduced for local authorities to preserve playing fields and other open spaces and to address quality and safety concerns among users; safe play environments within open spaces, including ranger and park keeping schemes and safe walking environments should be introduced. This can be co-ordinated with local schemes to promote walking for health by signed routes, maps, local publicity and advice from health professionals.

Locally

Evidence shows four interventions that work.

1. Walking versus Facility

Following a systematic review of physical activity promotion schemes around the world⁷² Hillsden et al stated:

'Interventions that encourage walking and do not require attendance at a facility are most likely to lead to sustainable increases in overall physical activity'

They went on to say that:

'The emphasis placed on attending a leisure facility and the neglect of walking as a form of exercise is inconsistent with the findings of this review'

The amount of walking or cycling to work or school has fallen by 26% over the past 20 years⁷³. However, in the last 10 years there has been a rise in leisure walking.

62% say that walking is their main exercise⁷⁴ and walking over 2 miles (3.2 km) once a month is three times more likely than the second commonest exercise (swimming at 15%)⁷⁵.

44% of men and 38% of women having taken a recreational walk of more than 2 miles over the past four weeks. The totals for 1987, 1993 and 1997 were 38%, 41% and 44.5% respectively⁷⁶. It is harnessing this rise in leisure walking within green space that could offer an unlimited resource to increase the levels of activity in the UK.

2. Physical activity promotion using professional interventions

There are some patients with specific conditions that often need personal advice from a professional as to the type and intensity of physical activity required as part of the management of their condition. There is good evidence that these interventions should be 'a routine part of primary care using referral to properly trained and resourced physical activity and lifestyle coaches'⁷⁷.

It is therefore important that these professionals are aware of the benefit of local green space to increase the physical activity levels of specific patients. Exercise referral schemes encourage the GP to refer patients with specific conditions to leisure centres or gyms for exercise. Although some schemes show sustainable improvements in physical activity, there is increasing concern about their effectiveness and best value at national and local levels⁷⁸.

These schemes are not the answer to increasing levels of physical activity in a whole population. There is even evidence that structured exercise may decrease overall activity levels as there is a feeling of 'saving one's energy' for the next exercise session⁷⁹.

There is a place for rehabilitation schemes for people who have had a recent heart attack and those with chronic obstructive pulmonary disease (COPD) and heart failure. While the gym may be the most suitable setting initially, the evidence shows that any physical activity promotion is less likely to succeed if it relies on attendance at a facility.

3. Stages of change in Physical Activity Promotion.

There is strong evidence that individually adapted health behaviour change programmes are effective in increasing physical activity levels⁷⁷. The understanding of the stages of change of an individual can apply to promoting physical activity in a green space. The key to this is that a change of behaviour comes in stages⁸⁰:

- 1 Precontemplation (not thinking about physical activity)
Marketing task: Create awareness change value
- 2 Contemplation (thinking about undertaking physical activity)
Marketing task: Persuade motivate
- 3 Preparation (have decided to try physical activity)
Marketing task: Create action
- 4 Action (trying physical activity for the first time)
Marketing task: Create action
- 5 Confirmation (Committed to physical activity)
Marketing task: Maintain change

This can be used to understand the stages that a person goes from being totally unaware of visiting green space to becoming regularly active through visits to local green space. However, to successfully market physical activity one has to have a deep understanding about the exact needs for each group of people. For example, research on behalf of Cheshire County Council and Countryside Agency identified five groups of walkers⁸¹. This classification can help to target marketing to the needs of these groups.

- Serious walkers: those that look forward to going for a walk and who walk regularly
- Social walker: those that walk for social benefits

'We choose a pub and then we go for a walk. I always choose a circular route and like to include a pub at the end for lunch'

- Emotional Walkers: those who go for a walk to try and 'clear their heads' because they are feeling stressed due to work or family pressure, or who walk when they are feeling down/depressed.

'Well before you go for a walk you're not doing much and you might be doing housework and that and you're a bit overburdened with jobs and things and its a miserable feeling and then when you go for your walk, you change.'

- Apathetic walkers: those who have little desire to go for walks, but do so under duress for example: when under pressure from a partner.

'When you get back, you feel, you know, you're glad that you've been on it'

- Non walkers: People who do not walk and who have no desire to do so.

'Do I heck, since I got my car'

It is therefore more likely that the level of physical activity for a particular individual will be increased by understanding their motives and stage of change at that point in time.

4. Social Support interventions

There is a need for individuals to support and encourage each other to change levels of physical activity. The energy within a community to improve health is often overlooked but if harnessed can help drive change further than if owned by professionals alone.

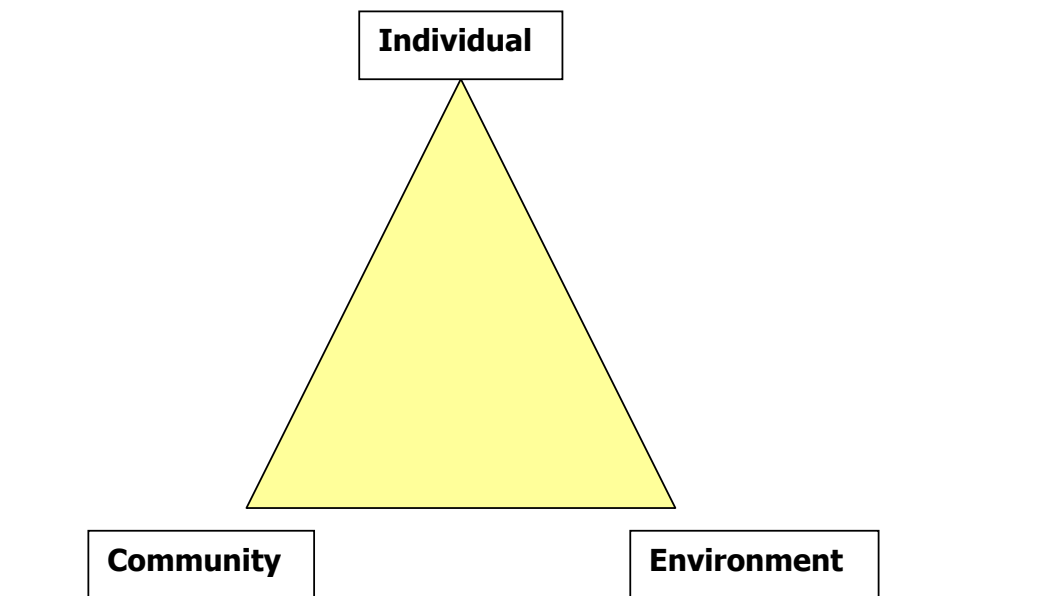


Figure 5. Components of physical activity promotion.

Figure 5 illustrates the balance between the three main components that make up physical activity promotion; motivating the individual, empowering a community and improving the local environment. Ideally, an individual can draw on community (friends and family) support, and a healthy safe environment as resources to sustain

their levels of physical activity. Giles–Corti quantified this relationship and found that an attractive local environment for walking (trees, minor traffic, pavement and a local shop) was associated with double the chance of someone achieving the recommended level of physical activity when compared with a poor environment. A motivated individual was three times as likely to reach the required levels and a supportive community resulted in somewhere between the two⁸².

Summary

Regionally there should be incentives for local authorities to develop green space to increase levels of physical activity as well as co-ordinate local schemes to promote walking.

At a local level, physical activity promotion should be done close to where the patient lives and with an emphasis on walking. As recreational walking is one of the few activities that is increasing then this is a suitable activity to look to increase physical activity levels. Attendance at a gym does not provide the best way of increasing physical activity in a population. Physical activity specialists in the NHS need to be aware of the potential of green space.

Successful promotion relies on a balance between motivating the individual, empowering the community and improving the environment.

PART B**Can the provision of wildlife-rich green space benefit the health of a population by increasing levels of physical activity?****9*****Is the Government Linking Green Space with Physical Activity Promotion?***

Many Government departments are turning towards the problem of obesity and inactivity in the population. This is a cross-government issue, which has been acknowledged by the Cabinet Office Strategy Unit. At the same time, the value of biodiversity and access to green space is being given a higher priority. The following examples show areas where these two spheres of natural environment and physical activity promotion are coming together.

Cabinet Office

Game Plan, from the Cabinet Office Strategy Unit²⁶, aims to increase physical activity and competitive sport in the UK by co-ordinating policy across Government. The report, published in December 2002, sets targets of participation of physical activity from the current 32% to 70% by 2020. This would involve a further 21 million extra people becoming active. The only mention of the natural environment is in paragraph 2.73:

'Therefore, the maintenance of otherwise under-used community settings (parks, playing fields and walking/cycling routes) may have a significant role to play in the development of the quality of life in communities'.

There has been concern that competitive sport and physical activity have been brought together in Game Plan. A pan-European Union survey found that on average 25% of Europeans cited the sporty image of physical activity as a major deterrent⁸³.

DEFRA

A key aim of the Countryside and Rights of Way Act 2000 was to increase public access to mountain, moor, heath, down and common land. It also looked at improving access to rights of way and states that:

*'Every local highway authority ...shall, within 5 years ...prepare and publish a plan, to be known as a rights of way improvement plan, containing: ...the opportunities provided by local rights of way for **exercise** and other forms of open-air recreation.'*⁸⁴

Advised by 50 local access forums, Local Authorities have started to work on these rights of way improvement plans and will be consulting widely over the next 2 years.

The Biodiversity Strategy for England *Working with the Grain of Nature* aims to 'mainstream' biodiversity into all our activities so that it is embedded in all the main sectors of economic activity. There is mention of using the countryside as an additional motivator for physical activity and to bring biodiversity to people as well as increasing access to biodiversity. There is also mention of using NHS Estates to increase biodiversity within NHS grounds.

Department of Health (DH)

The NHS National Service Frameworks (NSF) for coronary heart disease, the elderly, diabetes and children state that all NHS bodies working with Local Authorities should have agreed and be contributing to the delivery of the local programme of effective policies on increasing physical activity. However, the natural environment is not mentioned at all⁸⁵.

A series of pilot projects (called LEAP) to promote physical activity has been set up in several areas of the country. The partnership includes the Countryside Agency and DH and one scheme uses local parks as a health resource.

A white paper on public health entitled, *Choosing Health*, will be published in autumn 2004. The consultation document *Choosing Health, Choosing Activity* is published by DoH and the Department for Culture Media and Sport. One area for consultation is 'Improving the environment in which we live to encourage safe and active lifestyles' There is an understanding in the consultation that:

'countryside, coast, canals, rivers, and informal green areas in and around towns and cities also provide a natural resource for people to be active at little cost'.

The Chief Medical Officer's (CMOs) report on physical activity published in April 2004, *At Least Five a Week*⁸ focuses on the evidence of benefits of physical activity but makes no mention of suitable environments to exercise. The Health Development Agency (HDA) reviewed interventions that get people more active. They found that interventions that promote moderate intensity physical activity, particularly walking, and are not facility dependent, are also associated with longer-term changes in behaviour⁷⁷. At a regional level, the review states the importance of preserving playing fields and other open spaces and mentions the use of ranger and park keeping schemes and safe walking environments^{77 71}.

NHS estates, which look after the infrastructure of the NHS such as hospitals and GP surgeries, do not have any policy of using their grounds to encourage physical activity for patients or the elderly.

Countryside Agency

The Countryside Agency has been at the forefront in linking levels of physical activity with green space.

The development of Community Forests has provided opportunities to use the land to promote physical activity:

*'Doctors will be able to suggest that patients take exercise on the new health walks being created by the Great Western Community Forest partnership, East Wiltshire Healthcare Trust and Wiltshire Health Promotion Service.'*⁸⁶

The Countryside Agency is working with the British Heart Foundation to deliver Walking the Way for Health Initiative (www.whi.org.uk) by using rural and urban green space to promote over 400 walking schemes in the UK. This is to be extended by a scheme called 'Your Countryside Your Health' that aims to spend £25 million over six years to improve the health of 2 million people in disadvantaged areas by investing in paths, parks and open spaces.

There is a consultation led by the Countryside Agency and Groundwork called 'Unlocking the potential of the urban fringe' that will create a comprehensive strategy to improve green space around towns with physical activity as one of the named benefits.

Greenways are an initiative of the Agency, which aims to give better mobility and access for people on foot, bike or horseback or for people with disabilities. Greenways are designed for shared use and largely exclude motorised vehicles. They are in and around towns, cities and the countryside.

HM Treasury

The Wanless report 'Securing Good Health for the Whole Population' has reported that more funding effort and direction should be given to promoting good health rather than just treating it. Lack of physical activity and the rise of obesity are singled out as high priorities.

English Nature

In its document, *Revealing the Value of Nature*, English Nature recognises that there is evidence of the psychological and physiological health benefits of having access to natural areas⁸⁷.

Forestry Commission

A report commissioned by the Forestry Commission stated that physical exercise was one of the four areas that are widely advocated as being important in promoting individual and public health⁸⁸.

Office of Deputy Prime Minister

The Urban Summit 2002 organised by the Office of Deputy Prime Minister looked at understanding the environment's contribution to health. Anna Coote from the King's Fund highlighted the role of the NHS in promoting health through environmental measures and corporate citizenship.

CABE Space, established in 2003, is part of CABE, the Commission for Architecture and the Built Environment, and is publicly funded by the Office of the Deputy Prime Minister (ODPM). CABE space is likely to become the lead organisation to improve urban green space. It is actively looking to improve green space to increase the

opportunities for physical activity. In its publication *The Value of Public Space*⁸⁹ there is a section on the impact that high quality green space can have on physical and mental health:

'By encouraging us to walk more, to play sport, or simply to enjoy a green and natural environment'.

There is also the recognition of the benefits of biodiversity:

'provides an opportunity for people to be close to nature, with the associated positive impact that this can bring in terms of mental health and the simple pleasure of experiencing trees, birds, squirrels, ladybirds and other wildlife in an urban situation.'

More recently, CABE Space have published a guide to help local authorities produce a park and green space management plan as well as a good practice guide^{90 91}.

Ministry of Defence

The MOD aims to take appropriate account of environmental, public access, social, planning and heritage factors in managing its estate. It has an aim to meet its declared presumption in favour of safe public enjoyment of its estate wherever this is compatible with operational and military training uses, public safety, security, conservation and the interests of its tenants.

Summary

The rise in inactivity and obesity is now high on the Government's agenda. There is growing recognition that natural green space can increase levels of physical activity. However, the huge potential that open space can offer is still not fully recognised. A better understanding of the relationship between exercise and wildlife-rich open space will help the Government reach targets to increase levels of physical activity as well as provide a more sustainable economic model for maintaining green space.

10

What Green Space is Available for Physical Activity?

There are over 5 billion visits to the countryside in England every year⁹² and 2.5 billion visits to urban parks. Despite the high density of population, there are many areas of green space within the UK. The countryside can be seen as a great outpatient department whose therapeutic value is yet to be fully realised. This chapter highlights some areas of public access that can contribute to physical activity within green space.

Rights of way

There are 91,300 miles of footpath, 19,900 miles of bridleway and 3,700 miles of roads used as public paths/restricted byways in England⁹³.

National Cycle Network

This network has 8,000 miles of cycle and walking access, and will extend to 10,000 miles by 2005. A third is on paths free from traffic, which make use of disused railway tracks, canal towpaths, routes through forests, paths through country parks and bridleways. This is being co-ordinated by the charity Sustrans in partnership with many local organisations.

Open Country

An extra 1.1 million hectares of access land (mountain, moor, heath, down and common) will be open to the public in England and Wales from 2005 through the Countryside and Rights of Way Act (2000). Local Access Forums being currently set up in consultation with local authorities and organisations such as the Ramblers, the RSPB, British Horse Society, Countryside Landowners' Association etc, will ensure that the public can benefit from this access to the full.

