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Exercise:
The miracle cure and the role of the doctor in promoting it

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Foreword

Being active has enormous health and well-being benefits. Physical activity is important in the management of long-term diseases, but, it is even more important in the prevention of many other common diseases. I believe that if physical activity was a drug it would be classed as a wonder drug, which is why I would encourage everyone to get up and be active.

As the population has become more sedentary, conditions such as diabetes and obesity have increased dramatically. The focus of previous reports has been on obesity and nutrition. This report focuses on the less well-known benefits of regular physical activity and the increasing risks of a sedentary lifestyle. Over 40% of adults do not reach the minimum recommended level of 30 minutes of moderately intense exercise five times per week. Evidence in this report highlights that those achieving even this minimum level of activity can reduce their risk of developing heart disease, stroke, dementia, diabetes and some cancers by at least 30%. A society-wide increase in moderate physical activity could help reduce health inequalities and improve mental, as well as physical, health.

Two recent studies neatly illustrate the lack of focus on this issue. The first, by researchers at King's College London [1] showed that 80% of obese patients had never discussed their weight with their GP. The second, by researchers at The University of Cambridge,[2] who conducted a Europe-wide study over 12 years showed that twice as many deaths are due to inactivity than are due to obesity on its own. The Academy has reported on the prime importance of healthy eating.[3]

This report outlines not just 'why' doctors in all four nations in the UK must take a leading role in the fight against a sedentary lifestyle, but commendably sets out in clear and simple terms 'how' they should do that. I recognise that doctors are frequently prevailed upon to take the lead when it comes to helping people become more active. For me though, this is an integral part of our role in the community. Doctors should lead by example and take every opportunity to provide wise counsel, especially on behalf of those patients who have fewest opportunities in society. I would like to thank the lead author Scarlett McNally and her colleagues on the Academy's Health Inequalities Forum for their painstaking work in writing this report.



Professor Dame Sue Bailey
Chair, Academy of Medical Royal Colleges

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Executive Summary

The big four "proximate" causes of preventable ill-health are: smoking, poor nutrition, lack of physical activity and alcohol excess. Of these, the importance of regular exercise is the least well-known. Relatively low levels of increased activity can make a huge difference. All the evidence suggests small amounts of regular exercise (five times a week for 30 minutes each time for adults) brings dramatic benefits. The exercise should be moderate – enough to get a person slightly out of breath and/or sweaty, and with an increased heart rate. This report is a thorough review of that evidence.

Regular exercise can prevent dementia, type 2 diabetes, some cancers, depression, heart disease and other common serious conditions – reducing the risk of each by at least 30%. This is better than many drugs.

The need to encourage individuals to participate in physical activity has never been greater. Half the population do not reach this level of activity, with wide variations between groups, sufficient to cause ill-health. The costs of physical inactivity to the UK, the NHS and other public bodies are estimated to be in excess of £15bn.

There are greater intangible costs too, to individuals, families and communities. In the UK now, lack of physical activity is acknowledged as one of the top four factors responsible for premature deaths and long-term diseases, and also as a key mechanism for large inequalities in health.[1,2,3,4,5,6,7] These factors (smoking, nutrition, lack of physical activity and alcohol) are often described as lifestyle choices, yet many people do not have the finances, self-efficacy, environment or knowledge to be able to exercise lifestyle "choices". These are the mechanisms by which inequalities develop. This report is about targeting just one of these factors.

Doctors are increasingly being asked to carry out a range of interventions when they see patients, including screening and changing behaviour, with initiatives such as 'Make Every Contact Count'.[8] However this report calls on doctors to promote the benefits of regular physical activity to their patients and to communities in their wider roles as 'advocates for health'. We have some tips, but the message is simple. Exercise is a miracle cure too often overlooked by doctors and the people they care for.

This report sets out what doctors can do on a one-to-one basis and in a broader way with communities and organisations, including their own as many doctors are themselves employers. Helping NHS staff to become more active will help change society. In a wider context, sports and recreational facilities need to actively seek a diversity of clientele, and infrastructure is needed to support more active travel and outdoor spaces. It then sets out a series of case studies which show how relatively simple measures designed to enable and encourage physical activity can make an impact on individuals' health.

This is about people and their doctors believing that the small effort involved is worth it because they are worth it. This needs to work across the life-course, from children to the very elderly.



Case Study: Prevention is better than cure

Two patients, Jane and Tracy, presented to the same GP in the same week with similar problems.

They were both in their late 40s and worked indoors as office administrators. Both were overweight with moderately high blood pressure and some depression. Both had recent worsening of back pain. The GP suggested to each that they avoid spending long periods sitting and try to be more active.

Angela...

worked in an Ambulance station with a cycle-to-work scheme. She set herself the goal of cycling to work, helped by other colleagues, especially through the dark and rainy times. Within a year Angela had a blood pressure within the normal range and some weight loss. She is now cycling with her son at weekends and has minimal back pain.

Tracy...

did not manage to increase her activity. She had several months off sick with back pain, which worsened with lack of activity. She bought a mobility scooter to save the pain and effort of moving out of a car. Her weight increased and her blood pressure stayed high, requiring medication that she felt made her tired. On one occasion, she fell from the mobility scooter, fracturing her proximal humerus, where the bone had developed osteoporosis from disuse.

This required surgery, then several months of physiotherapy. She was no longer able to work. Routine blood tests three years later revealed type 2 diabetes.



Case Study: Widowers

Two men sadly became widowers in the same week.
Both were in their late 60s, and were retired.

Albert...

decided he needed to do more and started attending the local “widows and widowers club” in Bexhill which held dances three times a week. He made friends and kept active over the next few years, requiring no medication and no additional care.

Alan...

thought he should prepare for the future by moving into a flat in sheltered accommodation, rather than staying in the family home. His main pastimes were watching T.V. and driving to the shops. He had increasing blood pressure and felt short of breath whenever he did an unaccustomed activity, such as climbing stairs.

Within 5 years, he was on several different medications for ischaemic heart disease, hypertension, osteoporosis and osteoarthritic pain. He required increasing care from his daughter, who started doing all his shopping, and from the social services team. He tripped over in the flat and sustained a hip fracture, which required major surgery. After the fracture, his daughter suggested that he move into a residential home, where he would be looked after. He died following a stroke a year later.

Although both Albert and Alan thought they were doing the best for their own future, Albert’s active strategy was better for long-term health. Alan’s sedentary lifestyle meant he had a dangerously low level of activity, with a vicious cycle of less activity and worsening health.

Part one:
The scale of the problem and the evidence that physical activity improves health in the short and long term

We have moved towards a sedentary society with changing work and domestic habits and patterns. We now drive cars, sit in front of computers or TVs and use domestic appliances. There are far fewer manual jobs. This means that physical activity is not routine for most people.[9] In 1949, 34% of miles travelled using a mechanical mode were by bicycle; today only 1-2% are.[10,11] Now half of all adults spend more than 5 hours sedentary every day.[12,13] Fear of traffic and fear of risks outdoors further limit people's activity.[14]

The link between physical activity and health benefits

Exercise has been called a "wonder drug" or "miracle cure".[2] Increasing physical activity improves health for those with chronic conditions and prevents many common serious medical conditions. The health improvements with physical activity are often greater than many drugs.[2,15,16] The effect is seen with small amounts of physical activity: 30 minutes, 5 times a week. For children 60 minutes per day is the recommended minimum.[17] There are four main physical causes of most preventable ill-health. These "big 4" proximate causes are: poor nutrition, smoking, lack of activity and alcohol. These are also the four main physical causes of most premature deaths and of most inequalities in health. Lack of physical activity is the most recently recognised modifiable risk factor of all the large contributors to ill-health.[1,17,18,19]

Evidence of improvement in health for those with chronic conditions and scale of improvement in the short term (table 1)

Table 1: Evidence of improvement in health for those with chronic conditions and scale of improvement

Condition	Evidence for improvement, and scale of improvement with physical activity
Short term improvements	Many papers report global improvements in health across a range of conditions.[17] *"Physical activity helps to manage over 20 chronic conditions, including coronary heart disease, stroke, type 2 diabetes, cancer, obesity, mental health problems and musculoskeletal conditions".*[20]
COPD	Physical activity improves cardiorespiratory health.[21] Furthermore, in COPD, exercise training reduces dyspnoea symptoms and increases ability for exertion.[16]
Heart disease and/ or Heart failure and/or Angina	All studies show clear improvements in cardiovascular health with moderate exercise.[30] There are similar beneficial effects for sufferers of angina.[27] Overall, exercise reduces cardiac mortality by 31%.[16]
Hypertension (high blood pressure)	Hypertension is very common with 10% of adults in England having this diagnosis.[31] Hypertension is responsible for 50% of strokes and 50% of Ischaemic heart disease.[7,30] Most people with hypertension are on long-term medication. Randomised controlled trials show a clear lowering of blood pressure with aerobic training.[16] The scale of the reduction has been quantified: 31% of patients on average experience a drop of at least 10 mmHg with regular physical activity.[33]
Cholesterol	Across several studies, exercise led to a reduction in LDL by an average of 1 to 2mmol/l and an increase in "good" High Density Lipoprotein (HDL).[16]

Obesity	Exercise only has a moderate effect in reducing obesity.[17,34] Aerobic physical activity has a consistent effect on achieving weight maintenance.[20,30] Exercise also changes the distribution of fat, by reducing the less healthy visceral [abdominal] fat – for some individuals the body weight may stay the same as muscle is built up but the reduction in visceral fat is highly beneficial for health.[16]
Depression	There has been a wealth of evidence on the effect of exercise in the treatment of depression, most showing positive outcome.[22] A Cochrane review showed a moderate improvement [23] and in 2009 the Chief Medical Officer's annual report stated that exercise may be as effective as medication in treatment of depression.[2] NICE [24] guidance on the treatment of depression recommends and gives evidence for the uptake of physical activity as part of a package of other measures. Simple activity has been found to be highly effective for people with mental health issues, eg the 'walk in to work out' trial in Glasgow,[22,25,26] sustained good results for older people with depression,[22] significant improvements in depression with activity [27] and a 90% improvement in self-esteem and well-being with "ecotherapy" or any physical activity outdoors.[28] Trials with small numbers of patients do not always detect clear differences in mental health with physical activity.[29] An updated Cochrane review 23 evaluated 30 trials of physical activity as a treatment for depression, showing overall 'moderate' improvement.
Peripheral vascular disease	Exercise leads to a moderate improvement in peripheral vascular disease.[17] Improvements are seen in both pain-free walking time and distance in several studies.[16]
Diabetes	Exercise has a statistically and clinically significant beneficial effect on glycemic control[16] and the metabolic state.[35] Exercise works as a treatment modality in both type 1 and type 2 diabetes.
Osteoarthritis Joints / Low back pain / osteoporosis	Osteoarthritis is sometimes thought to be related to "wear and tear" yet physical activity improves symptoms of osteoarthritis by 22-83% and does not lead to worsening of this condition. It has benefits in reducing pain (by 25-52%), improving function, improving quality of life and mental health.[30] Others have commented on exercise being weakly effective in osteoarthritis[17] and leading to moderate improvement in low back pain.[17] Exercise increases muscle strength and coordination.[30]
Chronic pain	Exercise leads to improvement in pain conditions by 25 -52%.[30]

Fibromyalgia and fatigue	Aerobic exercise improves physical function and well-being in fibromyalgia.[16] It can also reduce the symptom of fatigue seen in different conditions.
Cancer	There are few studies looking at exercise as a treatment for cancer, and effects would be expected to vary by type of cancer. In prostate cancer, a 57% lower rate of cancer progression was found with exercise.[36] Exercise helps with side-effects of treatment, improves mood, fatigue and stamina and probably prolongs life.[37]
Dementia	Physical exercise improves cognitive function and consistently reverses brain atrophy.[38] A significant relationship between physical activity training and improved cognition was obtained for both normal adults and patients with early signs of Alzheimer's disease, in which memory or cognitive ability was mildly impaired.[39] Some studies lament the paucity of case-control studies for exercise in people with established dementia, but all show "strong indications of benefits" in well-being, quality of life, improved balance and strength with reduced falls and more prolonged independence.[40]

It should be noted that these effects occur at low levels of activity – 30 minutes, 5 times per week. The largest health gains occur in people moving from inactive to moderately inactive and from moderately inactive to moderately active [41]. The effects work by different mechanisms. In patients with multiple co-morbidities, physical activity can improve several conditions in different ways.[16,41,42,43] The benefits of physical activity work independently from those of weight change. Increasing 'fitness' works in a different way to reducing 'fatness' [44,45] so even people who are overweight can improve their metabolic health by exercising, even if they don't necessarily lose weight.[46]

Type 2 Diabetes – the personal costs and the beneficial effect of exercise

Type 2 diabetes causes problems with sugar processing, metabolism and inflammation. It also causes damage to small blood vessels (microvascular disease), large blood vessels (macrovascular disease) and nerves. There is a greater tendency to infection and a reduced capacity to heal.

Complications are common and affect all systems: diabetic retinopathy (eyesight), nephropathy (kidney failure), neuropathy (nerve damage), microvascular complications, ulcers and sexual dysfunction. Amputations can be needed for infection and poor nerve function in digits or legs. 6,000 foot amputations occur per year in the UK as a result of diabetes.[47]

Individuals with diabetes have a life expectancy that can be shortened by as much as 15 years, with up to 75% dying of macrovascular complications. In England around 1.3 million people currently have a diagnosis of diabetes and the incidence is increasing in all age groups. Around 5% of total NHS resources and up to 10% of hospital inpatient resources are used for the care of people with diabetes. For people with type 2 diabetes, lifestyle interventions are at least as effective as drug treatment. In common with other long-term conditions, the concept of "Number Needed to Treat for Benefit" is helpful is assessing the efficacy of a treatment; in type 2 diabetes, the NNTB is 6.4 for lifestyle interventions compared with 10 for medication, yet medication has more side-effects.[47]

For people without a diagnosis of diabetes, physical activity is proven to reduce the risk of developing type 2 diabetes by 50-80%.

Falls and independence in older people – the beneficial effect of exercise:

Older adults have worrying low levels of activity. Increasing activity could be the key to health improvement by reducing the risk of falls and fractures, by improving or preventing dementia and other long-term conditions and by enabling people to retain their independence. Older adults have the lowest levels of physical activity with only 7% achieving the recommended minimum frequency of five times a week.[48] The requirement for regular physical activity 5 times a week applies equally to older adults, who are often overlooked.[17]

Although older people have the greatest range of health status due to inactivity of any group, they also have the most to gain from increased activity [21]. Exercise is an important means of reducing disability and increasing the number of people living independently.[16]

Being physically active reduces the likelihood of developing dementia and the speed of decline in dementia.[38] Dementia is now the leading cause of death for women in England and Wales.[49]

Approximately 30% of people over 65 years of age living in the community fall each year.[50,51] 10% (70,000) of ambulance call-outs per year are for older people needing urgent treatment after a fall.[52] 75,000 hip fractures occur per year in the UK, with 95% requiring an operation. 30% of people with a hip fracture die within a year [53] and 50% are dependent for activities of daily living after a hip fracture.[50]

Numerous studies show that exercise programmes are highly effective in older adults [50,54] and that most will stick to them.[54,55] Physical activity programmes for older adults that emphasise balance training, coordination and muscle strengthening safely significantly reduce the risk of falls by 30-50%.[21,30,50,52,56,57,58] Exercise also maintains muscle strength and increases bone mineral density so fractures are far less likely even after a fall.[17,55] Being physically active reduces the risk of later hip fracture by 35-68%.[2,20,30,59]

Evidence of improvement in health for those with chronic conditions and the scale of improvement on the long term

Physical activity comes into its own in the scale of the prevention of future ill-health. There is clear evidence that undertaking physical activity 5 times a week, for 30-minutes each time, can reduce the chance of developing a number of serious and very common conditions.

Table 2: Long term benefits (i.e. preventing diseases) Evidence of reduction in risk of common conditions, and scale of reduction, with exercise at the 30-minutes 5-times-per-week level:

Condition	UK lifetime risk of condition*	The reduction (%) in a person's chance of developing each condition by doing the recommended level of exercise	Evidence for physical activity preventing certain conditions and the impact (by % of cases prevented)
All-cause mortality (death)	-	30%	Many studies give an approximate 30% risk reduction in all-cause mortality.[30] Smoking is the biggest contributor to early mortality and years living with chronic illness and disability. Physical inactivity, through multiple mechanisms produces an effect one-third the effect of smoking.[6,7,19,44] The World Health Organisation[60] has physical activity as a main plank in its strategy to reduce non-communicable diseases.
Heart disease	33%[61]	40%	Two-thirds of the burden of cardiovascular diseases can be attributed to the combination of diet and physical inactivity.[7] Physical activity has a very strong effect in reducing the development of heart disease.[17] Studies vary in quantifying the reduction in risk of heart disease as "up to 50%",[3] or "20 - 35% lower risk" of cardiovascular disease and coronary heart disease.[20,30] People who change from doing minimal activity to moderate activity have most to gain.[2] Across a population, a move to active travel alone could reduce heart disease by 10%.[62,63]

Hypertension (high blood pressure)	70%[64]	50%	Exercising regularly reduces the risk of ever developing hypertension by 52%.[33]
Stroke	17%[65]	30%	Different reports quote exercise as reducing the risk of stroke or of mortality from stroke by 20 - 40%.[2,3,20,30]
Type 2 Diabetes – including infections, wound healing, vascular disease, ulcers etc. See box 1 for importance of Diabetes	10%[66,67]	50%	There is evidence of a strong effect of physical activity in reducing type 2 diabetes ever occurring.[17] Different reports quantify this slightly differently as: "30 - 40%",[20] "35-50%"[30] or "up to 50%"[3] lower risk of type 2 diabetes. It has been noted that exercise is more effective than medication in preventing progression to diabetes.[48,68,69] Overall, 80-90% of type 2 diabetes can be prevented by lifestyle changes (principally nutrition and physical activity).[68] This is similar to good nutrition, and both lifestyle interventions work synergistically.
Obesity	25%[70]	10%	Whilst physical exercise only has a "modest"[71] or "moderate" effect on weight-loss without appropriate dietary restrictions,[71] it does however help individuals maintain a healthy weight. Aerobic physical activity has a consistent effect in achieving weight maintenance.[30]
Cancer	33%[72]	Unclear	The effect of physical activity varies with different types of cancer. Overall, the reduction in risk of cancer is "moderate".[17]
Breast cancer	13%[73]	25%	Most studies report a "moderate effect"[17] with a 20%[30] or even 30%[2] lower risk of breast cancer with physical activity.
Bowel cancer	6%[73]	45%	Physical activity has a very strong effect in reducing the occurrence of bowel cancer[17] This is quantified at 30-50% lower risk.[2,30,74] The 30 to 50% lower risk of colon cancer in men and women across 19 international studies was related to the beneficial effect of exercise on growth factors and insulin resistance.[74]

Depression	33%[75]	30%	There is a 20% to 33% lower risk of developing depression, for adults participating in daily physical activity. [2,20,35]
Dementia	13%[76]	30%	The evidence is fairly consistent in quoting reduced risks of developing dementia at "20-50%". [20,35,77,78] Since the onset of dementia is not always clearly defined, it is also helpful to note that moderate physical exercise a few times per week reverses brain atrophy in the critical areas of the hippocampus and frontal lobe so delays the progression of the disease.[38]
Low back pain	65%[79]	40%	Exercise is very useful in reducing the symptoms from low back pain from progressing.[17]
Osteoarthritis	14%[80]	50%	Analysing several studies quantified the reduction in risk of developing arthritis by undertaking moderate exercise at between 22-83%.[30]
Falls in elderly	50%[56]	40%	A number of studies have consistently shown the sustainable benefits of exercise programmes in reducing falls.[30,54] Most programmes specified balance and strength training exercises. Different studies found the rate of falls could be reduced by 30-50%.[50,52,56,57]
Osteoporosis	50%[81]	40%	There is a strong effect on reducing the development of osteoporosis (or weak bones).[17] The importance of exercise in preventing osteoporosis is not widely known.[82]
Major Fractures	35%[56,81,83]	50%	Being physically active works by several mechanisms to reduce the risk of serious fractures, principally by reducing the risk of falls and by reducing osteoporosis; being physically active reduces the risk of later hip fracture by 35-65%. [2,20,30]

References for UK lifetime risk of each condition: Heart disease [61], Hypertension [64], Stroke [65], Type 2 Diabetes [66 67], Obesity [70], Cancer [73], Breast cancer [73], Bowel cancer [73], Depression[75]. Dementia [76], Low back pain [79], Osteoarthritis [80], Falls in elderly[56], Osteoporosis [81], Major Fractures. [56, 81,83]

* Collated from a number of sources to give a scale of potential future problems – varies according to deprivation

How much exercise do we typically do?

The minimum recommended amount of physical activity is "5-times-per-week" at moderate intensity for 30 minutes, or 150 minutes per week for adults.[12 17 31] The Chief Medical Officers of the 4 nations modified this to include minimising the amount of time spent sedentary (sitting) and recommending 10-minute blocks of varieties of activities. [21] Only 56% of adults in England currently reach this minimum level [84] with 62% in Scotland doing so.[13]

Fewer than a third of adults over age 65 do sufficient exercise.[12,85]

Health survey Trends, 2008

Twenty seven per cent of UK adults do not even achieve 30 minutes of exercise in total over a week, putting them at a dangerous level of inactivity.[13.84]

Women report less time doing physical activity than men at all age groups by 10-60%.[13,84,86,87]

For children, the recommended minimum is 60 minutes moderate intensity exercise per day.[17] Girls do significantly less activity than boys.[13,88] Depending on methodology, some studies find only 21% of boys and 16% of girls reached the minimum target of one hour per day of exercise,[88] whereas others put these figures at 73% of boys and 68% of girls reaching the minimum target.[13,89]

People in the most deprived socio-economic groups undertake 50% less structured physical activity than those in the least deprived groups.[86] The differences in activity levels between groups and within groups mirror the profile of inequalities in health.[41] There are wide geographical variations, linked with socio-economic deprivation; for example, the proportion with dangerously sedentary lifestyles, reporting less than 30 minutes activity per week, is 38% in Bradford, West Yorkshire and 17% in Cambridge.[84]

How is lack of physical activity linked to inequalities in health?

Across the UK there are huge differences in life expectancy and in health between people in different socio-economic groups and between people with different characteristics.[90] People in the poorest areas on average spend up to 17 more years living with poor health, die seven years earlier than those in the richest areas [91] and are more likely to have several medical conditions.[92,93] Recent reports by the British Medical Association [94], Department of Health,[95] Marmot at the Institute for Health Equity,[96] Chief Medical Officers,[20] Royal College of Physicians [97] and Royal College of General Practitioners,[98] have recommended that the medical profession should lead on actions to reduce inequalities in health. Despite decades of such reports, no appreciable change has occurred. There are very few interventions that reduce inequalities in health.[95]

This is similar to good nutrition, and both lifestyle interventions work synergistically. Despite decades of such reports, no appreciable change has occurred. There are very few interventions that reduce inequalities in health.[95] Improving people's health and wellbeing is a key way to tackle health inequalities.[90,100,101,102] The inequalities gap is widening because recent reductions in the four unhealthy behaviours (smoking, alcohol intake, poor nutrition and inactivity) have been greater in more affluent people.[4]

There is mounting evidence that physical inactivity is a major causative physical link between social inequality and poor health.[1,2,3,4,4,5,6,7,101,103] There is also evidence that tackling physical inactivity should be a major focus to improve health across different groups [95,96] (APCOPA, 2014). There is no other viable intervention which has the potential to improve health in the UK on such a scale. The dose-response graph between amount of physical activity and all-cause mortality is a straight line with a sharp gradient down (Lee and Skerrett 2001). This inverse linear dose-response relationship not only suggests a strong cause and effect relationship between physical inactivity and mortality, but also suggests that even small increases in physical activity can have a life-prolonging (and life-enhancing) effect.

There are barriers stopping people being active, which are different for people from different groups.[18,21,101,106,107,108] Inequalities in physical activity exist across almost all the nine protected equalities characteristics and across socio-economic groups (PHE, 2014, HM Govt and Mayor of London 2014). People from BME backgrounds are 9% less likely to reach the minimum activity target [84] and 10-25% less likely to be able to swim or cycle.[85] Only 11% of Bangladeshi and 14% of Pakistani women were reported to have undertaken the recommended amounts of physical activity, compared with 25% in the general population.[3] Similarly, Asian women are far less likely to participate in sports than women of mixed background or white women.[100] Unemployed people are 60% less likely to have undertaken physical activity than employed people.[85] People with a disability have less than half the activity levels of those without.[84,107] Fewer than 20% of people with learning disabilities achieve the minimum target for activity.[110]

19% of the UK population is classified as having a disability as set out in the Equality Act.[45] Only 36% of disabled people reach the minimum activity guidelines (30 minutes, 5 times per week), and 49% do not achieve even 30 minutes of activity per week.