Types of Habitat

Woodland

Woodland extends over some 1 million hectares of England and 247,000 hectares in Wales. Only 29% of woodland in England and 46% in Wales is open for public access

beyond rights of way. 333 million leisure day trips were made to woods or forests in England and Wales. Importantly, there is a positive correlation between the proximity to woodland and frequency of visits. The majority of day woodland visits last less than two hours. The average distance travelled to woodland is 14 miles⁹⁴.

As with many visits to the countryside 61% of visits to woodland are for walking with sport and cycling accounting for 11% and 6% respectively. The English Forestry Strategy aims to promote public access and recreation activities in woodland⁹⁵. Most woodland is in discrete areas of between 2 and 10 hectares in size. Even these small areas of woodland near to a population can be used for frequent daily visits.

Community Forests

These 12 areas cover 452,649 hectares of England and are situated around the major cities such as Middlesbrough, Liverpool, Manchester, Sheffield, Bedford, London, London and Bristol. Millions of trees are being planted to allow local people to enjoy, learn and exercise. There are 26 million people that live within 12 miles of these forests that are being developed jointly by the Countryside Agency, Forestry Commission and Forests for the Community⁹⁶.

Inland Watersides

There are 24,900 miles of rivers, 1,740 miles of canals and 1,600 lakes in England and Wales. The majority of riverbanks and lakeshores are privately owned, but most canal towpaths are owned by British Waterways, which is a public company. The advantage of canal towpaths is that they pass through major cities and provide a good flat surface for walking or cycling. There are about 180 million day visits to canals or rivers each year⁹⁴.

The quality of rivers influences the positive experience to the visitor by increasing the diversity of wildlife. 94% of rivers are now of good or fair quality, up from 86% in 1990. However, 55% of rivers still have high phosphate levels and 32% have high nitrate levels.

Wetlands

There are approximately 200,000 hectares of grazing marsh, 5,000 hectares of reedbed and 1,500 hectares of flood plain meadow in England. There were 3,380km² of undrained fenland in England in the 1700s, but this is now to 10km²⁹⁷.

The Coast

There is 4,400km of coastline in England and Wales. The coast is increasingly popular with a 7% per year rise in usage during the mid-90s. 27% of visitors to the coast visit it to walk, compared to 17% who visit for sightseeing⁹⁴.

Country Parks

There are 350 Country Parks in Great Britain including 267 in England. Most were developed in the 1980s and are in a serious state of decline. They provide a gateway between town and country. Following the Rural White Paper, these parks will receive both Lottery funding and funding from the Countryside Agency grant scheme. They receive 73 million visits per year, which averages out at 570 visits per park per day⁹⁸.

Urban Parks

14% of the area of our towns and cities is park and open space. There are 27,000 urban parks in the UK covering 143,000 hectares, which receive £630 million for upkeep. This has fallen by £1.3 billion in the past 10 years, which has led to a decline in standards. For many people without transport they represent the only contact with green space. If the urban population of England is assumed to be 37.8 million, then it is estimated that some 33 million people make over 2.5 billion visits each year to urban green space⁹⁹.

A local government report found that local councils and their communities are increasingly using parks as ways to involve and consult people, regenerate communities and contribute to more inclusive communities¹⁰⁰.

The Urban Task Force chaired by Lord Rogers¹⁰¹ acknowledged that green space was a vital part of urban development. In an attempt to safeguard this green space, they said that:

'There is a need for a sophisticated approach in protecting and designating green space. There are important green buffer zones and strategic gaps both within and between our urban areas that could be given the same weight in development

control terms as the Green Belt designation. This would help to protect urban biodiversity and ensure strong urban green space networks'.

Types of Management

Designated Sites

In the UK, land is conserved for biodiversity reasons as SSSI (Site of Special Scientific Interest), or as sites designated under the EU Birds and Habitats Directives. In England, SSSIs have an important role in access provision: 7.5% of the land area provides 55% of the land open under the new statutory right of access from the CROW Act (2000).

State-Run Nature Reserves

In England, there are 213 national nature reserves and 660 local nature reserves covering an area of over 30,700 hectares. They range from heathlands and mudflats to cemeteries and old railway cuttings. 35% of local nature reserves are urban and a further 33% lie within 1km of an urban area. Through positive management and partnership with local communities, these reserves can bring the benefits of nature closer to people and people closer to nature⁹⁷.

Non-Government Organisations

Numerous non-governmental organisations manage nature reserves in the UK. For example, RSPB nature reserves, cover more than 97,000 hectares, and provide a major recreational resource for people, as well as conserving biodiversity: over 1.1 million visits are made to RSPB reserves each year. The RSPB's reserve volunteering programme can benefit the health of participants, as well as assisting land management for biodiversity. The National Trust's land holding is approximately 250,000 hectares, and the Wildlife Trusts have over 80,000 hectares.

Summary

There are over 5 billion day visits to the English countryside each year and about 2.5 billion visits to urban parks. Despite the large population density in the UK there is existing natural green space to support physical activity. The most important of this space is in and around large populations. The large number of organisations that look after land with public access makes a policy for increasing physical activity more difficult.

The value of green space is hard to measure and therefore vulnerable to spending cuts, so that without investment and promotion the value to the local population is significantly reduced. Local authorities and Primary Care Trusts are in a good position to identify and improve communities that are poorly served by good quality green space.

11

Can More Green Space Improve the Health of a Population?

Contact with nature is good for health. In a review for the American Journal of Public Health^{102 103} nature was associated with fewer sick call visits among prisoners¹⁰⁴ improved attention among children with attention deficit disorder¹⁰⁵ and improved self discipline among inner city girls¹⁰⁶. There is also evidence that contact with nature enhances emotional and values related development in school children¹⁰⁷.

Even looking at nature through a window can lead to improved recovery and lower requirement for pain relief following operations in hospitals¹⁰⁸, and reduced stress and enhanced work performance in the office¹⁰⁹.

Other work has shown that the presence of nearby natural areas to be related to reduced crime, aggression and violence¹¹⁰, as well as increased civility and neighbourliness¹¹¹. This sense of using nature to build communities is strengthened by participation in local nature activities that has been shown to increase the sense of pride in one's community¹¹² and strengthen urban neighbourhoods¹¹³.

There is direct evidence that green space within an urban environment can benefit health and increase longevity, with one study demonstrating a dose response (i.e. the more the better). The authors of two reports suggest that physical activity is likely to be responsible for some of these benefits although the methodology did not allow them to measure this quantitatively.

The first study from Tokyo¹¹⁴ found that the five year survival of senior citizens increased with more space for taking a stroll near their residence and with nearby parks and tree lined streets near the residence. The authors comment:
'If favourable walkable green streets and spaces were provided, the health of senior citizens would be promoted further regardless of their socio-economic status'

The availability of a green space within walking distance is likely to promote physical activity outside the home, especially in densely populated urban areas with a high proportion of flats without gardens¹¹⁴.

The European Heart Network makes the same connection¹¹⁵:

'Making changes to the environment to support physically active lifestyles aims to increase the supply of appropriate environments where physical activity can take place, for example programmes can focus on green space.'

The second study from Holland¹¹⁶ showed that living near green space created less health complaints and both better mental and physical health than an urban environment.

'For every 10% increase in green space there was a reduction in health complaints equivalent to a reduction of 5 years of age.'

Other work¹¹⁷ has used aggregated data to show a positive correlation between woodland/farmland area and lower death rates for residents of cities with a population density of more than 4,000 inhabitants per km². However, the correlation did not occur among cities having a lower population density. Areas of low density urban populations representing urban sprawl have been studied and, despite having more trees and gardens, have been shown to have higher rates of obesity, physical inactivity and hypertension¹¹⁸. This is thought to be due to a greater dependency on the car to reach local services or areas of public space compared to more compact neighbourhoods.

Summary

Contact with nature has been shown to reduce stress, pain, crime and aggression and improve community integration, children's behaviour and a sense of pride in the community. These all indirectly can improve the health of a community. There is more direct evidence that green space in an urban environment can improve life expectancy and decrease health complaints. Much of this is thought to be due to a favourable environment for people to exercise. There was a specific significant relationship between parks and tree lined streets with increased longevity. The psychological benefits of nature may also increase motivation to exercise. Suburban

sprawl is associated with higher levels of obesity, high blood pressure and inactivity, because of the high dependency of the car.

12 ***Can Green Space Increase Levels of Physical Activity?***

As discussed in previous chapters, walking is the most effective means of physical activity promotion. Evidence also shows that green space in a city is associated with increased health and that some of this is due to increase opportunity of taking part in physical activity.

There is also evidence that the Government is beginning to see the opportunities that green space can bring to healthy lifestyles and physical activity promotion in particular.

The following chapter discusses the relationship between physical activity levels and proximity of green space to a community.

Walking and Local Green Space

There have been two major reviews investigating the relationship between the environment and physical activity^{119 120}. In summary levels of total walking which meet the current requirements are more likely to be met when there is:

- Local access to public space or beach
- Local area is attractive with enjoyable scenery
- Safe Footpaths
- Minor traffic with trees
- Pavements
- Diversity of land use
- Easy access to public transport
- Neighbourhood is friendly

There is much more research being undertaken to identify these links. The following studies are representative of many others. A study from Perth, Western Australia, found that people were twice as likely to walk at recommended levels in a high scoring physical environment with the most important environmental factor being local access to attractive public open spaces⁸².

Women living within walking distance of a park or footpath walked more (as measured by a pedometer) than those living near a community centre, pub, bar, coffee shop, post office or library¹²¹. Another study in the UK showed that walking over 150 minutes a week was associated with 'feeling safe' and 'access to shops' for women, but for men it was 'access to a park or open space' ¹²².

In summary the natural environment and local scenery is consistently important in increasing physical activity levels in communities.

The following three case studies have used the natural environment to increase physical activity in a healthcare setting.

Walking the Way to Health (Health Walks)

Health walks started in South Oxfordshire in 1995 based on the hypothesis that social and environmental factors are both essential to maintain levels of physical activity within a community setting^{123 124 125 126}. There are three parts to the scheme:

1. Way marked short Health Walk routes that are graded for difficulty and length.
2. Health Walks led by trained volunteers that encourage those who prefer a social incentive, safety and guidance on where to walk.
3. Leaflets that show these walks on illustrated maps.

There are now over 350 similar schemes, being led by over 10,000 trained volunteers in the UK, co-ordinated by the British Heart Foundation and Countryside Agency as the 'Walking the Way to Health' initiative¹²⁷.

A four year review of the first Health Walk scheme in Sonning Common, involving 16,407 participations on 1,724 walks, demonstrated that the most popular walks are between 1.5 and 2 miles in length with a clear preference for walks that offered a variation in natural environment and with trees¹²⁴. It found that:

'Varied scenery was an important aspect of motivation with less attendance on walks with poor contrast and few or no trees.'

In a commissioned report¹²⁵ on a Health Walk scheme in Reading, a sample of 476 health walkers were asked what motivated them to continue walking (Figure 6). Out of 13 questions the four most important factors were (in order):

- improve my fitness levels
- have a chance to be in the countryside
- the health walks are nearby and convenient
- they are enjoyable and fun.

Women were statistically more likely to strongly agree about the positive nature of the countryside and seasons¹²⁵.

Although the walks were designed to increase fitness and improve health, figure 6 shows that **a chance to be in the countryside became the joint top reason to continue with the participation.** Even watching the seasons go by was a more important motivating factor than any of the health benefits. The local effect of health walks has other consequences with 64% of current or past participants saying that their transport habits have changed with 27% saying that they now walk rather than drive short distances. The most significant aspect is a lasting change in participants' patterns of exercise.

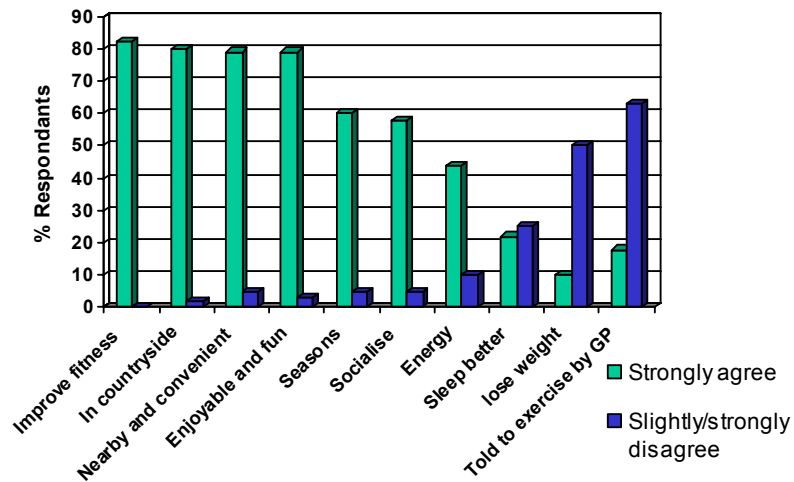


Figure 6. Factors that motivate participants of Health Walks to continue. The Key question was 'I will continue health walking because...'

Walking outdoors may offer other advantages (compared with using a gym). A study comparing adults walking indoors to outdoors showed that when asked to walk 'Fast but without over-exertion' the percentages of their maximum heart rate and walking speed were significantly higher for outdoor compared to indoor (treadmill) walking, yet their rate of perceived exertion was similar for both. This showed that when outdoors they walked faster and used up extra energy without feeling any extra effort. This may be partly due to the ground being easier to walk on than a treadmill, but the varied scenery and the natural surrounding (compared to a treadmill and wall) may provide a positive distraction from the actual exercise¹²⁸.

Green Space in a Hospital or Residential Care Setting

Patients, visitors and staff in hospitals or residential homes are often under stress or recovering from a stressful illness or operation. There has been a significant shift from design of the interior to that of the outdoors so that any open space can be used for healing relaxation and exercise. There is now considerable evidence to indicate that hospital patients looking out onto green space with varied vegetation recover from operations more quickly, have shorter stays in hospital and need less analgesia than those who have a view of just a wall¹²⁹.

Writing in 'Healing Gardens' Professor Roger Ulrich says:

'There are sound scientific grounds for contending that gardens in healthcare facilities will improve health outcomes to the extent they are effective in fostering restoration and coping with respect to the stress that accompanies illness and hospitalisation.'

*'Accordingly, supportive gardens in healthcare facilities can be an important complement to the healing effects of drugs and other modern medical technology and help improve the overall quality of care.'*¹³⁰

Ulrich goes on to say that there are three ways that designers can capitalise on gardens as effective ways of increasing physical activity:

- Small gardens can be designed to serve as destinations for a walk through the hospital. So even a small atrium with a tree and flowers and birdsong will be a small oasis of restoration to which the patient may have to walk across the hospital.
- Gardens alongside corridors with windows may increase the motivation to walk around the hospital. This is more suitable during the winter or when raining.
- A larger garden can provide paths and walking loops with clear access to encourage patients and staff to walk during breaks in work or treatment.

The elderly in residential care are vulnerable to inactivity. The ambulatory person may spend as much as six hours sitting in the same chair and the non-ambulatory resident up to 12 hours¹³¹. A report by the American Hospital Association described the optimal patient unit as providing interesting areas for walking and a tangible goal outside the patient's room to encourage walking¹³².

To increase activity outdoor gardens must be easy to navigate with chairs to allow rest and possibly hand rails to provide confidence. To make the garden worth a visit colourful plant materials and amenities to attract wildlife are used along with different leaf textures, forms, smells, and perhaps taste, to stimulate the senses and memory.

The Green Gym (Conservation Work, Physical Activity and Green Space)

The Green Gym¹³³ uses conservation work to increase both physical and mental health and is led by the British Trust Conservation Volunteers (BTCV). There are over

50 schemes within the UK encouraging physical activity through the natural environment.