Government policy recommendations include the need to: 'target the least active thereby helping to reduce health inequalities – in addition, the health gains for the least active are in relative terms greater than for those who are more physically active'.[45]



Case Study: Community dancing classes

Beryl is a surgeon working in an urban area. She realised that large numbers of Black and Minority Ethnic (BME) older people in the area were isolated and never exercised and many had heart disease and type 2 diabetes. As Trustee of a not-profit organisation, Beryl helped write a successful bid for funding for a new schedule of dancing classes at the community centre.[111] This enterprise is now thriving, with many people describing the classes as their motivation to get out and be more active. This is an extract from their bid:

"Dancing is a fun and sociable way to obtain 30mins of exercise a day. It is an aerobic exercise if done for more than 10 minutes can strengthen the heart and encourage weight loss. More importantly it can improve muscle strength and balance and reduce mental and physical stress. We also aim for the project to encourage community integration.

We can learn African dancing, Ballroom dancing, Indian dancing, Polish dancing, Turkish dancing etc. from our local community members. We will need to have suitable premises for the regular events, access to music via a laptop and specialist dance teachers for some sessions. We might hold events at weekends to ensure families can participate rather than just retired, unemployed or mothers during the day at weekly events.

We aim to ensure we can assist elderly people, single people, unemployed people and communities that are at high risk of heart disease – Turkish male smokers, Indians with diabetes and Africans with hypertension. We will be able to generate a lot of publicity for our project as it will be unique in bringing together community cohesion by involving different community members of our organisation."

Economic evidence for focussing on increasing physical activity as a means of improving health and reducing inequalities in health

There are sound economic reasons for encouraging people to be more active, for individuals and for the public purse.[112,113] Many analyses put the total cost of inactivity in the UK at over £20 billion a year.[45] Costs of inactivity include costs of at least £8bn relating to physical diseases[114] and over £7bn to mental diseases.[115,116]

The NHS UK budget is £120 billion[117] of which up to 70% is used for care of those with long-term conditions.[9] Financially, measures to support 'exercise 5-a-week' could generate savings of at least 15% of the NHS healthcare's £120 billion UK budget and a similar reduction of over 15% in the UK nations' social care budget.[113,118,119,120] Other bodies have made similar recommendations, including: NICE,[120] BMA,[78] Royal College of Physicians,[30] King's Fund [119] and the Department of Health.[3]

There are additional hidden costs due to reduced productivity.[3,121] 7% of the working age population is on incapacity benefit, of which 40% is related to mental ill-health and 30% to musculoskeletal conditions or injury.[122] There are further unquantifiable impacts on the children in these families. There are 6 million carers in the UK,[121] most looking after someone with a long-term condition (e.g. dementia, affecting 750,000).[123] Absenteeism (of carers or through sickness) costs the UK in total over 14bn,[121] at least £5.5bn of which is related to inactivity.[112]

The largest costs in social care supporting those with long-term conditions: an average Local Authority Residential care place or a complex package of care at home is £50,000 per person per year.[124] 11% of acute hospital inpatient beds are occupied by people with no acute illness, but unable to care for themselves.[125] The numbers of frail older people with multiple medical problems is increasing rapidly,[93] yet many conditions are preventable or improved with moderate physical activity.

Changes in infrastructure are needed to increase access places for physical activity and active travel especially for harder to reach groups.[2,10,21,62,78,120,126,127,128,129,130] The costs of improving the outdoor environment to increase activity are massively outweighed by the benefits.[120,131] Benefits to costs ratios of between 10:1 and 19:1 are reported for infrastructure to increase walking and cycling, mainly relating to health gains in the local population.[120,132,133]

The value of physical exercise to children. Dr Jane Ritchie, RCPCH

Physical activity is not just an important contributor to optimal weight; something which applies even to the very young. Exercise is one of the factors which promotes wellbeing and resilience §in childhood, thus improving health behaviours and health outcomes throughout life; resilience being the ability to overcome stressful situations or cope with challenging situations or environments which may have a negative impact on others, despite exposure to situations or insults that create negative effects in others. Evidence suggests that resilience and feeling connected has a positive effect on reducing participation in 'exploratory' or risk taking behaviour.[134] Compared with other OECD countries, the UK has a higher rate of inequality,[134,135] which restricts access for poorer children to creative, sporting or outdoor activities, resulting in a more sedentary and disconnected lifestyle.[135]

The benefits for children in terms of increased physical and mental health are the same, but there are the additional issues of *choice* and the *life* course to consider. Health is more than the result of personal choice and is clearly influenced by the environment in which people are conceived, raised and age. This is particularly the case for children, who do not make choices and learn to adopt the lifestyles to which they have been exposed.[136] The life-course perspective, and the idea that disadvantage accumulates throughout life, is central to Marmot Review,[102] which stresses that the close links between early disadvantage and poor outcomes over time can only be broken by taking action to reduce health inequalities before birth, and throughout the life of the child.[134] At the beginning of the life-course, maternal physical and mental health is one of the key drivers of life change throughout childhood, and socio-economic factors such as poverty, unemployment or homelessness may exert their effects on the child by the overall reduction in parental capacity to meet their own, and their children's, emotional and developmental needs.[137]

Fewer than half of children aged 11 to 15 years engage in at least one hour per day of moderate to vigorous physical activity, and the rate decreases with age. A body of evidence points to the fact that many children are leading a more sedentary life and not experiencing the physical challenges that help them mature and develop resilience,[134] and in this respect the accessibility and safety of the built environment is particularly important. Those living in disadvantaged circumstances or poverty, may also experience a lack of parental motivation and initiative, or simple material poverty that does not allow for sports kits, swimming sessions, skate boards or bikes.

This poor level of exercise in children is an important area that should be corrected through intervention and education. Schools, and even early child-care facilities, play an important part, and community initiatives to engage families are ideal. If facilities for exercise or sport are difficult to access or too expensive they will not be used. Investment in open spaces, leisure centres, sports facilities and exercise equipment in parks would help to increase engagement in activity and reduce health problems resulting from a sedentary life. Schools, local authorities, the voluntary sector, those interacting with children and parents need to make sure the right environment is available, ie open spaces and playing fields . One example of an initiative that works to increase exercise is the charity "Living Streets' Walk to School" campaign, which reaches more than 1.9 million children each year.[134] Encouraging adults to be more active will be easier if they have been children who did not become obese, are in the habit of being active and know the benefits to one's sense of well-being that accrue from regular exercise.

Part two:
The role of the doctor in promoting physical activity

Why are doctors the key to encouraging increased physical activity?

Doctors are unique in being trusted, often seeing people at their most vulnerable and interacting with many of those suffering the worst health, in particular those with the most to gain from small improvements in health. Since such a large proportion of the population are inactive or moderately inactive, 'even small differences in lifestyle may make a big difference to health in the population and encourage behaviour change'.[138] Life events can be triggers for change – a health scare, divorce, redundancy etc often create opportunities to re-evaluate.[139] Changing behaviour is very difficult. Messages that work best to 'trigger' a change are provocative and come from a trusted source.[140] Doctors already play a central role in evaluating risks and motivating patients with chronic disease [16]. Across all specialties, doctors take safety issues into account on an individual level.[16] We are also are privileged to see people at their most 'teachable moments'.[101]

By definition, doctors have most interaction with those who are most frequently unwell and hence the people who would have most to gain through regular physical activity. Doctors, especially GPs, have been increasingly expected to monitor and cajole their patients over a number of other measures, recently with the 'Make Every Contact Count' initiative.[91] Promoting physical activity may seem an extension of this but is very different. As doctors, we have traditionally focussed on a medical paradigm and the individual patient, yet the scale of improvements in health with physical activity make the promotion of physical activity into the key change to improve health across a very wide range of major and common conditions.

People are often advised to ask their doctor's advice before embarking on additional exercise. Many doctors doubt their own skills and influence, and feel they lack skills of behavioural advice or doing exercise.[112] Some with a good understanding of health inequalities respond with sympathy, rather than action.[141] Healthcare professionals already possess the required consultation skills to offer advice on increasing physical activity.[142,143] They often already recognise the underlying behavioural contribution to a presenting condition, and should be reassured that their skills in tackling this are just as effective as "trained" motivational coaches.[143] Follow up is often useful in supporting prolonged behaviour change and is routine for those on "exercise on prescription" schemes.[144]

As well as being in close professional contact with those suffering health inequalities, doctors have influence across the generations, which can work in changing what is considered a normal level of activity.

Doctors are pivotal to encouraging people to increase their levels of activity. "The term 'brief advice' is used in this guidance to mean verbal advice, discussion, negotiation or encouragement, with or without written or other support or follow-up. It can vary from basic advice to a more extended, individually focused discussion"; brief advice is very cost effective, especially in older people.[112]

What should doctors be saying to their patients?

The message is simple:

All adults should do physical activity at a minimum amount of 5-times-a-week, for 30 minutes each time. The sessions can be broken into 10- or 15-minute blocks.

The activity should be moderately intense – enough to get a little out of breath and/or to feel your heart rate increase, and/or to feel a little sweaty. For children, a minimum of one hour exercise is expected, five times a week.

Doctors may need to reassure people that the risks of exercise are very low. The risks of sudden death or severe cardiac events during exercise are extremely rare.[114] Even relatively small increases in physical activity are associated with some protection against chronic disease and improved quality of life.[3] Patients need to be advised to stop the activity if they have chest pain, and to slow down if short of breath. People with mechanical problems should avoid jogging or sports with high impact loading, and consider low impact activities such as swimming or cycling. Apart from this, there are surprisingly few restrictions.

The actual activities are not important, as long as they are moderately intense, can be fitted into the person's schedule and are regular. There is no difference between "structured exercise" and "lifestyle physical activity" in the protective effect offered for the number of minutes of activity.[48] The choice of activity should be relevant, rational and routine. The intensity may need to build up over several sessions. For some, a sociable activity is more likely to be maintained.[145] Young people from deprived backgrounds find group activities, sport and timetabled sessions more attractive when facilities are cheaper and they are given encouragement.[35,146] Fun activities are more likely to be sustained.[146]

Many activities can be promoted; brisk walking, cycling, climbing stairs, dog-walking, using outdoor gyms and dancing - even sexual activity can bring some benefits. Basing activities in communities leads to sustained acceptance.[35,146]

For example the Ekta (meaning Unity) project in Newham, East London brings together elderly, isolated, housebound or disabled Asian people and has had great success in increasing activity with regular bhangra dancing classes.

In Hertfordshire the council run Health Walks programme, specifically designed for people who don't want to or feel they can't use a gym, has 32,000 participants a year.

Exercises which increase muscle coordination, balance and bone strength reduce falls, osteoporosis and the risk of fractures by 30-50%.[50,52,58,148] Dancing has been promoted as part of a "boogie for your bones" campaign.[148]

People who regularly walk a dog are 34% more likely to attain sufficient weekly physical activity than those who do not.[147]

The doctor's role in changing behaviour and changing culture

It is hard to change behaviour.[149] Doctors supporting people to be more physically active need to borrow from coaching techniques, motivational interviewing skills and psychological concepts. This is about embedding the idea that physical activity is good for you. Encouragement, motivation and goal-setting improve long-term changes of behaviour with a physical activity program, especially for older people and women.[5,18,150,151,152,153] It is important to be able to advise or refer people on to somewhere, and this is where links with local authority, voluntary sector and private sector schemes can help. People are more likely to act on advice when motivated and when they feel they can get into a programme or the new activity easily.

Changing behaviour requires:

- Knowledge [114]
- Motivation
- Often a trigger
- Easily available opportunities and the skills to be able to change
- The individual to feel empowered or supported, eg by friends [154]
- A physical environment that facilitates the change
- A plan to cope with future potential failure and persevere [41,140]

The trust a person has in their own ability to change is "self-efficacy" - this can be addressed with motivational interviewing and goal-setting.[154] The "G.R.O.W" model of coaching [155,156] involves working through:

- Goal (what do I want to achieve?)
- Reality (what is it like now?)
- Options (what might work?)
- What next? (how can I do this and keep doing it?)