A commissioned study¹³⁴ of the Portslade Green Gym near Brighton found that: *'50% of members felt that being in the countryside was a very important factor at the beginning of the scheme but after six months this increased to 75%. Keeping fit was very important in 100% of members at the start but fell to 45% after six months.'* (Figure 7)

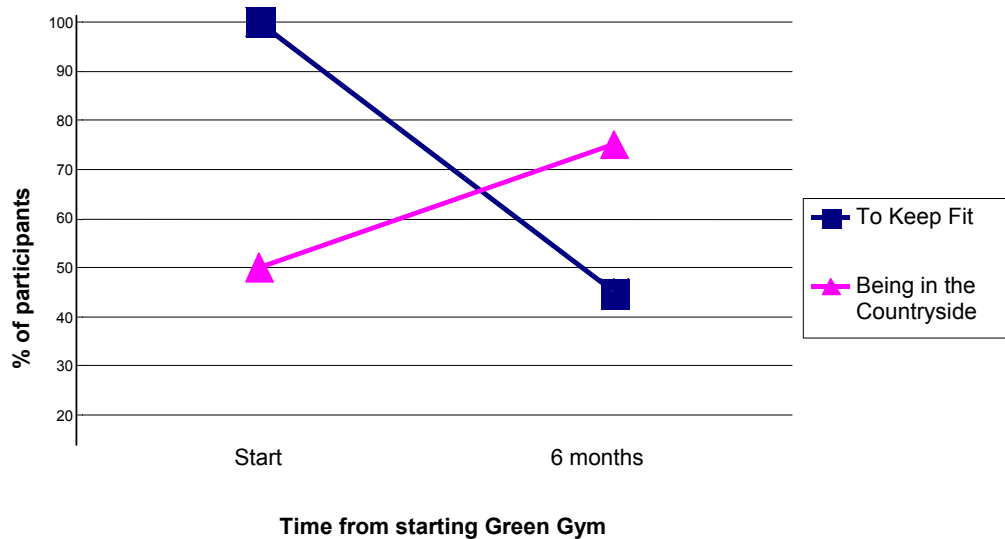


Figure 7: Factors that were **very important** in continuing participation in the Green Gym¹³⁴.

Although this deals with a small sample, most people joined the scheme because of the need to become fit. However, it appears that being in the countryside became a more important motivating factor to encourage people to continue with the Green Gym. Organisers of the Green Gym schemes throughout the UK have noted this trend of people entering conservation with a 'health ticket', but continuing through a developing relationship with nature¹³⁴.

The main difference for the person undertaking exercise through gardening or conservation work is that they concentrate on the job in hand rather than seeing it primarily as a source of exercise. There is a similar rise in heart rate with both the

Green Gym and step aerobics (Figure 8). However, participants in the Green Gym were less aware that they are exercising than with step aerobics and were happier to continue for longer in order to finish the task.

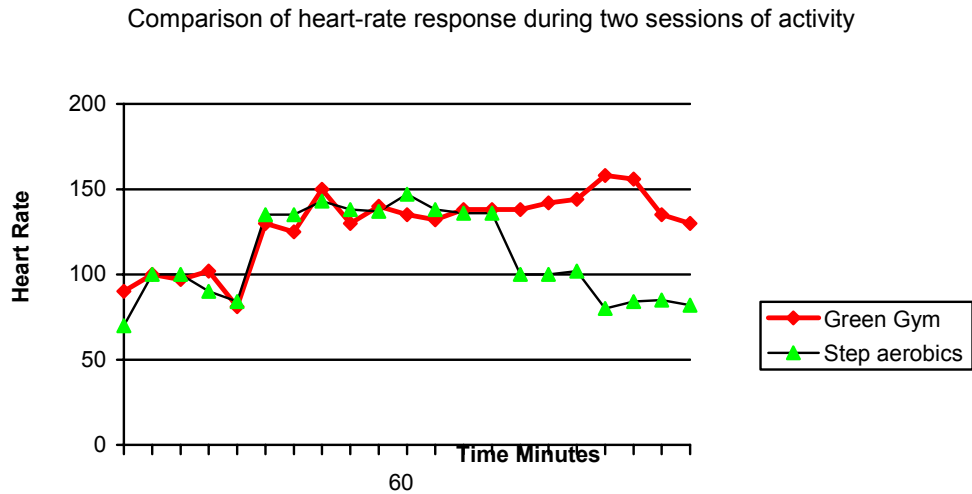


Figure 8: Comparison of heart rate between 60 mins of step aerobics and Green Gym session¹³⁵.

General comments from members on why they continue with the Green Gym:

'Now that I am not working anymore it was a way of getting out and I love being in the country.' (Noel, 34 yrs old)

'Being surrounded by nature is what I like about it.' (Paul, 65 yrs old)

With the Green Gym, the aim of the morning session is the conservation task in hand not 'how much exercise will I do by lunchtime?'. This is an example of achieving exercise as a by-product of doing something else that is enjoyable or with purpose.

Children's Physical Activity and Green Space

There is very strong evidence that being outdoors is the most powerful correlate of physical activity, particularly in pre-school children¹³⁶. Children's physical activity levels are also associated with the number of play spaces near their homes and the amount of time children use those play spaces¹³⁷.

Contact with the elements of nature - sunlight, fresh air, soil, water, plants and animals - is a fascination for children, encouraging them to go outdoors where they are more active. The advice from those who have designed these gardens for children is to 'Provide as wide a range of natural settings as possible within the constraints of climate and available space'.

Allowing children to play freely is important to their development. A safe natural environment allows children to exercise by exploration by jumping streams or puddles, rolling in the grass, climbing trees or rocks, etc. Great diversity of vegetation and wildlife with hands on planting and harvesting can keep children interested and very active. Local green space within walking distance is therefore vital to maintain levels of physical activity in children. Using green space for gardening or conservation work may provide some children with physical activity as an alternative to sport at school.

Summary

Local access to safe natural green space and attractive scenery is associated with high levels of physical activity within communities. Research on two national schemes show that health reasons motivate people to join, but experiencing close contact with nature becomes the more important factor in maintain levels of physical activity. Activities in which exercise becomes secondary to environmental or social benefits (e.g. cycling, gardening, Green Gym, walking in green space and many sports) appear to be more sustainable than activities in which exercise remains the primary driver.

Children increase their physical activity levels when outdoors and are attracted to nature. Physical activity levels benefit from living close to a green space. The benefit from increased physical activity may be even greater in hospitals or residential care homes. Good design of wildlife-rich gardens can be used to increase physical activity in sedentary and vulnerable patients or residents.

13

Can Biodiversity Contribute to the Promotion of Physical Activity in a Green Space?

Biodiversity

Biodiversity is the earth's life support system. It includes all plants, animals and micro-organisms and the places where they live¹³⁸. A recent definition of Biodiversity⁸⁹ is considered to be the most appropriate. In simplified terms, the authors suggested that biodiversity is best considered at three levels

- Genes: The number of subspecies and genetic variation
- Species: The number of different species
- Ecological: The number of interactions between all forms of life.

An economic value has been calculated for biodiversity in a recent DEFRA report¹³⁹, that discusses how the value of biodiversity is ultimately governed by the population (the consumer) rather than experts. For example, a piece of land that is the habitat of a 'cute' animal will hold more value to the public regardless of the view of experts. There are two main ways a wildlife-rich value can be realised by the public:

- Direct
 - 'Use value' - This makes direct use of biodiversity. For those taking part in physical activity this may be the sound of birdsong, flowers, the variety of trees and the sight of birds or animals. An important motivator for maintaining physical activity through health walks is the change of seasons, that are be more pronounced in a wildlife-rich environment.
 - 'Passive-use value' - This is when people care about species richness because they care about naturalness and the knowledge that a species will be preserved for future generations.

- Indirect.
 - This is the reliance of biodiversity which people exploit in order to produce goods and services. For example, a golf course uses the natural processes of biodiversity in its design, such as shelter provided by trees and pollination of flowers by insects.

Using two specific examples, in Cambridgeshire and Northumberland the value that each local person is willing each year to pay to protect against biodiversity loss are £45 and £38 respectively, per year. Biodiversity is hard to value, but this study shows that people are prepared to place a value on increased biodiversity near to where they live. In the US there are countless ballot outcomes showing people's willingness to be taxed for urban green spaces and for the preservation of nearby farms and forests¹⁴⁰.

Despite this, a lot of wildlife-rich land in the UK has been lost over this century⁹⁷:

Lowland Heathland:	75% loss in England since 1800.
Downland:	50% loss in Dorset between 1950s and 1990s.
Wet Grassland:	Estimated 40% loss between 1930s and 1980s.
Caledonian Pineforest:	Approx 99% loss.
Upland Heath:	27% of heather moorland in England and Wales lost between 1947 and 1980.
Ancient Woodland:	46% has been converted to plantation or agriculture since 1946.
Lowland Meadows:	97% loss over the past 50 years.

These habitats are rich in biodiversity, and support unique and varied wildlife. The loss should not just be measured in species and hectares, but also by the loss of associated potential physical and mental health benefits.

The Government's *UK Biodiversity Action Plan*¹⁴¹ outlines the actions needed to protect and enhance wildlife in the UK. It includes actions for creating open-country habitats. The RSPB's *Futurescapes*¹⁴² goes further, arguing that the relatively modest BAP targets should be raised: it presents a vision for large-scale habitat recreation to enhance wildlife, the natural environment, and people's quality of life.

In the context of this report, the value of these habitats to human health can be measured by the loss of potential physical activity. This may be from day trips with the family to a walk, cycle or horse ride, if situated close by. The family day trip is important as it introduces children to outdoor exercise, which if maintained through childhood, is more likely to remain with them into adulthood.

Nature

In the DTLR report, *'Improving Urban Parks, Play Areas and Green Spaces'*⁹⁹, all the focus groups, right across the spectrum of underrepresented groups, spoke of the opportunities that their local green spaces offered for contact with nature. This included 'the value of experiencing wildlife, nature, the changing scenery, flowers and the environment in general'. The attraction of the park is related to the 'variety of nature' or biodiversity. As 80% use the park for some kind of physical activity and many who come to relax will have walked, then exercise becomes a means to enjoy the close contact with nature.

So the health of the natural environment can be connected to human health. Increasing the diversity of the landscape must also become a health issue. Below are two examples of the reversal of the decline in some sensitive habitats in which human health has been acknowledged as a major benefit.

*'At Wicken Fen the National Trust is expanding their property, aiming to acquire 3,700 ha of neighbouring farmland for biodiversity and a green lung for the people of Cambridge and Newmarket.'*⁹⁷

*'Close to Leeds, Wakefield, Castleford, Pontefract and Selby is an area of former coal workings. Next to it are a power station, a chemical works, a railway and a trunk road. Yet the RSPB has created a reserve that is home to large numbers of birds, and at the same time is a gateway for local people to experience the beauty and wonder of wildlife and wild places, close to these big urban areas.'*¹⁴²

Summary

Biodiversity can have a 'direct use-value' on those engaging in physical activity. Being in the countryside is an important motivator but this is due to variety both by time (seasons) and space (biodiversity). The more wildlife-rich the green space, the

more varied it is perceived as being. People put a value on biodiversity and the significant public support enjoyed by conservation organisations in the UK demonstrates widespread support for maintaining biodiversity. UK Government plans to do this through habitat restoration and creation are described in the UK Biodiversity Action Plan' ¹⁴¹.

Use surveys show that one measure of the attractiveness of a green space is the amount of nature it can offer to the visitor, and this is the main reason why someone would chose to use a park that is not their closest park. Exercise has been shown to be simply a method of travelling to, and engaging with, the benefits of nature. Nature is a major motivating factor for exercise.

14

How Can a Wildlife-Rich Green Space Be Managed to Promote Activity and Increase Public Health?

Why Do People Choose Green Space?

This report has found that there are two ways that green space can increase levels of physical activity:

1. Green space is a destination within walking or cycling distance.
2. Physical activity (e.g. walking, cycling) within a green space adds value to the experience of a natural setting.

It appears that the reward of visiting a green space is primarily the emotional well-being generated by both the green space itself and the physical activity involved in reaching the destination or fully experiencing the space.

Improving Green Space to Increase Emotional Well-being

Restoration from stress is perceived as the most consistently important benefit of a natural setting. This may be due to social support, physical activity and temporary escape. However, viewing nature appears to provide the most benefit. A study in Sweden using EEGs (Electroencephalogram) to measure brain activity demonstrated that a view of nature was significantly more effective than a view of buildings in eliciting a relaxed yet wakeful state¹⁴³.

After watching videos of nature or buildings, patients who were stressed showed a significantly faster recovery, as measured by blood pressure, muscle tension and skin conductance, with the nature videos compared to those with buildings videos. The recovery effect peaked within 3-4 minutes. Other ratings suggested that the nature settings produced significantly higher levels of positive feelings and lower levels of fear and anger¹⁴⁴.

How Can Green Space Be Improved to Increase Emotional Well-being?

Much research has looked into peoples' preferences for outdoor scenery. Overall, people do not prefer to look at large, wide-open spaces devoid of trees. There is a widespread preference for 'natural' scenes that are moderately complex yet coherently organised and include large trees, maintained ground areas, smooth ground cover, and where buildings do not dominate¹⁴⁵.

Users of an arboretum near Chicago¹⁴⁶ also perceived specific features such as lush vegetation, large trees, flowers and openness as particularly restful. Vegetation, water, and savannalike qualities such as scattered trees, grass and spatial openness were perceived as particularly restful amongst urban park users¹⁴⁷.

The ideal park was determined by focus groups to include⁹⁹:

- Variety: it's good to have many different experiences, meadows, formal areas, water
- Vegetation: trees, greenery and flowers
- Water: fountains, lakes, ponds, streams and waterfalls
- Sensory stimulation: scent, colour
- Opportunities for play
- Provision for young people
- Comfort: seating, shelters and toilets
- Lack of urban noise

The design of green space to attract people can be summarised using evidence from the two most eminent research groups who have studied this area in depth. This design takes into account the emotional attractiveness of a green space^{4 145 148}. In a green space people prefer:

- Many separate elements (Complexity, wildlife-rich)
- 'A focal point and other order or patterning.' (Coherence)
- 'Moderate to high level of depth that is clearly defined' (Legibility i.e. landmarks are clear and easy to follow)
- The ground is smooth and looks like people could move through it, which involves having 'lush, grassy or herbaceous ground covers'. (Accessibility)

- 'A deflected or curving sightline is present, conveying a sense that the new landscape information lies immediately beyond the observer's visual bounds' (Mystery – they want to explore)
- 'There is little in the way of perceived threat' (Safety)
- There is water.

Improving Green Space to Increase Levels of Physical Activity

Studies in Australia concluded that parks are more likely to stimulate physical activity if they are aesthetically pleasing and have tree lined walking paths rather than empty open space¹⁴⁹. This is backed up by a 2003 UK survey of 2,000 adults that found that the most important reasons for choosing to visit a park which was not the nearest was that it was attractive (21%), it was well maintained (17%), the setting (14%) and its flora and fauna (11%)¹⁵⁰.

In Australia, local people believed that most park or recreation land was set up for organised team sports, but the majority of residents preferred unstructured activities such as walking and cycling. Space for physical activity was available, but it was not appropriately designed¹⁵¹.

The evidence suggests that people are satisfied with walking through small, well-designed parks with views on larger areas that may support more sensitive habitats³⁶. In other words, biodiversity and humans can co-exist by good design and using the view rather than increased access to areas that are sensitive.

Improving Rights of Way to Increase Physical Activity Levels

Paths and cycle routes are used for purpose or pleasure. In rural areas, footpaths often provide the only opportunity for walking, and therefore are as important as urban parks in promoting physical activity. They can only be correctly laid out by extensive public consultation. At present many paths have dead ends or lead to places that have since disappeared or become less important. This means that they are unsuitable for purpose and by not providing a circular route, are less likely to be suitable for pleasure.

Research in Cheshire found the reasons most people did not use footpaths were:

- Personal safety: personal attack or worry that there may be a medical emergency
- Terrain: Lack of knowledge about the terrain puts people off particularly with joint and balance problems and low levels of fitness.
- Uneven Surface/soft hard surfaces
- Steep Hills
- Obstacles e.g. stiles
- Poor maintenance of paths and hedges
- Facilities on route e.g. toilets and benches.

Right of Way Improvement Plans will be implemented in England from 2005. This is an opportunity to allow the public access to areas of the countryside currently inaccessible such as watersides, coast, woodland and viewpoints. New rights of way can allow people to travel between destinations without having to use the road.

Importantly they can link existing footpaths or bridleways to create a circular route with a variety of landscapes¹⁵². Local access forums have been set up following the Countryside and Rights of Way Act 2000 to gather data including advice on the extent to which local rights of way meet the present and likely future needs of the public. There is also the opportunity, which has yet to be taken up, of including an NHS representative in the forum.

Based on the available evidence, an ideal circular walk:

- Is between about 2 and 3km.
- Is local and accessible (clear signs and an area for parking or the ability to walk to, and join any part of the walk).
- Is mainly flat with any gradients being slight.
- Has a firm surface with no obstructions such as stiles, mud or overgrowth.
- Has a path wide enough for a wheelchair or pushchair.
- Has at least one landmark of interest that can act as a focal point.
- Has a variety of natural vegetation, wildlife and views that provide continuous and changing interest.
- Has contrasting environments which break up the walk into several sections
- Is well promoted.

- Feels safe with good visibility adjacent to the walk.
- Is maintained to a high standard.

Local Access

Much of the evidence has indicated that opportunities for physical activity must be local to the population, literally on the doorstep. Local access is one of the key motivating factors for people to carry on with health walks. 20% of those who do not use parks state that being too far away is the main barrier⁹⁹ Being overweight or obese is associated with poor local access to open space or not being within walking distance (5 minute drive) of a cycle or footpath¹⁵³, and those who are unable to walk to a public park within 10 mins are less likely to meet physical activity targets¹⁵⁴.

Linking areas of green space together particularly between town and country has been actively promoted by the Countryside Agency as greenways or green corridors, which can increase access to green space. For example, a town park may be linked to the urban edge by a green corridor combining woodland, semi-natural grassland, a cemetery, a linear green space along a river or canal, or an area of farmland. This can serve as a wildlife corridor, a passage for walking or cycling, a landscape feature and a strategic break between developments. It may also contain a linked series of footpaths or parks, which can become a nature trail⁹⁹.

Recommendations from the UK Man and the Biosphere Urban Forum and English Nature advise that there should be standards for access to urban green space¹⁵⁵. These standards are:

- An urban resident should be able to enter an urban green space of at least 2 ha within 0.5km of their home. (For children 280 metres is the threshold in which parents feel able to let their children visit this space on their own)
- Provision should be made for Local Nature Reserves in every urban area at the minimum level of 1 ha per 1,000 population.

In addition there should be

- 1 x 20 ha site within 2 km of all residents
- 1 x 100 ha site within 5 km of all residents
- 1 x 500 ha site within 10km of all residents

The Institute of Leisure and Amenity Management (ILAM) define a four level hierarchy of parks:

1. Principal Park of more than 8 hectares with a city wide catchment area
2. District Park of up to 8 hectares with a catchment area from 1.5 to 2 km.
3. Neighbourhood Park of up to 4 hectares serving a catchment area of between 1 to 1.5 km.
4. Local Park up to 1.2 hectares serving a catchment area of between 0.5 and 1 km.

These definitions and recommendations have not been devised with respect to physical activity needs and so there remains an opportunity for future recommendations.

Overgrowth, Mud and Stiles

A good firm walking surface is important both for safety and to allow an ideal walking speed. This may be grass, but with firm alternatives if the paths get muddy. There should be encouragement to build hard paths within wild natural landscapes to allow more people access to experience nature. It is important that paths have some signs to aid direction.

In one questionnaire, 30% of respondents found that overgrown vegetation (e.g. stinging nettles) was either a slight or significant problem. Women were twice as likely to find it a deterrent. Mud was less of a barrier with only 9% of men and 18% of women stating that it prevented them from walking as much as they would like in the countryside¹⁵⁶.

Stiles are frequently found on some footpaths and are a significant problem. 43% of those over 70 years cannot climb a stile with ease. Of this age group, 66% had not climbed a stile within 6 months compared to 30% in the 51-70yrs group and 23% in the under 50s.

Keeping Local Green Space in the Public Eye

A park, reserve or any green space will only reach its full value if promoted. There needs to be a concerted marketing effort to motivate those who rarely take any exercise outside. The young are neither motivated nor are knowledgeable about

where to walk (Figures 9 & 10). Promoting local green space is likely to benefit from a more wildlife-rich environment which will have something worth visiting for every season of the year (e.g. bluebells, birdsong in spring, leaves turning in the autumn, etc). These may appear obvious but they provide excellent marketing opportunities to increase awareness of local footpaths, nature reserves and parks at different times of year.

Lack of motivation or interest being a factor in preventing walking in the countryside

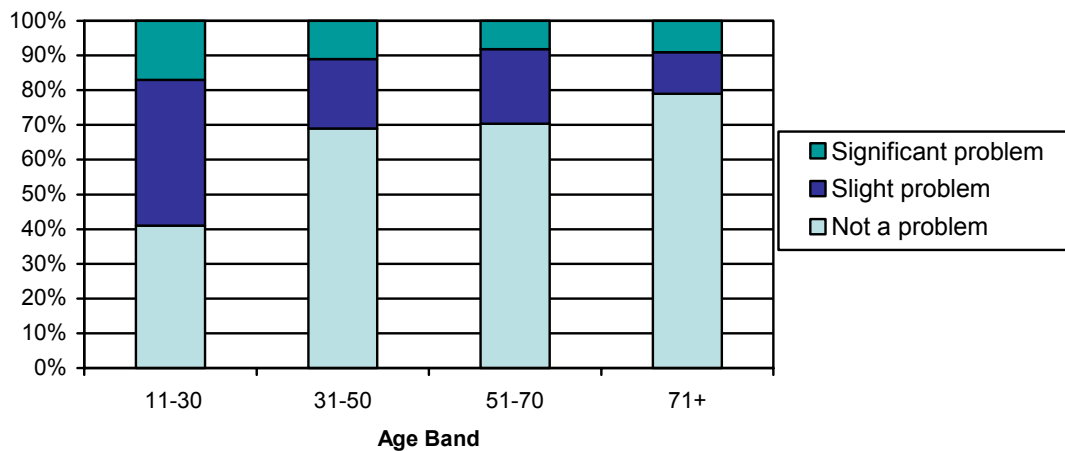


Figure 9: Percentage of respondents by age who find 'lack of motivation or interest' prevents them walking in the countryside.

Don't know where to walk

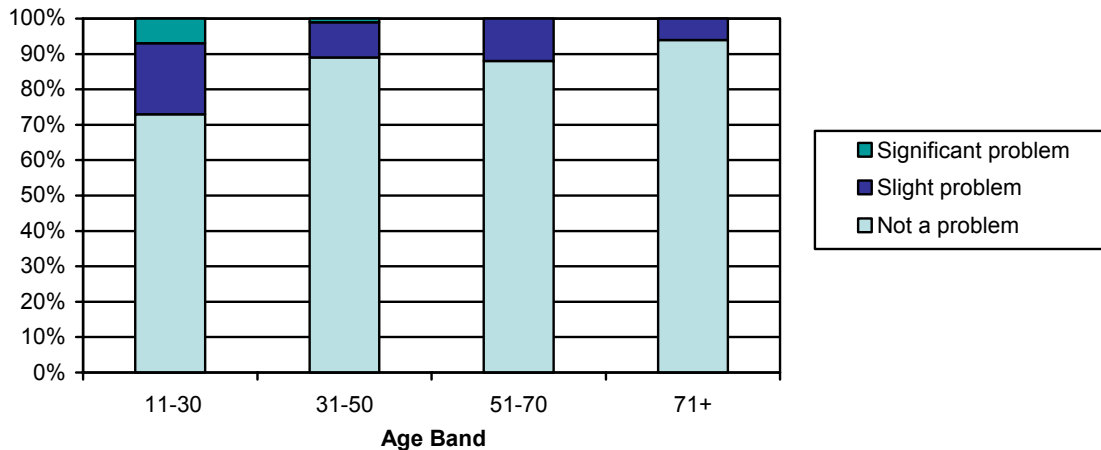


Figure 10: Percentage of respondents by age who find 'Don't know where to walk' from preventing them walking in the countryside as much as they would like.

Safety

Any exercise within a green space can be a concern among women who want to walk on their own. Figure 11 shows that 73% of women find walking alone in the countryside a problem. In a questionnaire for local parks, 49% of women said that safety fears put them off from using urban green spaces; this is ranked third after dog mess and vandalism. This is a major barrier to increase access to rural and urban green space and increase physical activity.

Parks are perceived as risky when they are more densely vegetated, particularly when it is not maintained¹⁵⁷. Park wardens are a possible solution and their cost would be worthwhile compared to the health savings if they were to increase the number of people using the area.

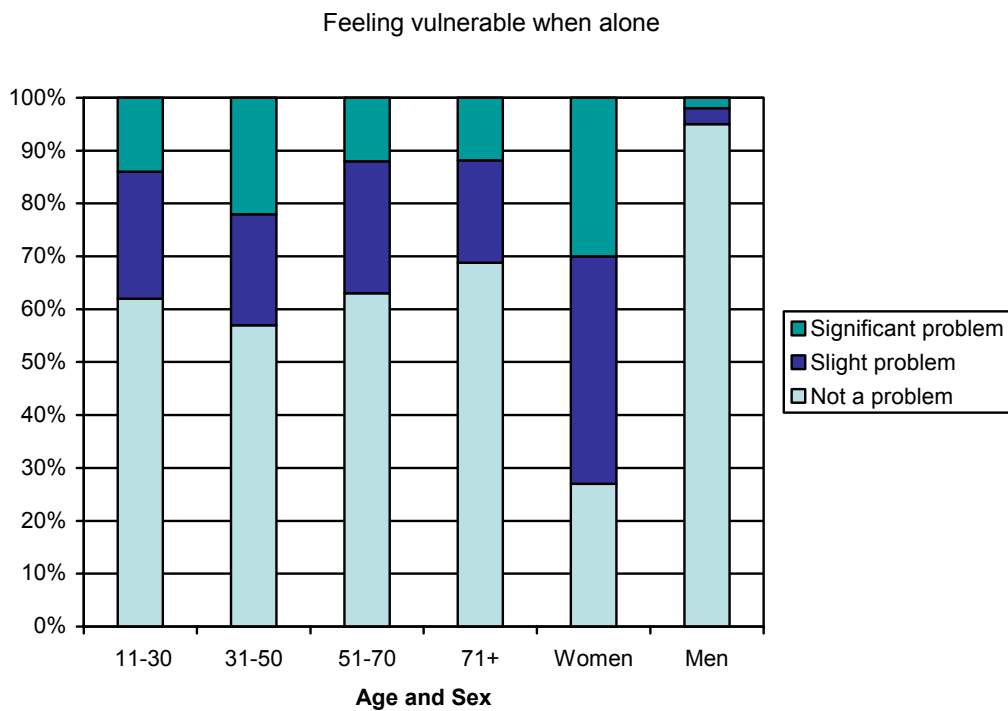


Figure 11: Percentage of respondents by age who find ‘Feeling vulnerable when alone’ prevents them from walking in the countryside.

Quality of green space

The Green Flag Awards were launched in 1996 to encourage the provision of good quality public parks and green spaces that are managed in environmentally sustainable ways. The Award has achieved a 58% year on year growth in applications leading to 240 applications in 2003 of which 182 were judged to be of a high enough standard to win a green flag. In addition, the Green Pennant Awards introduced in 2002 to recognise high quality green spaces in England and Wales that are managed by voluntary and community groups. They are run by the Civic Trust with majority funding from CABE Space. There are eight criteria¹⁵⁸:

- **A welcoming park:** Good and safe access
- **A healthy, safe and secure park:** The park must be a secure place for all members of the community to use or traverse
- **A clean and well maintained park:** A policy on litter, vandalism and maintenance should be in place, in practice and regularly reviewed
- **Sustainability:** Pesticides should be minimised and peat eliminated
- **Conservation and heritage:** Attention should be paid to the conservation of natural features, wildlife and flora
- **Community involvement:** Park management should actively pursue the involvement of members of the community, with representation of as many park user groups as possible
- **Marketing:** Good provision of information to users and effective promotion of the park as a community resource
- **Management:** Clear objectives which can identify the contribution the site is making to an area.

This list has been developed looking at many aspects that are important to people's view. However, opportunities for physical activity are not specifically addressed.

Summary

To increase physical activity levels in a green space it should be local (less than 2km), with a good surface, no obstructions such as stiles and, above all, it must feel safe to users. There need to be imaginative ways to promote a wildlife-rich green space, and market it to different age groups. The green space must appear attractive. This has now been well defined as 'natural but well kept', which means

that it is wildlife-rich, but facilities and access routes are well maintained. It is possible to have sensitive wildlife-rich areas visible from smaller well-kept areas, as the view of nature is a main motivating factor.

Appendix 1. The Economic Benefit of Green Space and Physical Activity

It is possible to model the approximate value that Green Space can offer by its ability to support physical activity within a community. However, there are many assumptions; where possible these have been treated conservatively.

This model provides a rough estimate to illustrate the potential value that green space and footpaths could provide given our current state of knowledge. Even if more accurate data resulted in a reduction of the current estimates, the figures are likely to remain surprisingly high. This highlights how green space and public rights of way have been undervalued in the past.

These estimates make no allowance for the non-linear relationship between inactivity and health benefits, although this would add value to less frequent users of green space and may increase the overall benefit. There has also been no profile of users of green space to determine whether they are already fulfilling their exercise elsewhere. There has been no adjustment for age, sex and socio-economic profiles of individual users, although again this may add benefit since the highest values are in the most densely populated and most deprived areas.

The final figures are unlikely to be appropriate to all the areas in England as there are considerable regional and local variations in activity and quality of green space. However, these figures may be used as a guide to the potential of available green space.

More research is urgently needed to create a more robust model.

This report has identified the cost of physical inactivity, calculated by the Cabinet Office Strategy Unit, as £8.2 billion/yr. The following analysis estimates the proportion of physical activity that green space (a public park and a circular walk) can contribute to the total amount of physical activity undertaken. It then estimates the economic benefit of this physical activity. To do this, the following questions need to be answered:

- A. How many visits to the park does the local population make?
- B. How many of these visits involve exercise?
- C. How many of these 'exercise visits' fulfil 30 minutes of moderate exercise?
- D. What is the catchment area covered by the park?
(With a similar set of calculations undertaken for a footpath)
- E. What is the population density?
- F. What is the cost of inactivity in the population?

A. How many visits to the park does the local population make?

The report '*Use of public parks in England 2003*'¹⁵⁰, shows the frequency of visits to a public park:

Daily	More than once a week	Weekly	Fortnightly	Monthly
10%	20%	16%	8%	13%

Table 4: Percentage of the local population visiting a public park.

From this the number of days of exercise for the local population can be estimated. The full exercise requirement is participation in exercise 5 days a week.

Frequency of Visits	% of population	Assumed no. of visits per week	% of exercise days required	% of total population's required exercise days
Daily	10%	Over 5	100%	10%
More than once a week	20%	3	60%	12%
Weekly	16%	1	20%	3.2%
Fortnightly	8%	0.5	10%	0.8%
Monthly	13%	0.23	5%	0.6%
Total				27%

Table 5: The contribution of a public park to physical exercise.

The park could therefore contribute about 27% of the recommended number of days of exercise for the local population.

B. How many of these visits involve exercise?

Between 60% and 75% of people used parks solely for walking, and 6-11% used the space for sport, 15-23% for dog walking and 26% for any informal activity (these are not mutually exclusive as each person may state several reasons why they go to the park). From the survey, '*Park Life*'⁹⁸ it was found that about 70% of people

walked to the park. For a park situated within 1 mile of them, 87% of people walk to the park and 90% of these walkers take less than 20 minutes to get there. So even those that use a park to sit and relax take some exercise in getting there and back. Taking into account that about 80% use the parks for some form of exercise and 87% walk to a park within one mile, we will conservatively assume that 90% of users gain some exercise on their visit.