The Foresight report [157] on obesity stated that people have difficulty in:

A. Translating intention into action (long-term benefit, forgetfulness, short-term costs).

B. Being aware that Automatic attitudes are different from self-reported attitudes.

Their suggestion was that prior planning and "thinking through" help overcome the risk of failure as people become 'perceptually ready' to respond when temptation occurs.[157]

Motivational Interviewing involves similar concepts of engaging, agreeing a focus with the patient, then evoking the patient's own motivation to change, followed by planning.[158,159]

- Engaging
- Focusing
- Evoking
- Planning

Doctors should motivate people to stick to their plans and work through perceived and actual barriers, which are different for each individual. Physical inactivity is a lifestyle 'choice' yet those with most to gain often have the fewest opportunities to make choices. Doctors can help those who most need this. Regular checks on progress may be helpful and will be more effective if there is integration between primary and secondary care.

It is clear that 'for most people, the easiest and most acceptable forms of physical activity are those that can be incorporated in everyday life' [2]. It is easiest to fit exercise into a schedule as "active travel", eg walking children to school or cycling to shops.[78,160] This is low cost and leads to sustained behaviour change.[120,178] The Department of Health's "change4life" get going programme and NHS "live well" programme both encourage physical activity as part of a healthy lifestyle.[161]

As well as the individual level, a change in culture is needed so that it is no longer considered "normal" to spend a large amount of time sitting in cars, on sofas and at desks. Furthermore, it needs to become "normal" to do 30-minute sessions of physical activity five times per week. Perseverance with being more physically active is better with community-wide strategies. Changing behaviour needs to come from the individual, but also from their healthcare professionals, friends and family and from the environment. There is ample evidence that increased activity and sustained behavioural change is more successful in a culture that supports it. The risks of ill health from inactivity are very high and outweigh the very low risk of injury from engaging in health promoting activity.[162]

Ways of changing behaviour and changing culture range on a "ladder of interventions" from guiding choice to legislating.[9,163] The Academy's report [71] on obesity suggested ways to 'make the right choice the easy choice' by using the 'nudge effect'.[164] Similarly point-of-decision prompts in buildings are effective at encouraging people to use stairs rather than the lift.[165] The Lancet suggested a move had occurred "from nudge to nag".[166]

The local environment may contain perceived threats (litter, risk of assaults, disturbances from youths) which can deter people, especially the elderly, from walking or cycling in the local area, or letting their children play outside.[108] Conversely, improved facilities enable more outdoor activities.[139] Doctors need to understand the patient's environment and work with them to pick regular activities that will be sustainable for them.

Those who are less advantaged may be less likely to take up physical activity, and experience a greater range of barriers, both real and perceived, to integrating physical activity into their daily lives. Interventions to support groups who have fewer resources may need to be designed to reflect specific groups' living circumstances and may need to be provided in a more intensive and more sustained way.

Putting this into practice – the dos and don'ts of encouraging your patients to exercise

Any conversations on lifestyle should avoid suggesting blame. The scale and importance of physical activity to health has only been acknowledged recently, so past behaviour can be understood without judgement. Doctors should not shy away from these awkward conversations. Activities do not need to be costly and schemes such as 'cycle-to-work' schemes through salary sacrifice, or subsidised local recreational sessions may be useful.

Many unhealthy behaviours co-exist, such as smoking, inactivity, alcohol use and poor nutrition. These have a cumulative effect on ill-health, such that all 4 unhealthy behaviours reduces life expectancy by an estimated 14 years [138] It is possible, and indeed more successful, to tackle several unhealthy behaviours at once.[4,112]

Doctors giving the clear message that exercise at a minimum level of 30 minutes, 5 times a week, may need to focus on some practical simple steps.

DO:

1. Give a clear message the benefits to the person e.g. 'Walking briskly for 30mins a day can reduce your risk of developing dementia because it increases the blood flow to your brain'.

2. Work with the individual to see what form of exercise might work best for them and how to fit this into their schedule, 30 minutes, 5 times per week. Recognise some people may be put off by some types of activity. People with poor self-image are unlikely to want to do gym based exercise.

3. Signpost them to somewhere. Work with your local authority, Health and Wellbeing Board, Public Health bodies, local sports partnership and others to find out what is possible locally. Consider ease of access.

4. Recommend that friends and family help or work together, eg meeting for a walk as part of "active ageing" [9]. Social networks exert a powerful influence on individual behaviour. [9]

5. Follow up with regular checks at the next clinic, or by phone or text: 'How's the exercise going?'

6. Be a role model! Try cycling to work once a week and using the stairs when you can.

DONT:

1. Don’t be preachy or reprimand.

2. Don’t assume or imply that a patient is lazy

3. Don’t assume they will respond positively immediately – some people take time to consider things.

4. Don’t assume that because you have given information people will act on it

5. Don’t be afraid to suggest a different type of activity next time – the people with most to gain are those who do least.

The practicalities of increasing physical activity

For those unused to physical activity, it is recommended to build up to the level of 30 minutes five times a week over time. The simple message is that the sessions should start gently and build up. The F.I.T.T. principle suggests what can be changed over time to build up the exercise:

- Frequency (times per week) or
- Intensity (how hard) or
- Time (go longer) or
- Type of exercise (eg build up from walk to jog)

There are very few specific instructions for people with different conditions. Most people do not need special advice, as the instructions are simple. For a very small number of those with severe physical problems, a trained exercise therapist may be of benefit, and for others they can be very motivating and inspire cultural change.[30,151,167] Those with COPD should be encouraged to wear loose clothing as they may need to rely on diaphragmatic breathing. People with diabetes should exercise more and plan their nutrition around their schedule.[168]

People may be encouraged to maintain good posture: "Use your "core" muscles: stand tall with your shoulders back, pull in your lower tummy and pelvic floor muscles a little way whenever you are standing or walking"[169]

It can be useful to stretch gently before and after a vigorous activity. "When stretching, avoid bouncing as this can cause small muscle tears. Reach for a position and hold it for 5-30 seconds"[169]

For some patients, knowledge and confidence can be improved with a leaflet specific to their own medical condition. This may empower them to make the change. For example, very few people know that exercise can improve bone strength and prevent fractures.[82] Leaflets are available to help specific groups of people, eg older people[170] or those with cardiac problems[171] or lung problems[172] or osteoporosis.[173]

The increasing numbers of people using motorised mobility scooters[174] need to be aware that their own weekly schedule needs to change to incorporate more times of activity to compensate for their often dangerously low levels of physical activity.

Opportunities are limited by budget and self-efficacy. An 18-hole round of golf involves an average walk of 5 miles, but course fees can keep this exclusive.

Doctors should promote an active lifestyle. Although the benefits of "150 minutes per week" are equivalent to "5 times a week", there are problems with expecting a sport to fulfil the physical activity requirements; the weather, sporting injury and holidays can reduce the sustainability of sporting activity. Furthermore, there are issues around taking up sport for the first time, and maintaining sporting activity throughout the life course. The Olympic legacy may have left some with continuing sedentary behaviour, if they feel that sport is for spectating and that the Olympic ideal is impossible to achieve.[175] It may be easier and better to kick a football around for fun, than to sign up for a football team.[159] In addition, for increasing numbers of people, signing up for a future charity challenge is an excellent way of obtaining regular training sessions in the weeks leading up to the event.

The National Obesity forum[176] suggests being active is important in preventing and reducing obesity along with tackling "junk food". Doctors should start having these conversations, although they may be very difficult, as there is often stigma attached.[176]

It may be helpful for people to realise that there are a finite number of options

	Activity	Comment
Options	Walking	Good for all ages and cheap.[145] This needs to be fitted into a schedule. Brisk walking to get slightly out of breath is best. Dog-walkers are healthier as their exercise is regular.
	Cycling	Cycling can be good for all ages. Many people are put off cycling due to the perception that it is not safe,[154,177] yet the risks from injury and pollution when cycling are outweighed by additional fitness by around 20:1[178] Confidence is increased with simple safety knowledge, eg about road positioning.[120,130,131,163,177,179]
	Dancing	Many types. Often sociable activities.
	Swimming	Good for all ages, eg as a family.
	Play	Children, parents and grandparents can all gain from playing.
	Football, basketball, hockey, rugby, etc	Throwing or kicking a football around regularly may be more achievable and sustainable than signing up for a team.
	Skateboarding, roller-blading, using non-motorised scooter	Can encourage parents and children to be active travelling to and from school.
	Tennis, squash, badminton, martial arts	These are sociable activities. There is often more scope for beginners to build up slowly than people realise.[180]
	Jogging/running	Should start gently and build up. Less useful for those with mechanical problems (eg knee osteoarthritis).
	Exercise machine – run/row/cycle	These can help people reach their minimum target, either in a gym or at home. It can be difficult to stay motivated, and needs to be fitted into a schedule. Unfortunately, many machines remain in the spare room, unused.

Other aspects	Outdoor activities	Outdoor activities also help with bone and muscle strength through exposure to vitamin D from sunlight. 25% of adults in the UK are deficient in Vitamin D, with elderly people and women from BME backgrounds are at higher risk.[50,181,182]
	Charity or event	Many people are very motivated to stick to a regular training schedule if they are committed to a future event and especially if they are helping others.
Active lifestyle	Gardening	More vigorous activities are required to be useful (pushing a lawnmower rather than pruning).
	Stair-climbing	This can be part of a commitment to be more active.
	Sexual activity	Embarrassment or cultural issues often prevent healthcare professionals from acknowledging the proven rehab benefits of sexual activity in relationships.[183]
	DIY	More intense activities are useful.

The doctors' wider role as employers, leaders in their communities and health ambassadors

Many doctors have wider roles as employers, managers, inspectors or advisors. The NHS is the largest employer in Europe, employing a reported 1.7 million workers across the four nations, as well as being a service provider for all of UK society. The NHS, and other publically-funded bodies, should insist on planning health into the built environment (with access) and into human resource measures, supporting staff.[141,184] Improved physical activity reduces sickness at work. There are already various opportunities that can help, e.g. workplace wellbeing charter schemes, public health responsibility deal, and Cycle-to-Work schemes with salary sacrifice. Healthcare professionals' wider role in promoting physical activity should be part of the curriculum at all levels for all clinical staff.[185] Those with oversight of educational programs already have to be assured, and could monitor, that education produces 'competent and capable staff'.[186,187,188]

When commissioning services to prevent or treat conditions such as cardiovascular disease, type 2 diabetes and stroke or to improve mental health, physical activity advice should be incorporated into the care pathway.[112,189]

Clinicians on Health and Wellbeing boards should be champions for physical activity action at a local government and partnership level [78]. The most gains at community level are in two areas: first, ensuring sport and fitness opportunities appeal to non-traditional participants;[106,190,191,192,193,194] second, improving facilities for active travel and green or outdoor spaces.[78,129,145,195,196,197] Changes in infrastructure work better than expecting 'choice' for harder to reach groups. [3,10,25,35,62,78,100,120,126,127,128,129,198,199]

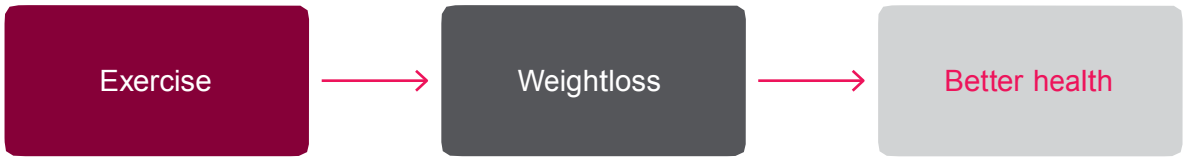
Planning that improves safety for those walking and cycling preferentially increases activity of women and older people and has other health gains from reducing pollution and collisions,[19,78,200,201,202,203,204,205,206,207,208] Doctors are widely respected[101] and interact with all sections of society.[209] They could make useful suggestions locally, since more affluent older people are over-represented in those objecting to planning proposals (eg skate parks which are used by younger people).[210] Targeted facilities for activity in deprived communities have been very successful with sustained uptake.[3,25,25] Doctors should support local charities to integrate physical activity messages and activity into what they do.

Exercise has health benefits in addition to any effects on a person's weight

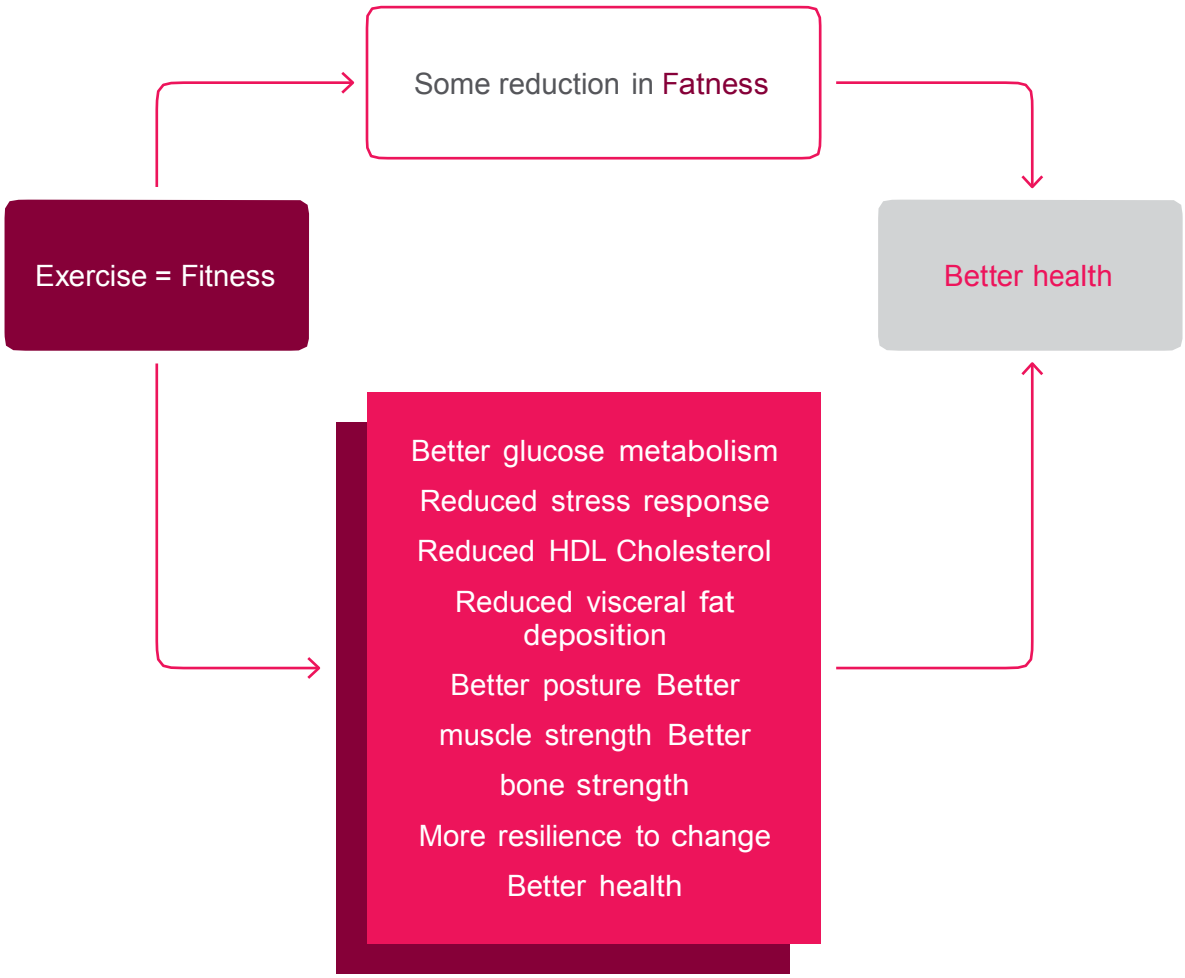
Diagram A



Diagram B



Fitness is more important than fatness



Conclusion

There is overwhelming evidence that physical activity improves the health of people with chronic conditions and also prevents many common diseases, reducing the risk of each of these by 20-50%. It does this at a very achievable amount of 30 minutes of moderate exercise, five times per week. Only 56% of adults achieve this 'minimum' weekly target and many people are dangerously inactive. Physical inactivity is responsible for a large proportion of the chronic physical and mental ill-health and is the final physical cause of many inequalities in health. Doctors should encourage individuals to achieve the minimum activity levels. Doctors already have the skills to do this. The messages are simple – start slowly and build up – but, do something. Regular activities need to be fitted into a schedule. Different groups experience different barriers which doctors are well-placed to understand, so the options are different for each person, although there are a finite number of options at each stage of the life course. Although many previous reports have called for action on health inequalities, there has not previously been the clear emphasis on supporting individuals to do more physical activity to improve health on a large scale.

Increased physical activity, particularly getting more people up to the minimum 30 minutes, 5 times a week level, would save over £18bn of NHS costs, saving at least 15% of the NHS budget. As the NHS faces a £30bn funding gap by 2020 the need to tackle preventable illness and disease has never been greater.

This report though, is not simply about saving money, it is about reducing pain and increasing the quality of care. An increase in physical activity at this level would reduce the risk of dementia, stroke and osteoporosis by 30% each which would have a powerful effect on social care costs and reduce the burden on the UK's 6 million carers.

This intervention is relatively inexpensive and has the potential to improve outcomes for all, not just selected groups. This 'Miracle cure' has reducing inequalities in health at its heart.

Doctors should also use their position in society to advocate for changes that will benefit on a wider scale, including harnessing the NHS workforce to help demonstrate and promote more physical activity. In local communities, doctors could advocate for better access to sporting and recreational facilities and changing the environment to enable active travel and activity in outdoor spaces.

In a world of shrinking resources and growing demand, promoting physical activity is the best way to improve the UK nations' health.

5-a-week physical activity Part 1

AHIF Health professionals' guide to 5-a-week

Physical activity + Five times-a-week + 30 minutes (can be in 10-minute blocks) + Moderately intense (increase breathing rate and heart rate) + For all Adults* (includes elderly and those with disabilities)

Why?

Regular exercise is a 'miracle cure'. Exercise reduces (by 30-80%) your chance of: dementia, type 2 diabetes, heart disease, stroke, depression, breast cancer, heart disease and osteoporosis (weak bones and fractures). Exercise helps manage many diseases too.

Warnings



5-a-week physical activity
Part 2

Practicalties

F.I.T.T: Start gently and build up:

Frequency (times per week) or
Intensity (how hard) or
Time (go longer) or
Type of exercise (eg build up from walk to jog)

Posture: Use your "core" muscles: stand tall with your shoulders back, pull in your lower tummy and pelvic floor muscles a little way whenever you are standing or walking.

Stretch: gently before and after a vigorous activity. When stretching, avoid bouncing as this can cause small muscle tears. Reach for a position and hold it for 5-30 seconds

Suggestions – different for different stages of the life-course:

- TRY brisk walking, dancing, walking the dog, stair climbing, gardening. Avoid sitting!
- TRY to fit it into your schedule: cycle to work/ exercise DVD before your TV program/ walk kids to school/ walk to shops/ family walk rather than family meal, etc
- KEEP MOTIVATED: perhaps exercise with a friend or use a phone exercise app?

Further info

Fit4life
www.nhs.uk/change4life/Pages/get-going-every-day.aspx

Chartered society of physiotherapists: Easy Exercise guide
http://www.csp.org.uk/documents/easy-exercise-guide-england

British Heart Foundation: "Be Active for life"
www.nhs.uk/change4life/Pages/get-going-every-day.aspx

Sustrans: "Bike belles: for women who want to cycle"
http://www.sustrans.org.uk/assets/files/BikeBelles_for_women_who_want_to_cycle_Feb_2010.pdf

Diabetes UK
www.diabetes.co.uk/exercise-for-diabetics.html

British lung foundation "How to get active"
www.blf.org.uk/Page/How-to-get-active

References in foreword

1. Booth HP, Prevost T, Gulliford MC (2015). Access to weight reduction interventions for overweight and obese patients in UK primary care: population-based cohort study. BMJ Open, 2015; 5 (1): e006642 http://bmjopen.bmj.com/content/5/1/e006642.full.pdf

2. Ekelund, U et al. (2015) Activity and all-cause mortality across levels of overall and abdominal adiposity in European men and women: the European Prospective Investigation into Cancer and Nutrition Study (EPIC). American Journal of Clinical Nutrition; 14 Jan 2015. http://ajcn.nutrition.org/content/early/2015/01/14/ajcn.114.100065.full.pdf+html

3. Malhotra A, Maruthappa M, Stephenson T (2014) Healthy eating: an NHS priority: A sure way to improve outcomes for NHS staff and the public. Postgrad Med J Nov 2014 http://m.pmj.bmj.com/content/early/2014/11/14/postgradmedj-2014-133103

References in main report

1. Drieskens S, Van Oyen H, Demarest S, Van der Heyden J, Gisle L, Tafforeau J (2010). 'Multiple risk behaviour: increasing socio-economic gap over time?' *European Journal of Public Health*, vol 20, no 6, pp 634–9 [ePub 2009] http://eurpub.oxfordjournals.org/content/20/6/634.abstract

2. Chief Medical Officer (2009) Annual report 2009, Department of Health http://www.sthc.co.uk/Documents/CMO_Report_2009.pdf

3. Dept of Health (2009). Be Active, Be Healthy: a plan to get the nation moving. http://webarchive.nationalarchives.gov.uk/20090410133341/http://www.diabetes.nhs.uk/news-folder/be-active-be-healthy-a-plan-for-getting-the-nation-moving/

4. Buck, D, Frosini F. (2012) Clustering of unhealthy behaviours over time Implications for policy and practice. Kings' Fund, London http://www.kingsfund.org.uk/publications/clustering-unhealthy-behaviours-over-time

5. Kings Fund (2008) Low-income Groups and Behaviour Change Interventions: A review of intervention, content and effectiveness. http://www.kingsfund.org.uk/sites/files/kf/field/field_document/low-income-groups-behaviour-change-intervention-kicking-bad-habits-paper.pdf

6. Blair SN (2009) Physical inactivity: the biggest public health problem of the 21st century. *Br J Sports Med January* 2009 Vol 43 No 1 http://bjsm.bmj.com/content/43/1/1.full.pdf+html

7. Murray CJL, Richards MAR, Newton JN, Fenton KA, Anderson HR, Atkinson C, Bennett D, Bernabé E, Blencowe H, Bourne R, Braithwaite T, Brayne C, Bruce NG, Brugha TS, Burney P, Dherani M, Dolk H, Edmond K, Ezzati M, Flaxman AD, Fleming TD, Freedman G, Gunnell D, Hay RJ, Hutchings SJ, Ohno SL, Lozano R, Lyons RA, Marcenes W, Naghavi M, Newton CR, Pearce N, Pope D, Rushton L, Salomon JA, Shibuya K, Vos T, Wang H, Williams HC, Woolf AD, Lopez AD, Davis A. UK health performance: findings of the Global Burden of Disease Study 2010. Lancet 2013; 381: 997–1020 http://dx.doi.org/10.1016/S0140-6736(13)60355-4 OR : http://www.ncbi.nlm.nih.gov/pubmed/23668584

8. Department of health (2012) The NHS's role in the public's health: a report from the NHS Future forum https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/216423/dh_132114.pdf

9. Department of health (2010) Healthy Lives, Healthy People: Our strategy for public health in England (2010) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/216096/dh_127424.pdf

10. Carnall, D. (2000) Cycling and health promotion: A safer, slower urban road environment is the key. *BMJ 2000:320:888*. http://www.bmj.com/content/320/7239/888.extract

11. House of Commons Library (2013) Road cycling: statistics Standard Note: SN/SG/06224 www.parliament.uk/briefing-papers/SN06224.pdf

12. Health survey Trends (2008) Health survey for England http://www.hscic.gov.uk/catalogue/PUB00430/heal-surv-phys-acti-fitn-eng-2008-rep-v1.pdf

13. Scottish Government (2014) Health of Scotland's population – physical activity http://www.scotland.gov.uk/Topics/Statistics/Browse/Health/TrendPhysicalActivity

14. Public Health England (2014) Everybody active, every day What works – the evidence https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/366113/Evidence_layout_23_Oct.pdf

15. Naci H, Ioannidis JPA (2013) Comparative effectiveness of exercise and drug interventions on mortality outcomes: meta-epidemiological study BMJ 2013;347:f5577 (Published 1 October 2013) http://www.bmj.com/content/347/bmj.f5577

16. Kujala UM (2009) Evidence on the effects of exercise therapy in the treatment of chronic disease. Br J Sports Med 43:550-555. Doi:10.1136/bjsm.2009.059808 http://bjsm.bmj.com/content/43/8/550.full.pdf+html