C. How many of these 'exercise visits' fulfil 30 minutes of moderate exercise?

Not everyone who is exercising will have the full 30 minutes of moderate exercise. However, the average time spent in a park visit is between 1-2 hours with only 12% using it for less than 30 minutes. One research group covertly observed walking speeds of those using the park for walking and found that when the same speed was recreated on a treadmill it fulfilled the criteria of 'moderate exercise'¹⁵⁹. From this it is estimated that about 80% of users who have exercised in the park will have had the full benefit of 30 minutes of physical activity.

The total amount of physical activity supported by the urban park is therefore:

- 27% of the recommended 5 days a week
- 90% of these days involve exercise
- 80% of this exercise is 30 minutes of moderate exercise

The total amount of physical activity provided by an urban park within 2km of a local population is $27\% \times 0.9 \times 0.8 = 19.4\%$. For ease of estimation, we will round this up to 20%.

D. What is the catchment area covered by the park?

English Nature recommendations are for a 20 ha public green space within 2km of every person or the 8 hectares per 2km which defines a district park^{155 99}. The catchment area within 2 km of a 20 ha park is approximately 16 km².

The Health and Economic Benefit of a 3km Circular Walk

The activity-use estimation for a park (C above) can also be made for a circular walk:

The Sonning Common Survey¹⁵⁶ of 350 residents demonstrated that 11% of residents in a semi-rural village had used a footpath over 7 times in 2 weeks. This is

not a representative sample of the population, but data in this area is very limited, so it will be used to guide the analysis for a footpath.

The rate of footpath use was:

More than six in two weeks	4-6 in two weeks	1-3 in two weeks	None
11%	10%	32%	47%

Table 6: % of participants who used a footpath to visit the countryside¹⁵⁶.

From this, the contribution of the footpath to the total physical activity needs of the local population can be estimated. For full exercise participation of 5 days a week, the total number of visits for the population is 10 sessions in two weeks.

Frequency of Visits	% of Population	Assumed no of visits per two weeks	% of full exercise requirement (of 10 visits in 2 weeks)	% of total physical activity need for the local populations
More than six in two weeks	11%	8	80%	8.8%
4-6 in two weeks	10%	4	40%	4%
1-3 in two weeks	32%	1	10%	3.2%
Total				16%

Table 7: The contribution of a public footpath to the physical exercise requirement of a local population.

The footpath can therefore contribute to 16% of the total physical activity needs for the population within 1km. The economic benefit of local 3km circular walk would look at the population living within 1 km of a footpath; the 3km circular walk would have a radius of 0.5 km, and the catchment area will extend a further 1 km beyond that, giving a circular catchment area with a radius of 1.5 km. This catchment will have a total area of 7 km². One can make the assumption (rightly or wrongly), that all those using the footpath took 30 minutes of moderate exercise.

E. What is the population density?

The Office of National Statistics calculates population densities for each local authority, which can be used to estimate the number of people in the catchment area.

F. What is the cost of inactivity in the population in England?

Using figures on levels of physical activity in England¹² and the percentage who are totally inactive¹⁶, the population's rate of physical activity can be calculated. As before, physical activity is assumed as 30 minutes, 5 days a week (or 260 days each year).

Number of days physical activity	% of population	% of physical activity requirement	Total contribution to physical activity
5 days a week	30%	100%	30%
1-4 days a week (assume 2 days)	32%	40%	13%
Less than 1 day a week (assume 1 day a fortnight)	14%	10%	1%
Totally inactive	24%	0%	0%
Total			44%

Table 8: Percentage of Physical Activity Undertaken in England

In England, the population is only undertaking 44% of its physical activity needs, therefore the inactivity rate in the population is 56%. As the relationship between physical activity and health benefits is not linear, the difference between 0 and 1 day of exercise a week will provide significantly more benefit than the difference between 4 and 5 days. This is likely to lead to an underestimate of benefit. The Cabinet Office calculates that the cost of inactivity in England is £8.2 billion for the economy and £1.7 billion for the NHS. This is for an England population of 50 million, who as a whole are undertaking only 44% of the physical activity target of 30mins 5 days a week. For this model, this is equivalent to 56% of the population being inactive.

Therefore, the cost to the economy of physical inactivity is £293 per inactive person, including £61 costs to the NHS.

The Potential Value of the Green Space for Physical Activity

The potential value of the contribution of green space in supporting physical activity can be estimated as the costs saved from avoided inactivity.

The estimated current contribution from an urban park to its catchment population's physical activity is 20%, and for footpaths it is 16%. The number of people using the green space for physical activity is dependent on the population density in the

relevant catchment area of the green space. The estimated physical activity value for a green space with a catchment of 1,000 people is shown in table 9 below.

Green Space with catchment of 1,000 people	Park	Circular Footpath
Population's physical activity supported	20%	16%
Number of people's activity supported	200	160
Potential Value per person		
To NHS	£61	£61
To Economy	£293	£293
Total Potential Value in Catchment of 1,000 people		
To NHS	£12,200	£9,760
To Economy	£58,600	£46,880

Table 9: Value of physical activity supported by green space.

Using population densities from the Office of National Statistics and the area that is served by the park (16 km²) or circular walk (7km²), the total population potentially benefiting from a green space can be estimated. A value can be put on this in the same way as in table 9 above. Representative values for an urban park and a rural footpath are shown in tables 10 and 11 below.

Potential value of physical activity when 20% of population within 2km use a 8-20 hectare green space to reach their activity target of 30 mins 5 days a week			
Urban Area	Population Density (population/Sq km)	Potential Saving to Economy, £000s	Potential Saving to NHS, £000s
Inner London	9,297	8,717	1,815
Portsmouth	4,671	4,380	912
Manchester	3,652	3,424	713
Newcastle	2,294	2,151	448
Edinburgh	1,699	1,593	332

Table 10: Value from physical activity in 20 hectares of urban green space

The potential value of an urban park, in terms of avoided inactivity, is estimated for a selection of UK cities at between £1.6 million and £8.7 million to the national economy, including £0.3 million to £1.8 million to the NHS. The large ranges reflect the different population densities examined.

Potential value of physical activity when 16% of population within 1 km use a 3 km footpath to reach their activity target of 30 mins 5 days a week			
Area	Population Density (population/Sq km)	Potential Saving to Economy, £000s	Potential Saving to NHS, £000s
Norwich	3,117	1,023	213
Middlesborough	2,485	815	170
Wirral	1,975	648	135
Surrey Heath	838	275	57
West Lancashire	313	103	21

Table 11: Value from physical activity on a 3km footpath.

The potential value of a 3 km footpath, in terms of avoided inactivity, is estimated for a selection of UK areas at between £0.1 million and £1 million to the national economy, including £21 thousand to £213 thousand to the NHS. The large ranges reflect the different population densities examined.

A full list of local authority areas, showing the estimated potential values for a 8-20 ha green space and a 3km footpath, are shown in appendix 2. There is considerable evidence linking poor health with low incomes and unemployment. The number of people in these groups in certain local authority areas, who could hypothetically benefit from access to green space, are also shown in appendix 2.

Reality Check

The recommended area of green space where population densities are high is a 20ha green space within 2 km of the population. This would serve a catchment area within 2 km of the space. If the green space was square, this would be approximately 16 km². Taking a population density of 3,500 per sq km (which is exceeded in only a few cities outside London), this catchment would contain approximately 56,000 people. Physical activity is supported amongst 20% of these; 11,200 people. They each would use the site 5 times per week, (meaning about 8,000 per day) for 30 minutes. If you take 10 hrs in the day, this gives 20 periods of 30 minutes, this implies 400 people per 30 minutes. If people walk in pairs (on average), then 200 pairs of people will use the park for physical activity at any one time.

In a 20 ha (50 acre) green space, this would mean 10 pairs of people per ha (or 4 pairs per acre). This is a relatively high density of people, but is realistic. It is maximum estimate, as:

- It is based on the maximum population density in most urban areas, at such high densities, more green space than a site within 2km of everyone would be beneficial.
- People get exercise in travelling to and from the green space, therefore, not all will need to spend 30 minutes using the space.
- If the demand for use of the green space is higher, the area available for activity can be increased, by increasing the length of footpath available, or creating open space (e.g. lawns).

The density of people may also be an underestimate, because use of the green space may not be evenly spread through the day, resulting in higher use of the green space at peak times. It is assumed that these under and over-estimating factors roughly balance with each other.

Summary

It is possible to estimate the potential economic benefits that green space can provide through provision of physical activity. The estimations are based on an urban park providing 20% of total physical activity needs and a 3km footpath providing 16% of total physical activity needs. Each year a park in Portsmouth could potentially save the economy £4.4 million, including £910,00 to the NHS. A 3 km footpath on the edge of Norwich could potentially save the economy £1 million, including £210,00 to the NHS.

Appendix 2. Potential Green Space Values, Unemployment and Income Deprivation per 20 ha Green Space by Local Authority Area.

Local Authority Area	Area (sq km)	People per sq. km	Potential Cost Savings, £ 000's per year			
			URBAN PARKS		3KM FOOTPATH	
			to Economy	to NHS	to Economy	to NHS
Kensington and Chelsea	12	13,609	10,660	2,210	3,498	725
Islington	15	12,181	9,541	1,978	3,131	649
Hackney	19	11,027	8,637	1,791	2,834	588
Hammersmith and Fulham	16	10,566	8,276	1,716	2,716	563
Tower Hamlets	20	10,462	8,195	1,699	2,689	557
Lambeth	27	10,136	7,939	1,646	2,605	540
Camden	22	9,498	7,440	1,542	2,441	506
Westminster	21	8,875	6,952	1,441	2,281	473
Southwark	29	8,710	6,822	1,414	2,239	464
Wandsworth	34	7,859	6,156	1,276	2,020	419
Haringey	30	7,609	5,960	1,236	1,956	405
Lewisham	35	7,220	5,655	1,172	1,856	385
Newham	36	7,013	5,493	1,139	1,802	374
Brent	43	6,302	4,936	1,023	1,620	336
Waltham Forest	39	5,751	4,505	934	1,478	306
Ealing	56	5,554	4,350	902	1,427	296
Merton	38	5,112	4,004	830	1,314	272
Greenwich	47	4,677	3,663	759	1,202	249
Portsmouth UA	40	4,671	3,659	758	1,201	249
Barking and Dagenham	36	4,636	3,631	753	1,192	247
Southampton UA	50	4,438	3,476	721	1,141	236
Redbridge	56	4,326	3,388	702	1,112	231
Luton UA	43	4,295	3,364	697	1,104	229
Harrow	50	4,193	3,284	681	1,078	223
Sutton	44	4,126	3,232	670	1,060	220
Blackpool UA	35	4,065	3,184	660	1,045	217
Kingston upon Thames	37	4,031	3,157	655	1,036	215
Liverpool	112	3,947	3,092	641	1,014	210
Croydon	87	3,890	3,047	632	1,000	207
Hounslow	56	3,870	3,031	628	995	206
Leicester UA	73	3,868	3,030	628	994	206
Southend-on-Sea UA	42	3,802	2,978	617	977	203
Watford	21	3,751	2,938	609	964	200
Slough UA	33	3,725	2,918	605	957	198
Birmingham	268	3,697	2,896	600	950	197
Barnet	87	3,694	2,893	600	949	197
Manchester	116	3,652	2,861	593	939	195
Nottingham UA	75	3,619	2,835	588	930	193
Bexley	61	3,612	2,829	587	928	192
Reading UA	40	3,574	2,799	580	919	190
Bournemouth UA	46	3,547	2,778	576	912	189

*Note: These Local Authorities have population densities above 3,500 people per km², the density used for the reality check on page 74.

Enfield	81	3,486	5	2,731	566	896	186
City of Bristol, UA	110	3,482	7	2,727	565	895	186
Wolverhampton	69	3,447	4	2,700	560	886	184
City of Kingston upon Hull, UA	71	3,379	4	2,647	549	868	180
Sandwell	86	3,329	5	2,608	541	856	177
Norwich	39	3,117	2	2,441	506	801	166
Dudley	98	3,112	6	2,438	505	800	166
Coventry	99	3,089	6	2,420	502	794	165
Stevenage	26	3,068	2	2,403	498	789	163
Gosport	25	3,043	2	2,384	494	782	162
Richmond upon Thames	57	3,038	4	2,380	493	781	162
Brighton and Hove UA	83	3,023	5	2,368	491	777	161
Plymouth UA	80	3,000	5	2,350	487	771	160
Worthing	32	3,000	2	2,350	487	771	160
Ipswich	39	2,976	2	2,331	483	765	159
Oxford	46	2,952	3	2,312	479	759	157
Hastings	30	2,886	2	2,261	469	742	154
Derby UA	78	2,861	5	2,241	465	735	152
Worcester	33	2,801	2	2,194	455	720	149
Gloucester	41	2,727	3	2,136	443	701	145
Cambridge	41	2,719	3	2,130	442	699	145
Harlow	31	2,572	2	2,015	418	661	137
Stoke-on-Trent UA	93	2,553	6	2,000	415	656	136
Middlesbrough UA	54	2,485	3	1,946	404	639	132
Walsall	104	2,428	7	1,902	394	624	129
Tamworth	31	2,418	2	1,894	393	621	129
Oadby and Wigston	24	2,411	2	1,888	392	620	128
Lincoln	36	2,408	2	1,886	391	619	128
Northampton	81	2,404	5	1,883	390	618	128
South Tyneside	64	2,365	4	1,852	384	608	126
Exeter	47	2,363	3	1,851	384	607	126
Cheltenham	47	2,360	3	1,849	383	607	126
North Tyneside	82	2,321	5	1,818	377	597	124
Rushmoor	39	2,320	2	1,817	377	596	124
Newcastle-upon-Tyne	113	2,294	7	1,797	373	590	122
Stockport	126	2,246	8	1,759	365	577	120
Salford	97	2,224	6	1,742	361	572	119
Crawley	45	2,219	3	1,738	360	570	118
Hillingdon	116	2,131	7	1,669	346	548	114
Poole UA	65	2,130	4	1,668	346	547	113
Havant	55	2,103	3	1,647	341	540	112
Torbay UA	63	2,081	4	1,630	338	535	111
Tameside	103	2,063	6	1,616	335	530	110
Eastbourne	44	2,055	3	1,610	334	528	109
Sunderland	137	2,030	9	1,590	330	522	108
Spelthorne	45	1,998	3	1,565	324	514	106