17. Chief Medical Officer (2004) At least five a week: Evidence on the impact of physical activity and its relationship to health – A report from the Chief Medical Officer. Department of Health http://webarchive.nationalarchives.gov.uk/+/dh.gov.uk/en/publicationsandstatistics/publications/publicationspolicyandguidance/dh_4080994

18. Kings Fund (2008): Commissioning behaviour change: kicking bad habits final report http://www.kingsfund.org.uk/publications/commissioning-and-behaviour-change

19. Institute for health metrics and evaluation (IHME) (2014) Transport for health The global burden of disease from motorised road transport http://www.healthmetricsandevaluation.org/sites/default/files/policy_report/2014/IHME_T4H_Full_Report.pdf

20. Chief Medical Officers of England, Scotland, Wales and Northern Ireland (2011) Start active, stay active: a report on physical activity from the four home countries' Chief Medical Officers, Departments of Health https://www.gov.uk/government/publications/start-active-stay-active-a-report-on-physical-activity-from-the-four-home-countries-chief-medical-officers

21. World Health Organization (2010) Global recommendations on physical activity for health. Geneva: World Health Organization. http://whqlibdoc.who.int/publications/2010/9789241599979_eng.pdf

22. Blake H,Mo P, Malik S, Thomas S (2009)How effective are physical activity interventions for alleviating depressive symptoms in older people? A systematic review. http://cre.sagepub.com/content/23/10/873.abstract

23. Rimer J, Dwan K, Lawlor DA, Greig CA, McMurdo M, Morley W, Mead GE. (2012) Exercise for depression. *Cochrane Database Syst Rev.* 2012 Jul 11;7:CD004366. doi: 10.1002/14651858.CD004366.pub5. http://www.ncbi.nlm.nih.gov/pubmed/22786489

24. NICE (2010) Depression: The NICE guideline on the treatment and management of depression in adults, updated edition. Published by: The British Psychological Society& The Royal College of Psychiatrists http://www.nice.org.uk/guidance/CG90

25. Ogilvie D, Foster, CE, Rothnie H, Cavill N, Hamilton V, Fitzsimons CF, Mutrie N on behalf of the Scottish Physical Activity Research Collaboration (SPARColl) (2007) Interventions to promote walking: systematic review, *British Medical Journal* http://www.bmj.com/content/334/7605/1204

26. Mutrie N, Carney C, Blamey A, Crawford F, Aitchison T, Whitelaw A (2002) Public health policy and practice "Walk in to Work Out": a randomised controlled trial of a self- help intervention to promote active commuting. J Epidemiol Community Health 2002;56:407-412 doi:10.1136/jech.56.6.407 http://jech.bmj.com/content/56/6/407

27. Lewin RJ, Furze g, Robinson J, Griffith K, Wiseman S, Pye M. Boyle R (2002) A randomized controlled trial of a self-management plan for patients with newly diagnosed angina *Br J Gen Pract* 52(476): 194–6, 199–201.

28. Mind (2007) Ecotherapy: The green agenda for mental health http://www.mind.org.uk/about-us/policies-issues/ecotherapy/

29. Chalder M, Wiles NJ, Campbell J et al. (2012) Facilitated physical activity as a treatment for depressed adults: randomised controlled trial. *BMJ 2012*; 344 http://www.bmj.com/content/344/bmj.e2758

30. Royal College of Physicians (2012) *Exercise for life: physical activity in health and disease*. London: RCP http://www.rcplondon.ac.uk/sites/default/files/documents/exercise-for-life-final.pdf

31. Department of health (2011) Health Survey for England - 2010, Trend tables [NS] Publication date: December 15, 2011 http://www.hscic.gov.uk/pubs/hse10trends

32. Lawes CM, Vander Hoorn S, Rodgers A. International Society of Hypertension. Global burden of blood pressure related disease, 2001. Lancet 2008; 371:1315-1318. http://www.ncbi.nlm.nih.gov/pubmed/18456100

33. Brooks JHM Ferro A (2012) The physician's role in prescribing physical activity for the prevention and treatment of essential hypertension. JRSM Cardiovascular Disease 2012 1(4):12 http://cvd.sagepub.com/content/1/4/12.full

34. Department of health (2010) Sedentary Behaviour and Obesity: Review of the Current Scientific Evidence https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/213745/dh_128225.pdf

35. Sport and Recreation Alliance (2012) Game of life: How sport and recreation can make us happier, healthier and richer. http://www.sportandrecreation.org.uk/sites/sportandrecreation.org.uk/files/web/Game_of_Life/3310_SRA_literary%20review_v9%20WITH%20HYPERLINK.pdf

36. Richman EL, Kenfield SA, Stampfer MJ, Paciorek A, Carroll PR, Chan JM (2011) Physical activity after diagnosis and risk of prostate cancer progression: data from the cancer of the prostate strategic urologic research endeavor. Cancer Res. 2011 Jun 1;71(11):3889-95. doi: 10.1158/0008-5472.CAN-10-3932. Epub 2011 May 24. http://www.ncbi.nlm.nih.gov/pubmed/21610110

37. Macmillan (2011) Move more: physical activity the wonder drug www.macmillan.org.uk/Documents/AboutUs/Newsroom/Physicalactivityreport.pdf

38. Erickson K, Gildengers AG, Butters MA (2013) Physical activity and brain plasticity in late adulthood. Dialogues Clin Neurosci. 2013 March; 15(1): 99–108 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3622473/

39. Hillman CH, Erickson KI and Kramer AF (2008) Be smart, exercise your heart: exercise effects on brain and cognition http://dericbownds.net/uploaded_images/exercise_hillman.pdf

40. Bowes A, Dawson A, Jepson R, McCabe L (2013) Physical activity for people with dementia: a scoping study BMC geriatrics 13:129. http://www.biomedcentral.com/1471-2318/13/129

41. Khaw KT, Jakes R, Bingham S, Welch A, Luben R, Day N, Wareham N. (2006) Work and leisure time physical activity assessed using a simple, pragmatic, validated questionnaire and incident cardiovascular disease and all-cause mortality in men and women: The European Prospective Investigation into Cancer in Norfolk prospective population study. *Int J Epidemiol.* 2006 Aug; 35(4):1034-43. Epub 2006 May 18. http://www.ncbi.nlm.nih.gov/pubmed/16709620

42. Egede LE, Ellis C (2010) Diabetes and depression: Global perspectives. *Diabetes research and clinical practice* 87 (2010) 302-312. http://www.idf.org/webdata/docs/PIIS0168822710000471.pdf

43. Whooley MD, de Jonge P, Vittinghoff E, Otte C, Moos R, Carney RM, Ali S, Dowray S, Na B, Feldman MD, Schiller NB, Browner WS (2008) Depressive symptoms, health behaviors, and risk of cardiovascular events in patients with coronary heart disease. *JAMA*, vol 300, no 20, pp 2379–88. http://www.ncbi.nlm.nih.gov/pubmed/19033588

44. Lee D, Sui X, Church TS, Lavie CJ, Jackson AS, Blair SN (2012) Changes in Fitness and Fatness on the Development of Cardiovascular Disease Risk Factors: Hypertension, Metabolic Syndrome, and Hypercholesterolemia Journal of the American college of Cardiology 59(7):665-672. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3293498/

45. HM government and Mayor of London (2014) Moving More, Living More; The Physical Activity Olympic and Paralympic Legacy for the Nation. Publ: Cabinet office. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/279657/moving_living_more_inspired_2012.pdf

46. Vranian MN, Keenan T, Blaha MJ, Silverman MG, Michos ED, Minder CM, Blumenthal, Nasir K, Meneghelo RS, Santos RD (2013) Impact of Fitness Versus Obesity on Routinely Measured Cardiometabolic Risk in Young, Healthy Adults Am J Cardiol. Apr 1, 2013; 111(7): 991–995. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3697077/

47. Gillies CL, Abrams KR, Lambert PC, Cooper NJ, Sutton AJ, Hsu RT, Khunti K. (2007) Pharmacological and lifestyle interventions to prevent or delay type 2 diabetes in people with impaired glucose tolerance: systematic review and meta-analysis. *BMJ.* 2007 Feb 10;334(7588):299 http://www.bmj.com/content/334/7588/299

48. Lee IM and Skerrett PJ (2011) Physical activity and all-cause mortality: what is the dose-response relation? *Medicine & Science in sports and exercise* 33 (6 Suppl):S459-71 http://www.ncbi.nlm.nih.gov/pubmed/11427772

49. Office of National Statistics (2013) Mortality Statistics: Deaths Registered in England and Wales (Series DR), 2012 http://www.ons.gov.uk/ons/rel/vsob1/mortality-statistics--deaths-registered-in-england-and-wales--series-dr-/2012/sty-causes-of-death.html

50. Gillespie LD, Robertson MC, Gillespie WJ, Sherrington C, Gates S, Clemson LM, Lamb SE. (2012) Interventions for preventing falls in older people living in the community. Cochrane Database of Systematic Reviews 2012, Issue 9. Art. No.: CD007146. DOI: 10.1002/14651858.CD007146.pub3 http://summaries.cochrane.org/CD007146/interventions-for-preventing-falls-in-older-people-living-in-the-community

51. Morris M. (2012) Preventing falls in older people *BMJ* 345:e4919 http://www.bmj.com/content/345/bmj.e4919

52. AGE UK (2013) Falls Prevention Exercise – following the evidence http://agile.csp.org.uk/news/2013/07/07/ageuk-publish-new-falls-prevention-exercise-document

53. NICE (2012) Osteoporosis: assessing the risk of fragility fracture CG146 http://publications.nice.org.uk/osteoporosis-assessing-the-risk-of-fragility-fracture-cg146

54. Carter ND, Kannus P, Khan KM. (2001) Exercise in the prevention of falls in older people: a systematic literature review examining the rationale and the evidence. *Sports Med*. 2001;31(6):427-38 http://www.ncbi.nlm.nih.gov/pubmed/11394562

55. National Healthcare Group (2011) OPTIMAL (Osteoporosis Patient Targeted and Integrated Management for Active Living) Programme.

56. World Health Organisation (2004) What are the main risk factors for falls amongst older people and what are the most effective interventions to prevent these falls? http://www.euro.who.int/__data/assets/pdf_file/0018/74700/E82552.pdf

57. AGE UK (2013) Stop Falling: Start Saving Lives and Money http://profane.co/2011/01/25/stop-falling-start-saving-lives-and-money-ageuk/

58. NICE (2013) Falls: assessment and prevention of falls in older people http://www.nice.org.uk/guidance/CG161

59. Institute of Bone Health (2012) Capture the fracture: a Global campaign to break the fragility fracture cycle. http://www.iofbonehealth.org/capture-fracture-report-2012

60. World Health Organisation (2008) 2008-2013 Action Plan for the Global Strategy for the Prevention and Control of Non-communicable Diseases http://www.who.int/nmh/Actionplan-PC-NCD-2008.pdf

61. Bleumink GS, Knetsch AM, Sturkenboom MCJM, Straus SMJM, Hofman A, Deckers JW, Witteman JCM, Stricker BH (2004) Quantifying the heart failure epidemic: prevalence, incidence rate, lifetime risk and prognosis of heart failure: The Rotterdam Study. European Heart Journal 25 (18):1614-1619. http://eurheartj.oxfordjournals.org/content/25/18/1614.short

62. Heath GW et al (2012) Evidence-based intervention in physical activity: lessons from around the world *The Lancet*, Volume 380, Issue 9838, Pages 272 - 281, 21 July 2012 http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(12)60816-2/fulltext

63. Lancet executive summary (2009) The health benefits of tackling climate change http://download.thelancet.com/flatcontentassets/series/health-and-climate-change.pdf

64. National High Blood Pressure Education Program (2004). The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. Bethesda (MD): National Heart, Lung, and Blood Institute (US); 2004 Aug. Lifetime Risk of Hypertension. Available from: http://www.ncbi.nlm.nih.gov/books/NBK9636/

65. Carandang R, Seshadri S, Beiser A, Kelly-Hayes M, Kase CS, Kannel, MD WB, Wolf PA (2006) Trends in Incidence, Lifetime Risk, Severity, and 30-Day Mortality of Stroke Over the Past 50 Years JAMA December 27, 2006, Vol 296, No. 24 http://jama.jamanetwork.com/article.aspx?articleid=204775#

66. Diabetes UK (2010) Diabetes in the UK 2010: Key statistics on diabetes http://www.diabetes.org.uk/documents/reports/diabetes_in_the_uk_2010.pdf

67. Diabetes National diabetes audit (2012) Are diabetes services in England and Wales measuring up? http://www.hscic.gov.uk/catalogue/PUB12421/nati-diab-audi-11-12-summ-rep.pdf

68. Stribling B, Yates T (2011) Prevention of type 2 diabetes: Making the evidence work in the UK (for "Walking away from diabetes") http://www.nice.org.uk/Guidance/PH38/Evidence (EP4)

69. Medical Advisory Secretariat (2009) Behavioural interventions for type 2 diabetes: an evidence-based analysis. *Ontario Health Technology Assessment Series* 2009; 9(21): 1–45.

70. Health and social care information centre (2012) Adult anthropometric measures, overweight and obesity http://www.hscic.gov.uk/catalogue/PUB13218/HSE2012-Ch10-Adult-BMI.pdf

71. Academy of Medical Royal Colleges (2013) Measuring Up: The Medical Profession's Prescription to the Nation's Obesity Crisis http://www.aomrc.org.uk/doc_details/9673-measuring-up

72. Sasieni PD, Shelton J, Ormiston-Smith N, et al. (2011) What is the lifetime risk of developing cancer?: The effect of adjusting for multiple primaries Br J Cancer, 2011. 105(3): p. 460-5. http://www.ncbi.nlm.nih.gov/pubmed/21772332

73. Cancer research UK (2013) Lifetime risk of cancer http://www.cancerresearchuk.org/cancer-info/cancerstats/incidence/risk/statistics-on-the-risk-of-developing-cancer

74. Samad AKA, Taylor RS, Marshall T, Chapman MAS (2005) A meta-analysis of the association of physical activity with reduced risk of colorectal cancer. Colorectal Disease Volume 7, Issue 3, pages 204–213, May 2005 http://onlinelibrary.wiley.com/doi/10.1111/j.1463-1318.2005.00747.x/full

75. Andrews G, Poulton R, Skoog I (2005) Lifetime risk of depression: restricted to a minority or waiting for most? The British Journal of Psychiatry 187: 495-496 Lifetime risk of depression: restricted to a minority or waiting for most? http://bjp.rcpsych.org/content/187/6/495.full

76. Alzheimer's association (2013) 2013 Alzheimer's disease facts and figures http://www.alz.org/downloads/facts_figures_2013.pdf

77. Ahlskog JE, Geda YE, Graff-Radford NR, Petersen RC (2011) Physical Exercise as a Preventive or Disease-Modifying Treatment of Dementia and Brain Aging Mayo Clin Proc. 2011 September; 86(9): 876–884. doi: 10.4065/mcp.2011.0252 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3258000/

78. British Medical Association (2012) Healthy transport=healthy lives, BMA, London from www.bma.org.uk/transport

79. WHO (2013) Priority diseases and reasons for inclusion: low back pain. http://www.who.int/medicines/areas/priority_medicines/Ch6_24LBP.pdf

80. Woolf AD, Pfleger B (2003) Burden of major musculoskeletal conditions. Bulletin of the World Health Organization 2003, 81(9):646-656. http://www.who.int/bulletin/volumes/81/9/Woolf.pdf

81. WHO (2007) WHO scientific group on the assessment of osteoporosis at primary care level http://www.who.int/chp/topics/Osteoporosis.pdf

82. All-Party Parliamentary Osteoporosis Group (APPOG) (2011) Inquiry into the role of nutrition in preventing osteoporosis and promoting good bone health Main report http://www.nos.org.uk/document.doc?id=894

83. Nguyen ND, Ahlborg HG, Center JR, Eisman JA, Nguyen TV. (2007) Residual lifetime risk of fractures in women and men. J Bone Miner Res. 2007 Jun;22(6):781-8. http://www.ncbi.nlm.nih.gov/pubmed/17352657

84. Public Health England (2014) Active people survey http://www.noo.org.uk/data_sources/physical_activity/activepeople

85. Department for Culture, Media & Sport (2012) Taking Part 2011/12 quarter 4: Statistical Release Quarter 4 http://www.culture.gov.uk/publications/9135.aspx

86. Sport England (2013) Who plays sport? https://www.sportengland.org/research/who-plays-sport/

87. Sport England (2013) Active People survey 7Q2 April 2012 – April 2013 http://archive.sportengland.org/research/active_people_survey/active_people_survey_7.aspx

88. Health and Social Care information centre (Hscic) (2014) Statistics on Obesity, physical activity and diet http://www.hscic.gov.uk/catalogue/PUB13648/Obes-phys-acti-diet-eng-2014-rep.pdf

89. NICE (2008) Promoting physical activity for children: review 1 - epidemiology (revised July 2008) http://www.nice.org.uk/guidance/PH17

90. Tudor Hart J. (1971) The inverse Care Law The Lancet Volume 297, Issue 7696, Pages 405 – 412 http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(71)92410-X/abstract

91. Department of health (2012) The NHS's role in the public's health: A report from the NHS Future Forum. DH: London. http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_132114.pdf

92. Barnett K, Mercer SW, Norbury M, Watt G, Wyke S, Guthrie B (2013) Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(12)60240-2/fulltext

93. King's Fund (2013) Long-term conditions and multi-morbidity http://www.kingsfund.org.uk/time-to-think-differently/trends/disease-and-disability/long-term-conditions-multi-morbidity

94. British Medical Association (2011) Social Determinants of Health – What Doctors Can Do, BMA, London. http://bma.org.uk/-/media/Files/PDFs/Working%20for%20change/Improving%20health/socialdeterminantshealth.pdf

95. Department of health (2009) Tackling Health Inequalities: 2006-08 Policy and Data Update for the 2010 National Target http://www.chimat.org.uk/resource/item.aspx?RID=81669

96. Institute for Health Equity (2013) Working for Health Equity: The Role of Health Professionals http://www.instituteofhealthequity.org/projects/working-for-health-equity-the-role-of-health-professionals

97. Royal College of Physicians (2010) How doctors can close the Health inequality gap https://www.rcplondon.ac.uk/sites/default/files/rcp-report-how-doctors-can-close-the-gap.pdf

98. Royal College of General Practitioners, RCGP (2008) Addressing Health Inequalities: A guide for general practitioners. RCGP: London

99. Department of Health (July 2012) Healthy People, healthy lives: update report a way forward) https://www.gov.uk/government/publications/healthy-lives-healthy-people-update-and-way-forward

100. WHO (2012) Social determinants of health http://www.who.int/social_determinants/sdh_definition/en/index.html

101. All Party commission on physical inactivity (APCOPA) (2014) Tackling physical inactivity – a coordinated approach. http://activitycommission.com/report-tackling-physical-inactivity-a-coordinated-approach/

102. Marmot review (2010) *Fair Society, Healthy Lives: A Strategic Review of Health Inequalities in England Post* 2010 http://www.instituteofhealthequity.org/projects/fair-society-healthy-lives-the-marmot-review

103. Willett WC (2013) Weight changes and health in Cuba. *British Medical Journal* BMJ2013;346:f1777 http://www.bmj.com/content/346/bmj.f1777

104. Owen N, Sparling PB, Healy GN, Dunstan DW, Matthews CE (2010) Sedentary Behavior: Emerging Evidence for a New Health Risk Mayo Clin Proc. 2010 December; 85(12): 1138–1141. doi: 10.4065/mcp.2010.0444 PMCID: PMC2996155 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2996155/

105. Public Health England (2013) Obesity and the environment: increasing physical activity and active travel https://www.gov.uk/government/publications/obesity-and-the-environment-briefing-increasing-physical-activity-and-active-travel

106. Higgins V, Dale A (2012) Obesity, healthy eating and exercise across ethnicities in England http://ukdataservice.ac.uk/use-data/data-in-use/case-study/?id=97

107. Sport England (2012) The Active People Survey, 2011/12. http://archive.sportengland.org/research/active_people_survey/active_people_survey_6.aspx

108. McIntyre S (2000) The social patterning of exercise behaviours: the role of personal and local resources. Br J Sports Med 2000;34:6 http://bjsm.bmj.com/content/34/1/6.full

109. Sports Equal (2012) Equity in Sports Participation: Ethnicity and Faith http://www.sportengland.org/media/156347/20121003-equity-ethnicity-faith-in-sports-participation.doc

110. Emerson E, Baines S (2010) Health Inequalities & People with Learning Disabilities in the UK: 2010 http://www.improvinghealthandlives.org.uk/uploads/doc/vid_7479_IHaL2010-3HealthInequality2010.pdf

111. British Heart Foundation (2014) Community matters https://www.bhf.org.uk/publications

112. NICE (2013) Physical activity: brief advice in primary care. http://guidance.nice.org.uk/PH44/Guidance/pdf/English OR: http://www.nice.org.uk/guidance/ph44/resources/guidance-physical-activity-brief-advice-for-adults-in-primary-care-pdf

113. World Health Organization (2011) Health economic assessment tools (HEAT) for walking and for cycling, available at http://www.heatwalkingcycling.org/

114. Department of Health (2004) Wanless Report http://webarchive.nationalarchives.gov.uk/+/www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_4074426

115. Lordon G et al for Nuffield Health (2013) 12 minutes more...The importance of physical activity, sports and exercise, in order to improve health, personal finances and the pressures on the NHS http://www.nuffieldhealth.com/sites/default/files/inline/Nuffield%20Health_%20LSE_Low-Fitness_Report.pdf

116. Naylor C, Parsonage M, McDaid D, Knapp M, Fossey M, Galea A for King's Fund (2012) Long-term conditions and mental health: The cost of co-morbidities King's Fund http://www.kingsfund.org.uk/sites/files/kf/field/field_publication_file/long-term-conditions-mental-health-cost-comorbidities-naylor-feb12.pdf

117. UK Public Spending UK (2013) Total public spending expenditure www.ukpublicspending.co.uk

118. CTC (2013) Cycling and the economy http://www.ctc.org.uk/campaigning/views-and-briefings/cycling-and-economy

119. King's Fund (2012) Sustainable health and social care Connecting environmental and financial performance http://www.kingsfund.org.uk/sites/files/kf/field/field_publication_file/sustainable-health-social-care-appleby-naylor-mar2012.pdf

120. NICE (2012) Walking and cycling: local measures to promote walking and cycling as forms of travel or recreation. http://www.nice.org.uk/guidance/PH41

121. HM Govt and Care UK (2013) Supporting Working Carers: The Benefits to Families, Business and the Economy. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/232303/Supporting_Working_Carers_Final_Report__accessible_.pdf

122. Black C (2008) Working for a healthier tomorrow https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/209782/hwwb-working-for-a-healthier-tomorrow.pdf

123. The Health foundation (2011) Spotlight on dementia care http://www.health.org.uk/publications/dementia-care/

124. PSSRU Personal Social Services Research Unit (2011) Unit costs of health and social care http://www.pssru.ac.uk/pdf/uc/uc2011/uc2011.pdf

125. Dr Foster (2012) Fit for the future: hospital guide 2012. Dr Foster http://drfosterintelligence.co.uk/thought-leadership/hospital-guide/

126. House of Lords (Science and Technology committee) (2011) Behaviour change. Stationery Office. http://www.publications.parliament.uk/pa/ld201012/ldselect/ldsctech/179/179.pdf

127. Morrison D, Petticrew M, Thomson H. (2003) What are the most effective ways of improving population health through transport interventions? Evidence from systematic reviews. *Journal of Epidemiology & Community Health* 2003; 57:327-333. http://www.ncbi.nlm.nih.gov/pubmed/12700214

128. Morrison et al (2004) Evaluation of the health effects of a neighbourhood traffic calming scheme, *Journal of Epidemiology and Community Health*, 58:837-840. http://jech.bmj.com/content/58/10/837.abstract

129. NICE (2008) (National Institute for Health and Clinical Excellence) Guidance on the promotion and creation of physical environments that support increased levels of physical activity http://guidance.nice.org.uk/PH8

130. Times (2012) Cities fit for cycling http://www.thetimes.co.uk/tto/public/cyclesafety/contact/

131. All Party Parliamentary cycling group (2013) Get Britain cycling. http://allpartycycling.org/inquiry/

132. Government office for the South West and Department of Health (2012) Value for Money: An Economic Assessment of Investment in Walking and Cycling www.apho.org.uk/resource/view.aspx?RID=91553

133. Sustrans (2012) Economic appraisal of walking and cycling routes http://www.sustrans.org.uk/policy-evidence/related-academic-research/walking-and-cycling-networks-and-places