Havering	112	1,997	7	1,564	324	513	106
Trafford	106	1,978	7	1,549	321	508	105
Bromley	150	1,977	9	1,549	321	508	105
Wirral	157	1,975	10	1,547	321	508	105
Epsom and Ewell	34	1,960	2	1,535	318	504	104
Castle Point	45	1,935	3	1,516	314	497	103
Bolton	140	1,871	9	1,466	304	481	100
Sefton	153	1,840	10	1,441	299	473	98
Bury	99	1,823	6	1,428	296	469	97
Knowsley	86	1,745	5	1,367	283	448	93
Broxbourne	51	1,701	3	1,332	276	437	91
Wigan	188	1,603	12	1,256	260	412	85
Weymouth and Portland	42	1,539	3	1,205	250	396	82
Oldham	142	1,535	9	1,202	249	395	82
Nuneaton and Bedworth	79	1,518	5	1,189	246	390	81
Basildon	110	1,512	7	1,184	246	389	81
Chesterfield	66	1,500	4	1,175	244	386	80
Halton UA	79	1,494	5	1,170	243	384	80
Fareham	74	1,466	5	1,148	238	377	78
Redditch	54	1,459	3	1,143	237	375	78
Eastleigh	80	1,454	5	1,139	236	374	77
Adur	42	1,448	3	1,134	235	372	77
Woking	64	1,406	4	1,101	228	361	75
Sheffield	368	1,392	23	1,090	226	358	74
Broxtowe	80	1,345	5	1,054	218	346	72
Gateshead	142	1,340	9	1,050	218	344	71
Medway UA	192	1,307	12	1,024	212	336	70
Elmbridge	95	1,307	6	1,024	212	336	70
Rochdale	158	1,305	10	1,022	212	335	70
Leeds	552	1,299	35	1,017	211	334	69
St Helens	136	1,296	9	1,015	210	333	69
Bradford	366	1,292	23	1,012	210	332	69
Mansfield	77	1,278	5	1,001	208	328	68
Thanet	103	1,236	6	968	201	318	66
Dartford	73	1,188	5	931	193	305	63
Cannock Chase	79	1,182	5	926	192	304	63
Blyth Valley	70	1,160	4	909	188	298	62
Aberdeen City	186	1,127	12	883	183	290	60
Hyndburn	73	1,121	5	878	182	288	60
Solihull	178	1,119	11	876	182	288	60
Warrington UA	181	1,064	11	833	173	273	57
Ashfield	110	1,043	7	817	169	268	56
Blackburn with Darwen UA	137	1,018	9	797	165	262	54
Runnymede	78	1,011	5	792	164	260	54
Erewash	110	1,009	7	790	164	259	54
Bracknell Forest UA	109	1,002	7	785	163	258	53
Reigate and Banstead	129	978	8	766	159	251	52
Gravesham	99	971	6	761	158	250	52

Kirklees	409	953	26	746	155	245	51
North Down	81	952	5	746	155	245	51
Hartlepool UA	94	940	6	736	153	242	50
Wakefield	339	934	21	732	152	240	50
Gedling	120	933	8	731	152	240	50
Three Rivers	89	929	6	728	151	239	50
South Ribble	113	926	7	725	150	238	49
Hertsmere	101	924	6	724	150	237	49
Ellesmere Port and Neston	88	920	6	721	149	236	49
Barrow-in-Furness	78	919	5	720	149	236	49
Wansbeck	67	914	4	716	148	235	49
Preston	142	914	9	716	148	235	49
Christchurch	50	900	3	705	146	231	48
Thurrock UA	163	889	10	696	144	228	47
Stockton-on-Tees UA	204	881	13	690	143	226	47
Rotherham	287	871	18	682	141	224	46
Wokingham UA	179	845	11	662	137	217	45
Surrey Heath	95	838	6	656	136	215	45
North East Lincolnshire UA	192	824	12	645	134	212	44
Burnley	111	804	7	630	131	207	43
St Albans	161	800	10	627	130	206	43
Chester-le-Street	68	788	4	617	128	203	42
Swindon UA	230	785	14	615	127	202	42
Castlereagh	85	780	5	611	127	200	42
Welwyn Hatfield	130	751	8	588	122	193	40
Newport	190	729	12	571	118	187	39
Torfaen	126	723	8	566	117	186	39
Blaby	130	702	8	550	114	180	37
North Lanarkshire	470	684	29	536	111	176	36
Milton Keynes UA	309	682	19	534	111	175	36
Windsor and Maidenhead UA	197	678	12	531	110	174	36
York UA	272	670	17	525	109	172	36
Corby	80	669	5	524	109	172	36
Barnsley	329	662	21	519	107	170	35
Renfrewshire	261	659	16	516	107	169	35
Dacorum	212	650	13	509	106	167	35
Easington	145	648	9	508	105	167	35
Arun	221	643	14	504	104	165	34
Blaenau Gwent	109	638	7	500	104	164	34
East Dunbartonshire	175	615	11	482	100	158	33
Caerphilly	278	613	17	480	100	158	33
Swansea	378	591	24	463	96	152	31
West Dunbartonshire	159	584	10	457	95	150	31
Newcastle-under-Lyme	211	579	13	454	94	149	31
Redcar and Cleveland UA	245	569	15	446	92	146	30
Telford and Wrekin UA	290	553	18	433	90	142	29
Charnwood	279	550	17	431	89	141	29
Rhondda, Cynon, Taff	424	545	27	427	88	140	29

Pendle	169	533	11	417	87	137	28
South Bedfordshire	213	533	13	417	87	137	28
Newtownabbey	151	532	9	417	86	137	28
Calderdale	364	531	23	416	86	136	28
Great Yarmouth	174	526	11	412	85	135	28
Inverclyde	160	521	10	408	85	134	28
East Renfrewshire	174	516	11	404	84	133	27
Bridgend	251	514	16	403	83	132	27
North Somerset UA	374	507	23	397	82	130	27
Doncaster	568	506	36	396	82	130	27
Merthyr Tydfil	111	504	7	395	82	130	27
Chorley	203	500	13	392	81	129	27
Wyre Forest	195	498	12	390	81	128	27
Wycombe	325	497	20	389	81	128	26
Darlington UA		496	0	389	81	127	26
South Gloucestershire UA		496	0	389	81	127	26
Bath and North East Somerset UA		491	0	385	80	126	26
Falkirk	297	490	19	384	80	126	26
Rossendale	138	477	9	374	77	123	25
Guildford	271	476	17	373	77	122	25
Colchester	329	472	21	370	77	121	25
Carrickfergus	81	472	5	370	77	121	25
Durham	187	470	12	368	76	121	25
Rochford	169	468	11	367	76	120	25
Chelmsford	339	465	21	364	76	120	25
Peterborough UA	343	460	21	360	75	118	25
Wellingborough	163	453	10	355	74	116	24
Warwick	283	453	18	355	74	116	24
Tonbridge and Malling	240	453	15	355	74	116	24
Bolsover	160	452	10	354	73	116	24
Chiltern	196	451	12	353	73	116	24
Brentwood	153	448	10	351	73	115	24
Fylde	166	447	10	350	73	115	24
Amber Valley	265	441	17	345	72	113	23
Canterbury	309	440	19	345	71	113	23
South Buckinghamshire	141	437	9	342	71	112	23
Congleton	211	432	13	338	70	111	23
Tendring	338	415	21	325	67	107	22
Bromsgrove	217	412	14	323	67	106	22
Sedgefield	217	399	14	313	65	103	21
Hart	215	391	13	306	63	100	21
Mid Sussex	334	381	21	298	62	98	20
Wyre	283	378	18	296	61	97	20
West Lothian	427	374	27	293	61	96	20
The Vale of Glamorgan	331	363	21	284	59	93	19
Epping Forest	339	358	21	280	58	92	19
Kettering	233	355	15	278	58	91	19

Isle of Wight UA	380	355	24	278	58	91	19
Maidstone	393	355	25	278	58	91	19
North East Derbyshire	276	352	17	276	57	90	19
Flintshire	438	341	27	267	55	88	18
Hinckley and Bosworth	297	339	19	266	55	87	18
Swale	373	336	23	263	55	86	18
Waverley	345	336	22	263	55	86	18
Dover	315	333	20	261	54	86	18
Vale Royal	380	324	24	254	53	83	17
Tandridge	248	321	16	251	52	83	17
Lewes	292	319	18	250	52	82	17
North Hertfordshire	375	315	23	247	51	81	17
Derwentside	271	314	17	246	51	81	17
West Lancashire	347	313	22	245	51	80	17
Bedford	476	313	30	245	51	80	17
Tunbridge Wells	331	313	21	245	51	80	17
Mole Valley	258	311	16	244	51	80	17
North West Leicestershire	279	310	17	243	50	80	17
Waveney	370	306	23	240	50	79	16
Neath Port Talbot	441	305	28	239	50	78	16
Clackmannanshire	159	302	10	237	49	78	16
Sevenoaks	369	294	23	230	48	76	16
Craigavon	282	290	18	227	47	75	15
Macclesfield	525	285	33	223	46	73	15
Lichfield	331	281	21	220	46	72	15
Derry	381	279	24	219	45	72	15
East Hertfordshire	476	273	30	214	44	70	15
Shepway	357	271	22	212	44	70	14
East Staffordshire	387	270	24	211	44	69	14
Chester	448	265	28	208	43	68	14
Fife	1,325	265	83	208	43	68	14
South Staffordshire	407	261	25	204	42	67	14
Crewe and Nantwich	430	259	27	203	42	67	14
Rushcliffe	409	259	26	203	42	67	14
Wrexham	504	257	32	201	42	66	14
Rugby	351	253	22	198	41	65	13
South Derbyshire	338	248	21	194	40	64	13
Lisburn	447	245	28	192	40	63	13
Mid Bedfordshire	503	243	31	190	39	62	13
Basingstoke and Deane	634	241	40	189	39	62	13
East Dorset	354	239	22	187	39	61	13
Stroud	461	235	29	184	38	60	13
West Wiltshire	517	234	32	183	38	60	12
Lancaster	576	232	36	182	38	60	12
Horsham	530	231	33	181	38	59	12
Midlothian	354	228	22	179	37	59	12
New Forest	753	226	47	177	37	58	12
Taunton Deane	462	224	29	175	36	58	12

Cherwell	589	222	37	174	36	57	12
North Warwickshire	284	221	18	173	36	57	12
Braintree	612	220	38	172	36	57	12
Broadland	552	216	35	169	35	56	12
Restormel	452	216	28	169	35	56	12
East Hampshire	514	213	32	167	35	55	11
Penwith	304	210	19	164	34	54	11
Vale of White Horse	578	202	36	158	33	52	11
Stafford	598	201	37	157	33	52	11
Kerrier	474	198	30	155	32	51	11
Ards	380	195	24	153	32	50	10
Carrick	458	194	29	152	32	50	10
Sedgemoor	564	191	35	150	31	49	10
South Oxfordshire	679	189	42	148	31	49	10
Tewkesbury	414	187	26	146	30	48	10
Aylesbury Vale	903	185	56	145	30	48	10
Teignbridge	674	181	42	142	29	47	10
Ashford	581	180	36	141	29	46	10
Test Valley	628	176	39	138	29	45	9
Huntingdonshire	906	174	57	136	28	45	9
Wychavon	664	172	42	135	28	44	9
South Lanarkshire	1,772	171	111	134	28	44	9
Bassetlaw	638	170	40	133	28	44	9
Maldon	359	168	22	132	27	43	9
Rother	509	168	32	132	27	43	9
Wealden	833	167	52	131	27	43	9
High Peak	539	166	34	130	27	43	9
Staffordshire Moorlands	576	165	36	129	27	42	9
Newark and Sherwood	651	164	41	128	27	42	9
North Wiltshire	768	164	48	128	27	42	9
Winchester	661	163	41	128	26	42	9
Shrewsbury and Atcham	602	159	38	125	26	41	8
South Somerset	959	158	60	124	26	41	8
Boston	362	157	23	123	25	40	8
East Devon	814	155	51	121	25	40	8
East Northamptonshire	510	154	32	121	25	40	8
Fenland	546	154	34	121	25	40	8
Forest of Dean	527	153	33	120	25	39	8
North Ayrshire	885	153	55	120	25	39	8
St Edmundsbury	657	150	41	117	24	39	8
Oswestry	256	149	16	117	24	38	8
Forest Heath	378	147	24	115	24	38	8
South Cambridgeshire	902	145	56	114	24	37	8
Babergh	594	143	37	112	23	37	8
Mendip	739	142	46	111	23	36	8
Chichester	786	136	49	107	22	35	7
West Oxfordshire	714	135	45	106	22	35	7
East Lothian	679	134	42	105	22	34	7

South Kesteven	943	133	59	104	22	34	7
Harborough	592	132	37	103	21	34	7
Isles of Scilly	16	132	1	103	21	34	7
Scarborough	817	131	51	103	21	34	7
Selby	599	130	37	102	21	33	7
South Northamptonshire	634	129	40	101	21	33	7
Suffolk Coastal	892	129	56	101	21	33	7
Malvern Hills	577	126	36	99	20	32	7
South Norfolk	908	124	57	97	20	32	7
Wear Valley	503	122	31	96	20	31	7
Caradon	664	120	42	94	19	31	6
Stratford-on-Avon	978	116	61	91	19	30	6
Antrim	421	116	26	91	19	30	6
Coleraine	486	116	30	91	19	30	6
Harrogate	1,308	115	82	90	19	30	6
Salisbury	1,004	115	63	90	19	30	6
East Cambridgeshire	651	114	41	89	19	29	6
Denbighshire	837	113	52	89	18	29	6
Daventry	663	111	41	87	18	29	6
Purbeck	404	109	25	85	18	28	6
Uttlesford	641	108	40	85	18	28	6
South Holland	742	107	46	84	17	28	6
North Kesteven	922	105	58	82	17	27	6
North Norfolk	964	103	60	81	17	26	5
North Dorset	609	102	38	80	17	26	5
Mid Suffolk	871	101	54	79	16	26	5
Melton	481	100	30	78	16	26	5
Monmouthshire	849	100	53	78	16	26	5
Down	649	100	41	78	16	26	5

	Area (sq km)	People per sq. km	No. Unemployed ¹⁶⁰ per Hypothetical 20Ha park
Local Authority			
Islington	15	12,181	21,143
Hackney	19	11,027	20,231
Tower Hamlets	20	10,462	15,807
Lambeth	27	10,136	14,628
Camden	22	9,498	12,929
Southwark	29	8,710	12,634
Hammersmith and Fulham	16	10,566	12,543
Kensington and Chelsea	12	13,609	12,489
Haringey	30	7,609	11,621
Newham	36	7,013	10,398
Westminster	21	8,875	10,312
Lewisham	35	7,220	9,484
Liverpool	112	3,947	9,370
Brent	43	6,302	7,562
Wandsworth	34	7,859	7,482
Manchester	116	3,652	7,003
Waltham Forest	39	5,751	6,531
Blackpool UA	35	4,065	6,286
Greenwich	47	4,677	5,848
Kingston upon Hull, City of UA	71	3,379	5,732
Nottingham UA	75	3,619	5,490
Ealing	56	5,554	5,477
Barking and Dagenham	36	4,636	5,142
Birmingham	268	3,697	5,055
Leicester UA	73	3,868	4,863
Middlesbrough UA	54	2,485	4,664
Wolverhampton	69	3,447	4,368
Portsmouth UA	40	4,671	4,342
Southampton UA	50	4,438	4,289
Sandwell	86	3,329	4,085
South Tyneside	64	2,365	4,065
Norwich	39	3,117	4,063
Southend-on-Sea UA	42	3,802	3,996
Luton UA	43	4,295	3,986
Knowsley	86	1,745	3,924
Plymouth UA	80	3,000	3,869
Newcastle-upon-Tyne	113	2,294	3,830
Brighton and Hove UA	83	3,023	3,784
Hastings	30	2,886	3,782
Bristol, City of UA	110	3,482	3,751
Bournemouth UA	46	3,547	3,723
Stoke-on-Trent UA	93	2,553	3,718
Redbridge	56	4,326	3,566
Sunderland	137	2,030	3,539
Coventry	99	3,089	3,477
Hounslow	56	3,870	3,393
Merton	38	5,112	3,375
Salford	97	2,224	3,372
Derby UA	78	2,861	3,318
Enfield	81	3,486	3,192

North Tyneside	82	2,321	3,191
Wirral	157	1,975	3,189
Croydon	87	3,890	3,167
Lincoln	36	2,408	2,987
Ipswich	39	2,976	2,916
Walsall	104	2,428	2,786
Harrow	50	4,193	2,775
Dudley	98	3,112	2,740
Slough UA	33	3,725	2,656
Sefton	153	1,840	2,594
Tameside	103	2,063	2,585
Barnet	87	3,694	2,582
Sutton	44	4,126	2,464
Bexley	61	3,612	2,455
Torbay UA	63	2,081	2,408
Gloucester	41	2,727	2,380
Wigan	188	1,603	2,363
Watford	21	3,751	2,320
Reading UA	40	3,574	2,282
Exeter	47	2,363	2,233
Bolton	140	1,871	2,181
Stevenage	26	3,068	2,108
Gosport	25	3,043	2,084
Worthing	32	3,000	2,083
Worcester	33	2,801	2,064
Oxford	46	2,952	2,044
Kingston upon Thames	37	4,031	2,021
Harlow	31	2,572	2,016
Tamworth	31	2,418	1,956
Northampton	81	2,404	1,880
Stockport	126	2,246	1,875
Bury	99	1,823	1,855
Trafford	106	1,978	1,803
Cambridge	41	2,719	1,802
Havant	55	2,103	1,683
Eastbourne	44	2,055	1,629
Cheltenham	47	2,360	1,594
Richmond upon Thames	57	3,038	1,549
Weymouth and Portland	42	1,539	1,515
Havering	112	1,997	1,399
Hillingdon	116	2,131	1,398
Poole UA	65	2,130	1,356
Castle Point	45	1,935	1,263
Bromley	150	1,977	1,203
Oadby and Wigston	24	2,411	1,194
Crawley	45	2,219	1,157
Rushmoor	39	2,320	1,013
Broxbourne	51	1,701	916
Spelthorne	45	1,998	913
Epsom and Ewell	34	1,960	854

Local Authority	Area (sq km)	People per sq. km	No. Income deprived people per hypothetical 20 ha urban park
Islington	15	12,181	69,921
Hackney	19	11,027	75,153
Tower Hamlets	20	10,462	74,355
Lambeth	27	10,136	50,247
Camden	22	9,498	41,751
Southwark	29	8,710	44,703
Hammersmith and Fulham	16	10,566	42,090
Kensington and Chelsea	12	13,609	37,977
Haringey	30	7,609	42,396
Newham	36	7,013	46,072
Westminster	21	8,875	32,827
Lewisham	35	7,220	33,810
Liverpool	112	3,947	28,872
Brent	43	6,302	26,932
Wandsworth	34	7,859	25,176
Manchester	116	3,652	25,148
Waltham Forest	39	5,751	26,800
Blackpool UA	35	4,065	20,191
Greenwich	47	4,677	22,569
Kingston upon Hull, City of UA	71	3,379	22,534
Nottingham UA	75	3,619	21,461
Ealing	56	5,554	19,502
Barking and Dagenham	36	4,636	21,787
Birmingham	268	3,697	21,746
Leicester UA	73	3,868	21,518
Middlesbrough UA	54	2,485	15,667
Wolverhampton	69	3,447	18,573
Portsmouth UA	40	4,671	17,234
Southampton UA	50	4,438	16,651
Sandwell	86	3,329	18,785
South Tyneside	64	2,365	13,424
Norwich	39	3,117	14,745
Southend-on-Sea UA	42	3,802	14,818
Luton UA	43	4,295	17,082
Knowsley	86	1,745	13,015
Plymouth UA	80	3,000	12,573
Newcastle-upon-Tyne	113	2,294	12,579
Brighton and Hove UA	83	3,023	11,243
Hastings	30	2,886	13,751
Bristol, City of UA	110	3,482	13,923
Bournemouth UA	46	3,547	12,849
Stoke-on-Trent UA	93	2,553	12,081
Redbridge	56	4,326	13,361
Sunderland	137	2,030	10,891
Coventry	99	3,089	13,869
Hounslow	56	3,870	13,293
Merton	38	5,112	13,091
Salford	97	2,224	12,450
Derby UA	78	2,861	12,428

Enfield	81	3,486	12,576
North Tyneside	82	2,321	10,944
Wirral	157	1,975	9,724
Croydon	87	3,890	12,579
Lincoln	36	2,408	10,952
Ipswich	39	2,976	11,832
Walsall	104	2,428	12,237
Harrow	50	4,193	10,730
Dudley	98	3,112	11,623
Slough UA	33	3,725	12,320
Sefton	153	1,840	8,216
Tameside	103	2,063	9,519
Barnet	87	3,694	9,788
Sutton	44	4,126	9,412
Bexley	61	3,612	9,373
Torbay UA	63	2,081	8,770
Gloucester	41	2,727	8,977
Wigan	188	1,603	6,402
Watford	21	3,751	10,484
Reading UA	40	3,574	10,462
Exeter	47	2,363	7,753
Bolton	140	1,871	8,676
Stevenage	26	3,068	10,542
Gosport	25	3,043	9,059
Worthing	32	3,000	8,363
Worcester	33	2,801	8,694
Oxford	46	2,952	8,487
Kingston upon Thames	37	4,031	7,174
Harlow	31	2,572	9,098
Tamworth	31	2,418	8,275
Northampton	81	2,404	7,851
Stockport	126	2,246	7,140
Bury	99	1,823	6,545
Trafford	106	1,978	6,448
Cambridge	41	2,719	6,396
Havant	55	2,103	7,441
Eastbourne	44	2,055	7,228
Cheltenham	47	2,360	5,820
Richmond upon Thames	57	3,038	5,226
Weymouth and Portland	42	1,539	5,154
Havering	112	1,997	5,306
Hillingdon	116	2,131	5,694
Poole UA	65	2,130	5,852
Castle Point	45	1,935	5,012
Bromley	150	1,977	4,438
Oadby and Wigston	24	2,411	4,759
Crawley	45	2,219	5,679
Rushmoor	39	2,320	4,501
Broxbourne	51	1,701	4,016
Spelthorne	45	1,998	3,508
Epsom and Ewell	34	1,960	2,672

References

- ¹ **Maller C, Townsend M, Brown P, St Leger L. Healthy Parks.** (2002) The health benefits of contact with nature in a park context. Deakin University, Parks Victoria.
- ² **Rhode CLE and Kendle AD.** (1997). Nature for people. In Urban Nature Conservation-Landscape Management in the urban Countryside pp 319-335. London: E & FN Spon.
- ³ **Ulrich RS.** (1993) Biophilia, Biophobia and Natural Landscapes. In The Biophilia Hypothesis (Ed by Kellert, SR & Wilson, EO.) pp 73-137. Washington DC: Sherawater Books/Island Press.
- ⁴ **Kaplan R and Kaplan S.** (1989) The experience of nature: A Psychological Perspective. Cambridge University Press.
- ⁵ **Department of Health** (1995) How much physical activity should we do? The case for moderate amounts and intensities of physical activity. Health Education Authority and Strategic Statement on Physical Activity.
- ⁶ **Health Education Authority** (1998) Young and active? Young people and health-enhancing physical activity-evidence and implications.
- ⁷ **Hardman A.** (1999). Accumulation of Physical activity for Health Gains: What is the evidence? British Journal of Sports Medicine; **33**, 87-92.
- ⁸ **Chief Medical Officer** (2004) At Least 5 a week: Evidence on the impact of physical activity and its relationship to health. A Report from the Chief Medical Officer HMSO April 2004.
- ⁹ **Department of Health** (1998) Health Survey for England. The Stationary Office
- ¹⁰ **Maniadakis N.** (1998) In Coronary Heart Disease Statistics Supplement 1998 London: British Heart Foundation.
- ¹¹ **Allied Dunbar National Fitness Survey** (1992) Main findings London: Health Education Authority, Sports Council.
- ¹² **Department of Health** (1998) Health Survey for England: the Health of young people, 1995-97. Office of National Statistics
- ¹³ **Institute of European Food Studies** (1999) A Pan-EU Survey on consumer attitudes to physical activity, bodyweight and health. IEFIS, Trinity College Dublin.
- ¹⁴ **Physical Activity and Cardiovascular Disease Prevention** (1998) The European Heart Network.
- ¹⁵ **Morris JN.** (1994) Exercise in the prevention of CHD: today's best buy in public health. Med. Sci. Sports Exercise: 26 (**7**); 807-814.
- ¹⁶ **Singleton N.** (2000) Psychiatric morbidity among adults. National Statistics. London.
- ¹⁷ **Office for National Statistics** (2000) UK Time Use Survey.
- ¹⁸ **Lee and Skerret** (2001) Physical activity and all-cause mortality: what is the dose-response relation? Medicine and Science in Sports and Exercise.
- ¹⁹ **Gregg EW, Cauley JA, Stone K, Thompson TJ, Bauer DC, Cummings SR and Ensrud KE.** (2003) Relationship of changes in physical activity and mortality among older women. Study of Osteoporotic Fractures Research Group. JAMA;2003 May 14;289(18):2379-86.
- ²⁰ **Hakim AA et al** (1998) Effects of walking on mortality among non-smoking retired men. New England Journal of Medicine; 338:94-9.
- ²¹ **British Heart Foundation** (2003) Coronary heart disease statistics.
- ²² **Button A and McPherson K.** (2000) National Heart Forum.
- ²³ **Joliffe JA, Rees K, Taylor RS, Thompson D, Oldridge N, Ebrahim S.** (2004) Exercise-based rehabilitation for coronary heart disease. The Cochrane Library. Issue 1. Oxford: Update Software.
- ²⁴ **Hambrecht R, Niebauer J, Marburger C, Grunze M, Kalberer B, Hauer K, Schlierf G, Kubler W, Schuler G.** (1993) Various intensities of leisure time physical activity in patients with coronary artery disease: effects on cardiorespiratory fitness and progression of coronary atherosclerotic lesions. J Am Coll Cardiol; 22 (2):478-9.
- ²⁵ **Hagberg JM, Park JJ and Brown MD.** (2000) The role of exercise training in the treatment of hypertension. Sports Med; 30 (3): 193-206.
- ²⁶ **Cabinet Office Strategy Unit** (2002) Health economics model for Game Plan, Dec 2002.

-
- ²⁷ **Hu FB, Stampfer MJ, Colditz GA, Ascherio A, Rexrode KM, Willett WC, et al.** (2000) Physical activity and risk of stroke in women. *Journal of the American Medical Association*; 283: 2961-2967.
- ²⁸ **British Heart Foundation** (2000) Coronary Heart Disease Statistics.
- ²⁹ **Department of Health** (2001) National Service Framework for Diabetes.
- ³⁰ **Diabetes Prevention Program Research Group** (2002) Reduction in the incidence of Type 2 Diabetes with Lifestyle intervention or Metformin. *N Eng J Med*; Vol.346. No6.
- ³¹ **Pan XR, Li GW, Hu YH, et al** (1997) The effects of diet and exercise in preventing NIDDM in people with impaired glucose tolerance: The Da Qing IGT and diabetes Study. *Diabetes Care*; 20:537-44.
- ³² **Hu FA, Sigal RJ, Rich-Edwards JW, Colditz, Solomon CG, Willet WC, Speizer FE and Manson JE.** (1999) Walking compared with vigorous Physical activity and Risk of Type 2 Diabetes in Women. *JAMA*; 282 No15.
- ³³ **Slattery ML, Potter J, Caan B, Edwards S, Coates A, Ma K-N and Berry TD.** (1997) Energy Balance and colon cancer – beyond physical activity. *Cancer Research*; 57, 75-80.
- ³⁴ **Hardman AE.** (2001) Physical Activity and Cancer Risk. *Proceedings of the Nutrition Society*; 60, 107-113.
- ³⁵ **McTiernan A, Kooperberg C, White E, Wilcox S, Coates R and Adams-Campbell LL.** (2003) Recreational physical activity and the risk of breast cancer in postmenopausal women: the women's health initiative cohort study. *Journal of the American Medical Association*. 290: 1331-1336.
- ³⁶ **Courneya KS, Mackey JR and Jones LW.** (2000) Coping with cancer: can exercise help? *The Physician and Sportsmedicine* 2000; **28**: 49-73.
- ³⁷ **Vuori IM.** (2001) Dose-response of physical activity and low back pain, osteoarthritis, and osteoporosis. *Medicine and Science in Sports and Exercise* 2001; 33: S551-S586; discussion S609-S610.
- ³⁸ **Ettinger WH, Burns R, Mesier SP, Applegate W, Rejeski WJ, Morgan T, Shmaker S, Berry MJ, O'Toole M, Monu J, and Craven T.** (1997) A Randomised trial comparing aerobic exercise and resistance exercise with a health education program in older adults with Knee Osteoarthritis. *The Fitness Arthritis and Seniors Trial (FAST)*. *JAMA*; 277 : 25-31.
- ³⁹ **BWJH Pennix et al.** (2001) Physical exercise and the prevention of disability in activities of daily living in older persons with osteoarthritis. *Archives of Internal Medicine*; 161:2309-2316.
- ⁴⁰ **ARC epidemiology unit University of Manchester** (2002) Arthritis the big picture: www.arc.org.uk/about_arth/bigpic.htm
- ⁴¹ **Department of Work and Pensions** (2000) Analytical services division.
- ⁴² **Sproston K and Primatesta P.** (2003) Health Survey for England 2002. The health of children and young people. London: The Stationary Office.
- ⁴³ **Prescott-Clarke P and Primatesta P.** (1999) Health Survey for England 1997. London: The Stationary Office.
- ⁴⁴ **Chin S and Rona RJ.** (2001) Prevalence and trends in overweight and obesity in three cross-sectional studies of British Children, 1974-94. *British Medical Journal*; 322:24-26.
- ⁴⁵ **NAO** (2001) Tackling Obesity in England, pp16-17. National Audit Office Report
- ⁴⁶ **Wanless D.** (2004) Securing Good Health for the whole population. Feb 2004 HM Treasury.
- ⁴⁷ **Biddle S and Faulkner G.** (2000) Benefits of physical activity on Psychological Well-being for Older Adults. Review for the BHF National Centre for Physical Activity and Health.
- ⁴⁸ **Lawlor DA, Hopker SW.** (2001) The effectiveness of exercise as an intervention in the management of depression: Systematic review and meta-regression analysis of randomised controlled trials. *British Medical Journal*; 322:1-8.
- ⁴⁹ **Mutrie N.** (2000) The relationship between physical activity and clinically defined depression. Physical activity and psychological well being. Biddle SJH, Fox KR, Boutcher SH . London: Routledge: 46-62.
- ⁵⁰ **Blumenthal JA, Babyak MA, Moor K, Craighead E, Herman S, Khatri Pet al.** (1999) Effects of exercise training on older patients with major depression. *Archives of internal medicine*; 159:2349-2356.

-
- ⁵¹ **Babyak M, Blumenthal JA, Herman S, Khatri P, Doraiswamy M, Moor K, et al.** (2000) Exercise treatment for major depression: Maintenance of therapeutic benefit at 10 months. *Psychosomatic Medicine*; 62:633-638.
- ⁵² **Thomas CM, Morris S.** (2003) Cost of depression among adults in England in 2000. *Br J Psychiatry*; 183:514-9.
- ⁵³ **Fox KR.** (2000) Self esteem, self perceptions and exercise. *International Journal of Sport. Psychology*; 31: 228-240.
- ⁵⁴ **Taylor AH.** (2000) Physical activity, anxiety, and stress: A Review. In: Biddle SJH, Fox KR, Boutcher SH. *Physical activity and psychological well-being*. London: Routledge: 10-45.
- ⁵⁵ **Sherrill DL, Kotchou K and Quan SF.** (1998) Association of physical activity and human sleep disorders. *Archives of Internal Medicine*; 158:1894-1898.
- ⁵⁶ **Johnell O, Gullberg B, and Allander JA, MEDOS Study group.** (1992) The apparent incidence of hip fracture in Europe. A Study of national register sources. *Osteoporosis International*; 2, pp 298-302.
- ⁵⁷ **Grisso J, Kelsey J, Strom B, et al.** (1991) Risk factors for falls as a cause of hip fracture in women *N Eng J Med*; 324:1326-31.
- ⁵⁸ **Cummings SR, Nevitt MC, Browner WS, et al.** (1995) Risk factors for hip fracture in White Women. *N Eng J Med*; 332: 767-73.
- ⁵⁹ **University of York** (2002) *The Economic Cost of Hip Fracture in the UK*.
- ⁶⁰ **Burge R.** (2001) The Cost of osteoporotic fractures in the UK: Projections for 2000-2020. *Journal of Medical Economics*; 4: 51-62.
- ⁶¹ **Le Mura LM.** (2002) Maziakas MT. Factors that alter body fat, body mass, and fat free mass in pediatric obesity. *Medicine and Science in Sports and Exercise*; 34:487-496.
- ⁶² **Sibley BA and Etnier JL.** (2003) The relationship between physical activity and cognition in children: A meta-analysis. *Pediatric Exercise Science*; 15: 243-256.
- ⁶³ **World Health Organisation** (1997)
- ⁶⁴ **Rowe J MD and Kahn R** (1998) *Successful Aging*. Pantheon Books, New York.
- ⁶⁵ **Bob Laventure** Evidence to the Commons Select Committee.
- ⁶⁶ **Yaffe K, et al.** (2001) A Prospective study of physical activity and cognitive decline in elderly women. *Archives of internal medicine*; 161: 1703-1708.
- ⁶⁷ **Smith et al.** (2002) The Protective effects of physical activity on the development of Alzheimers disease. *American Academy of Neurology's Annual Meeting in Minneapolis 1998*. *Am J Epidemiol*; 1;156(5):445-53.
- ⁶⁸ **Lindsay J, Laurin D, Verreault R, Hebert R, Helliwell B, Hill GB and McDowell I.** (2002) Risk factors for Alzheimer's disease: a prospective analysis from the Canadian Study of Health and Aging.
- ⁶⁹ **Scottish Executive** (2002) *Lets Make Scotland More Active; A Strategy for Physical Activity*.
- ⁷⁰ **Pratt M, Macera CA and Wang G.** (2000) Higher Direct Medical Costs Associated With Physical Inactivity. *Higher direct medical costs associated with physical inactivity. The Physician and Sports Medicine*; 28(10):63-70.
- ⁷¹ **Schroeder HW.** (1991) Preference and Meaning of Arboretum Landscapes: Combining Quantitative and Qualitative Data. *Journal of Environmental Psychology*; Vol.11, pp.231-248.
- ⁷² **Hillsdon M, Thorogood M, Anstiss T and Morris J** (1995) Randomised Controlled trials of physical activity promotion in free living populations: a review. *Journal of Epidemiology and Community Health*; 49, 448-453.
- ⁷³ **Department of Transport** (2001) *National travel survey; 1999-2001 Update*. London Department of Transport.
- ⁷⁴ **ICM** (2000) *Research Marketing; February 2000*.
- ⁷⁵ **Office of National Statistics** (1997) *General Household Survey*.
- ⁷⁶ **Office of National Statistics** (1995) *General Household Survey*.
- ⁷⁷ **Hillsdon M, Foster C, Naidoo B, and Crombie H.** (2004) The effectiveness of public health interventions for increasing physical activity among adults: a review of reviews. *HDA*.
- ⁷⁸ **Riddoch C, Puig-Ribera A, and Cooper A.** (1998) *Effectiveness of Physical activity promotion schemes in primary care: a review*. London:HEA.

-
- ⁷⁹ **Westerterp KR.** (2001) Pattern and intensity of physical activity *Nature* 410 (6828):539 Mar 29, 2001.
- ⁸⁰ **Andreasen A.** (1995) Marketing Social Change.
- ⁸¹ **Cheshire County Council/Countryside Agency** (2003) Rights of way research.
- ⁸² **Giles-Corti B and Donovan R.** (2003) Relative Influences of individual, Social Environmental, and Physical Environmental Correlates of Walking. *American Journal of Public Health*; 93, 9 pg 1583-1589.
- ⁸³ **European Commission** (1999) A pan EU survey on consumer attitudes to physical activity, body weight and health. Brussels.
- ⁸⁴ **Countryside and Rights of Way Act** (2000). HMSO. Part 2 para 60 (1).
- ⁸⁵ **Department of Health** (1999) The NHS Plan 1999-2002. HMSO.
- ⁸⁶ **Regeneration Around Cities** (1999) The Role of England's Community Forests. The Countryside Agency.
- ⁸⁷ **English Nature** (2002) Revealing the value of nature.
- ⁸⁸ **Henwood K.** (2001) Exploring Linkages between the environment and Health: Is there a role for Environmental and Countryside Agencies in Promoting Benefits to Health: Forestry Commission.
- ⁸⁹ **Cabe Space** (2004) The value of Public Space. How high quality parks and public spaces create economic, social and environmental value. London.
- ⁹⁰ **CABE Space** (2004) A Guide to Producing Park and Green Space Management Plans. London.
- ⁹¹ **CABE Space** (2004) Green Space strategies. A good practice guide. London SE1 7NX.
- ⁹² **TNS Travel and Tourism** (2004) GB Day Visits Survey. Edinburgh.
- ⁹³ **Countryside Agency** (2001) State of the Countryside.
- ⁹⁴ **The Countryside Agency** (2000) Improving access to woods watersides and the coast. A joint report to Government on options for change.
- ⁹⁵ **Forestry Commission** (1999) England Forestry Strategy.
- ⁹⁶ **The Countryside Agency** (1999) Regeneration around cities. The role of England's Community Forests.
- ⁹⁷ **DEFRA** (2002) Working with the grain of nature: A biodiversity strategy for England.
- ⁹⁸ **Greenhalgh E and Worpole K.** (1995) Park Life: Urban Parks and Social Renewal.
- ⁹⁹ **Dunnet N, Swanwick C, and Woolley H.** (2002) Improving Urban Parks, Play Areas and Green Spaces. Report for DTLR.
- ¹⁰⁰ **Local Government Association** (2001). The value of Parks and Open Spaces: Social Inclusion and Community Regeneration. London.
- ¹⁰¹ **Urban Task Force.** (1999). Towards an Urban Renaissance. London.
- ¹⁰² **Frumkin H.** (2003) Healthy Places, Exploring the Evidence. *Am J Public Health* Vol 93;9 1451-1455.
- ¹⁰³ **Kaplan S and Kaplan R.** (2003) Health, Supportive Environments, and the Reasonable Person Model *Am J Public Health* Sep 2003 Vol 93;9 1484-1488.
- ¹⁰⁴ **Moore EO.** (1982) A prison environments effect on health care service demands. *J Environ Syst.* 1981-1982; 11:17-34.
- ¹⁰⁵ **Faber Taylor A, Kuo FE, Sullivan WC.** (2001) Coping with ADD The surprising connection to green play settings. *Environment Behav.* 2001;33:54-77.
- ¹⁰⁶ **Faber Taylor A, Kuo FE, Sullivan WC.** (2000) Views of nature and self-discipline: evidence from inner city children. *J Environ Psychol.* 2002; 22:49-64.
- ¹⁰⁷ **Kellert SR.** (2002) Experiencing nature: affective, cognitive, and evaluative development in children. In, *Children and Nature: Psychological, socio-cultural and Evolutionary Investigations.* Cambridge, Mass MIT press; 2002:117-151.
- ¹⁰⁸ **Ulrich RS.** (1984) View through a window may influence recovery from surgery. *Science.* 1984;224:420-421.
- ¹⁰⁹ **Kaplan R, Kaplan S.** (1995) The experience of nature: A psychological perspective. New York: Cambridge University Press.
- ¹¹⁰ **Kuo FE, Sullivan WC.** (2001) Environment and .crime in the inner city: Does vegetation reduce crime? *Environment Behav;* 33: 343-367.

-
- ¹¹¹ **Kuo FE, Sullivan WC, Coley RL, Brunson L.** (1998) Fertile ground for community: Inner-city neighbourhood common spaces. *Am J Community Psychol*;26:825-851.
- ¹¹² **Austin ME.** (2002) Partnership opportunities in neighbourhood tree planting initiatives: building from local knowledge. *J Arboriculture*. 2002;28:178-186.
- ¹¹³ **Inerfield RB and Blom BB.** (2002) A New tool for strengthening urban neighbourhoods. *J Affordable Housing*. 2002;11:128-134
- ¹¹⁴ **Takano T, Nakamura K, and Watanabe M.** (2002). Urban residential environments and senior citizens' longevity in megacity areas: the importance of walkable green spaces. *Journal of Epidemiology and Community Health*; 56, 913-18.
- ¹¹⁵ **The European Heart Network** (1999) Physical Activity and cardiovascular Disease Prevention in the EU.
- ¹¹⁶ **de Vries S, Verheij RA and Groenewegen PP.** (2001) Nature and Health The Relation between health and green space in people's living environment. Euro Leisure-congress Netherlands.
- ¹¹⁷ **Tanaka A, Takano T, Nakamura K, et al.** (1996) Health Levels influence by urban residential conditions in a megacity- Tokyo. *Urban Studies*; **33**:879-94.
- ¹¹⁸ **Ewing R, Schmid T, Killingsworth R. Zlot A, Raundenbush S.** (2003) Relationship between urban sprawl and physical activity, obesity and morbidity. *American J Health Promotion*, 18 No1 47-57
- ¹¹⁹ **Humpel N, Owen N, Leslie E,** (2002) Environmental factors associated with adults participation in physical activity: A review. *Am J Prev Med* 2002;22(3).
- ¹²⁰ **Owen N, Humpel N, Leslie E, Bauman A, Sallis J** (2004) Understanding Environmental Influences on Walking. Review and Research Agenda. *Am J Prev Med* 2004;27(1).
- ¹²¹ **King WC, Brach JS, Belle S, Killingsworth R, Fenton M, Kriska AM.** (2003) The relationship between convenience of destinations and walking levels in older women. *Am Journal of Health Promotion* 18 No 1.
- ¹²² **Foster C, Hillsdon M and Thorogood M.** (forthcoming) Environmental Perceptions and Walking in English Adults. (In Press 2004).
- ¹²³ **Bandolier** (1999) Exercising the way to better cardiac health; 3-5
www.jr2.ox.ac.uk/bandolier/ImpAct/imp03/i3-5.html
- ¹²⁴ **Bird W and Adams F.** (2001) Sonning Common Health Walks a Four Year Review. Australia walking the 21st Century conference, Perth 2001.
- ¹²⁵ **Ashley A, Bartlett S, Lamb M and Steel M.** (1999) Evaluation of the Thames Valley Health Walks Scheme. Participants Feedback Survey. Oxford Brookes University report no 9.
- ¹²⁶ **Lamb SE, Bartlett HP, Ashley A, Bird W.** (2002) Can lay-led walking programmes increase physical activity in middle aged adults? A randomised controlled trial. *J Epidemiol Community Health*. 2002 Apr;56(4):246-52.
- ¹²⁷ **www.whi.org.uk**
- ¹²⁸ **Buchanan HC, Bird W, Kinch RFT and Ramsbottom R.** (2000) The Metabolic and Physiological demands of brisk walking in older men and women. Health walks Research and Development Unit Symposium Oxford Brookes University.
- ¹²⁹ **Ulrich RS.** (1984) "View through a window may influence recovery from surgery". *Science*; Vol. 224, pp420-421.
- ¹³⁰ **Cooper MC and Barnes M.** (1999) Healing Gardens Therapeutic Benefits and design Recommendations. John Wiley and son. New York. pp 27-87.
- ¹³¹ **Regnier V and Pynoos J.** (1987) Housing the aged. New York: Elsevier Science.
- ¹³² **American Hospital Association** (1991) 'The quest for the perfect Unit Design'. AHA Technical Document 055301, September.
- ¹³³ **www.btcv.org/greengym_old/about/about.html and www.greengym.org**
- ¹³⁴ **Reynolds V.** (2002) Well-being comes naturally: an evaluation of the BTCV Green Gym at Portslade, East Sussex. Oxford Brookes University School of Health Care Report 17 ISBN 1-902606-15-9.
- ¹³⁵ **Reynolds V.** (1999) Green Gym Evaluation of the pilot project Sonning Common: Oxford Brookes OCHRAD report No 8.

-
- ¹³⁶ **Baranowski T, Thompson WO, DuRant RH, et al.** (1993) Observations on physical activity in physical locations: age, gender, ethnicity, and month effects. *Res Q Exerc Sport*; **64**:127-33.
- ¹³⁷ **Sallis JF, Nadir PR, Broyles SL, et al.** (1995) Correlates of physical activity at home in Mexican-American and Anglo-American preschool children. *Health Psychology*; **12**:390-8.
- ¹³⁸ **RSPB** (2004) Sustaining biodiversity: Revitalising the Biodiversity Action Plan process. RSPB.
- ¹³⁹ **Christie M, Warren J, Hanley N, Murphy K, Wright R, Hyde A, and Lyons N.** (2004) Developing measures for valuing changes in biodiversity.
- ¹⁴⁰ **Land Vote** (2002): Americans invest in parks and open space. www.landvote.org
- ¹⁴¹ **DEFRA** (1994). Biodiversity, the UK Action Plan. HMSO.
- ¹⁴² **RSPB** (2001) *Futurescapes*. RSPB.
- ¹⁴³ **Ulrich RS.** (1981) "Natural versus Urban Scenes: Some Psychophysiological Effects." *Environment and Behaviour*; Vol 13, pp.523-556.
- ¹⁴⁴ **Ulrich RS, Simons RF, Losito BD, Fiorito E, Miles MA and Zelson M.** (1991). Stress Recovery during exposure to natural and urban environments" *Journal of Environmental Psychology*, Vol 11, pp.201-230.
- ¹⁴⁵ **Kaplan R, Kaplan S and Ryan R.** (1998) *With people in mind: Design and Management of everyday nature*. Washington, DC: Island Press.
- ¹⁴⁶ **Schroeder HW.** (1991) "Preference and Meaning of Arboretum Landscapes: Combining Quantitative and Qualitative Data". *Journal of Environmental Psychology*, Vol.11, pp.231-248.
- ¹⁴⁷ **Ulrich RS and Addoms DL.** (1981). Psychological and recreational Benefits of a residential park.' *Journal of Leisure Research*, Vol.13, pp.43-65.
- ¹⁴⁸ **Ulrich RS.** (1986) 'Human Responses to Vegetation and Landscapes.' *Landscape and Urban Planning* **13**: 29-44.
- ¹⁴⁹ **Corti B, Donovan RJ, and Holman CDJ.** (1997) Factors influencing the use of physical activity facilities: results from qualitative research. *Health Promotion J Austr*; **7**:16-21.
- ¹⁵⁰ **Sport England, The Countryside Agency and English Heritage** (2003) *The Use of Public Parks in England*.
- ¹⁵¹ **Hahn A and Craythorn E.** (1997) Inactivity and physical activity in two regional centres. *Health Promotion J Aust*; **7**:16-21.
- ¹⁵² **DEFRA** (2001) Consultation Paper on Draft Guidance to Local Highway Authorities on the preparation of Rights of Way Improvement Plans.
- ¹⁵³ **Giles-Corti B, Macintyre S, Clarkson JP, Pikora T and Donovan R.** (2003) Environmental and Lifestyle Factors associated With Overweight and Obesity in Perth, Australia. *American Journal of Public Health Promotion* Vol18, 1.
- ¹⁵⁴ **Powell KE.** (2003) Places to walk: Convenience and regular physical activity. *Am J Public Health* Sep 2003 93:9 1519-1521
- ¹⁵⁵ **Box J and Harrison C.** (1993) Natural Spaces in Urban Places. *Town and Country Planning* 62 (9) 231-235.
- ¹⁵⁶ **Bird W.** (1995) *Sonning Common Health Walk*. Questionnaire of 348 participants.
- ¹⁵⁷ **Michael SE and Hull RB.** (1994) Effects of vegetation on Crime in Urban Parks. Savoy, IL International Society of Arboriculture Research Trust.
- ¹⁵⁸ **Cabe Space** (2004) *Raising the standard: The Green Flag Award Guidance Manual*.
- ¹⁵⁹ **Murtagh EM, Boreham CA and Murphy MH.** (2002) Speed and exercise intensity of recreational walkers. *Preventative Medicine*; Oct;35(4):397-400.
- ¹⁶⁰ **ODPM** (2004) *English Indices of Deprivation*. ODPM Publications.