134. Department of Health (2013). Our children deserve better: Prevention pays. Annual Report of the Chief Medical Officer, October 2013. https://www.gov.uk/government/publications/chief-medical-officers-annual-report-2012-our-children-deserve-better-prevention-pays

135. UNICEF UK (2011). Children's well-being in UK, Sweden and Spain: The role of inequality and materialism. June 2011 https://www.unicef.org.uk/Documents/Publications/IPSOS_UNICEF_ChildWellBeingreport.pdf

136. Ritchie J (2014) Why should we all focus on health inequalities in the foetus and early childhood?, Perspectives in Public Health, 2014 134: 78 http://rsh.sagepub.com/content/134/2/78.extract

137. BMA Board of Science (2013). Growing up in the UK: Ensuring a Healthy Future for Our Children, 2013 http://bma.org.uk/working-for-change/improving-and-protecting-health/child-health/growing-up-in-the-uk

138. Khaw K-T, Wareham N, Bingham S, Welch A, Luben R, Day N (2008) Combined Impact of Health Behaviours and Mortality in Men and Women: The EPIC-Norfolk Prospective Population Study. Plos medicine Journal. http://www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.0050012

139. Chaterjee K, Sherwin H, Jain J (2013) Triggers for changes in cycling: the role of life events and modifications to the external environment Journal of Transport Geography 30 (2013) 183–193 http://eprints.uwe.ac.uk/21600/

140. Robertson R (2008) Using information to promote healthy behaviours. King's Fund, London http://www.kingsfund.org.uk/sites/files/kf/field/field_document/information-promote-healthy-behaviours-kicking-bad-habits-supporting-paper-ruth-robertson.pdf

141. UCL (2012) Working for Health Equity: The Role of Health Professionals. The Role of The Health Workforce in Tackling Health Inequalities: Action on the social determinants of health. www.instituteofhealthequity.org

142. Butler CC, Simpson SA, Hood K, Pickles T, Spanou C, McCambridge J, Moore L, Randell E, Alam MF, Kinnersley P, Edwards A, Smith C, Rollnick S (2013) Training practitioners to deliver opportunistic multiple behaviour change counselling in primary care: a cluster randomised trial. *British Medical Journal* BMJ 2013; 346: f1191 http://www.bmj.com/content/346/bmj.f1191

143. Kaner E, Mcgovern R (2013) Training practitioners in primary care to deliver lifestyle advice. *British Medical Journal* BMJ 2013; 346:f1763 http://www.bmj.com/content/346/bmj.f1763

144. Department health (2010) Improving health and well-being of people with long-term conditions. http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_111122

145. The Ramblers and Macmillan (2013) walking works http://www.macmillan.org.uk/Documents/AboutUs/Health_professionals/Physicalactivity/Walking-Works-professionals-version.pdf

146. Anon (2004) Time off: Living the high life; Kids get ready to dive into the fun again with Splash! http://www.thefreelibrary.com/Time+off%3A+Living+the+high+life%3B+Kids+get+ready+to+ dive+into+the+fun...-a0113835401

147. Reeves MJ, Rafferty AP, Miller CE, Lyon-Callo SK. (2011) The Impact of Dog Walking on Leisure-Time Physical Activity: Results From a Population-Based Survey of Michigan Adults. *Journal of Physical Activity and Health* 2011, 8: 3 http://journals.humankinetics.com/jpah-back-issues/jpah-volume-8-issue-3-march/the-impact-of-dog-walking-on-leisure-time-physical-activity-results-from-a-population-based-survey-of-michigan-adults

148. National Osteoporosis Society (2012) Boogie for your bones http://www.nos.org.uk/page.aspx?pid=533

149. NICE (2007) Behaviour change: the principles for effective interventions http://guidance.nice.org.uk/PH6/Guidance/pdf/English

150. Greaney ML, Riebe D, Ewing Garber C, Rossi JS, Lees FD, Burbank PA, Nigg CR, Ferrone CL, Clark PG (2008) Long-term effects of a stage-based intervention for changing exercise intentions and behavior in older adults. Gerontologist. 2008 Jun;48(3):358-67. http://gerontologist.oxfordjournals.org/content/48/3/358

151. Pavey T, Taylor A, Hillsdon M, Fox K, Campbell J, Foster C, Moxham T, Mutrie N, Searle J, Taylor R (2012) Levels and predictors of exercise referral scheme uptake and adherence: a systematic review. J Epidemiol Community Health doi:10.1136/jech-2011-200354 http://jech.bmj.com/content/early/2012/04/05/jech-2011-200354

152. Health Foundation (2011) Evidence: Helping people help themselves A review of the evidence considering whether it is worthwhile to support self-management. http://www.health.org.uk/public/cms/75/76/313/2434/Helping%20people%20help%20themselves%20publication.pdf?realName=03JXkw.pdf

153. Health Development Agency (2004) The effectiveness of public health interventions for increasing physical activity among adults: a review of reviews. London: Health Development Agency.

154. Ducheyne F, De Bourdeaudhuij I, Spittaels H and Cardon G (2012) Individual, social and physical environmental correlates of 'never' and 'always' cycling to school among 10 to 12 year old children living within a 3.0 km distance from school. International Journal of Behavioral Nutrition and Physical Activity 2012, 9:142 http://www.ijbnpa.org/content/9/1/142

155. Whitmore J (1992) Coaching for Performance, GROWing People, Perfomance and Purpose. Nicholas Brealey Publishing http://www.performanceconsultants.com/resources/coaching-for-performance-book

156. Michigan State University (2014) GROW Model – Four Step Questioning Approach http://od.msue.msu.edu/uploads/files/PD/Mentoring_Guide_October_2013.docx

157. FORESIGHT Government Office for Science (2013) Foresight Tackling Obesities: Future choices – project report 2nd edition http://www.bis.gov.uk/assets/foresight/docs/obesity/17.pdf

158. Miller, W., Rollnick, S. (2012) Motivational Interviewing. Third Edition. Motivational Interviewing: Helping people change. New York: Guildford Press

159. Johnson B et al (2014) Motivate 2 move http://gpcpd.walesdeanery.org/index.php/welcome-to-motivate-2-move

160. Transport for London (2013) Improving the health of Londoners transport action plan. http://www.tfl.gov.uk/cdn/static/cms/documents/improving-the-health-of-londoners-transport-action-plan.pdf

161. Fit4life (2013) www.nhs.uk/change4life/Pages/get-going-every-day.aspx

162. Department of Health (2011). 'UK physical activity guidelines' www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_127931

163. Ogilvie D, Egan M, Hamilton V, Petticrew M. (2004) Promoting walking and cycling as an alternative to using cars: systematic review. *British Medical Journal* 2004; 329:763-766. http://www.bmj.com/content/early/2003/12/31/bmj.38216.714560.55

164. Thaler, R.H. and Sunstein, C.R. 2008. *Nudge: improving decisions about health, wealth and happiness*. Publ: Penguin Books, London. Review at http://www.economicsnetwork.ac.uk/iree/v8n1/hoyt.pdf

165. Kahn EB, Ramsey LT, Brownson RC, Heath GW, Howze EH, Powell KE, Stone EJ, Rajab MW, Corso P, and the Task Force on Community Preventive Services (2002) The effectiveness of interventions to increase physical activity. *American Journal Preventive Medicine*, 2002, 22(4S), 73-107 http://www.thecommunityguide.org/pa/pa-ajpm-evrev.pdf

166. Lancet (2012) Public health in England: from nudge to nag – Editorial Lancet; 379:194 http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(12)60082-8/fulltext

167. Otago Medical School (2003) Otago exercise programme. http://www.acc.co.nz/PRD_EXT_CSMP/groups/external_providers/documents/publications_promotion/prd_ctrb118334.pdf

168. Diabetes UK (2013) www.diabetes.co.uk/exercise-for-diabetics.html

169. Chartered society of physiotherapists: Easy Exercise guide (2013) http://www.csp.org.uk/documents/easy-exercise-guide-england

170. British Heart Foundation (2012) Interpreting the UK physical activity guidelines for older adults (65+) Guidance for those who work with frailer, older people http://www.bhfactive.org.uk/userfiles/Documents/frailerolderadults.pdf

171. British Heart Foundation (2013) "Be Active for life" www.bhf.org.uk/publications/view-publication.aspx?ps=1001242

172. British lung foundation (2014) "How to get active" www.blf.org.uk/Page/How-to-get-active

173. East Sussex Healthcare NHS Trust (2012) Fracture around the wrist: information for patients. http://www.esht.nhs.uk/patient-and-visitor/services/leaflets/?entryid149=502768&q=0%7ewrist%7e

174. House of Commons Transport Committee (2010) Mobility scooters: Ninth Report of Session 2009–10 http://www.publications.parliament.uk/pa/cm200910/cmselect/cmtran/414/414.pdf

175. Rowbottam DJ (2012) Olympic and Paralympic games – will there be a medical legacy? BULLETIN of The Royal College of Anaesthetists 74:26-28 (July 2012) http://www.rcoa.ac.uk/system/files/CSQ-Bulletin74_1.pdf

176. National Obesity forum (2014): State of the nation's waistline. Obesity in the UK: Analysis and expectations. http://www.nationalobesityforum.org.uk/media/PDFs/StateOfTheNationsWaistlineObesityintheUKAnalysisandExpectations.pdf

177. Department for Transport (2008) Cycle infrastructure design. Local Transport Note 2/08 https://www.gov.uk/government/publications/local-transport-notes

178. CTC (2012) Cycling and health http://www.ctc.org.uk/campaigning/views-and-briefings/health-and-cycling

179. Bespoke Cycle Group (2013) Top Ten cycle safety tips www.bespokecyclegroup.org

180. Karate Union of Great Britain (2013) www.kugb.org

181. Department of health (2012) Vitamin D: Advice on supplements for high risk groups. http://www.dh.gov.uk/en/Publicationsandstatistics/Lettersandcirculars/Dearcolleagueletters/DH_132509

182. SACN, Scientific Advisory committee on Nutrition (2007) Update on vitamin D. http://www.sacn.gov.uk/reports_position_statements/position_statements/update_on_vitamin_d_-_november_2007.html

183. Steinke EE, Jaarsma T, Barnason SA, Byrne M, Doherty S, Dougherty CM, Fridlund B, Kautz DD, Mårtensson J, Mosack D and Mosak DK (2013) Sexual Counseling for Individuals With Cardiovascular Disease and Their Partners: A Consensus Document From the American Heart Association and the ESC Council on Cardiovascular Nursing and Allied Professions (CCNAP) http://circ.ahajournals.org/content/early/2013/07/29/CIR.0b013e31829c2e53.full.pdf+html

184. The Boorman review (2009) *NHS Health and Well-being* (November 2009) http://www.nhshealthandwellbeing.org/FinalReport.html

185. Move Eat Treat (2013) www.moveeattreat.org

186. Health Education England (2013) Education Outcomes framework http://hee.nhs.uk/work-programmes/education-outcomes/

187. The Care Quality Commission (2011) Essential Standards of Quality and safety http://www.cqc.org.uk/sites/default/files/documents/gac_-_dec_2011_update.pdf

188. NHS Litigation Authority (2012) NHSLA Risk Management Standards 2012-13. http://www.nhsla.com/safety/Documents/NHSLA%20Risk%20Management%20Standards%202012-2013.pdf

189. Richardson CR, Faulkner G, McDevitt J, Skrinar GS, Hutchinson DS, Piette JD (2005) Integrating Physical Activity Into Mental Health Services for Persons With Serious Mental Illness. *Psychiatric Services* 56 (3): 324 2005;doi: 10.1176/appi.ps.56.3.324 http://ps.psychiatryonline.org/article.aspx?articleID=89782

190. Equality network (2013) Key attitudinal findings http://www.equality-network.org/our-work/policyandcampaign/out-for-sport/the-facts/

191. Stonewall (2009) Leagues behind – football's failure to tackle anti-gay abuse http://www.stonewall.org.uk/documents/leagues_behind.pdf

192. Culture media and sport committee (House of Commons) UK Parliament (2012) Culture media and sport committee – Racism in Football – minutes of evidence http://www.publications.parliament.uk/pa/cm201213/cmselect/cmcumeds/89/120515.htm

193. Sporting Equals (2012) Faith Communities Engagement: helping drive growth in Sports Participation http://www.thefa.com/~/media/files/thefaportal/governance-docs/equality/faith-in-football/faith-centres-report---sporting-equals.ashx

194. Sport England (2013) Equality and Diversity advice http://archive.sportengland.org/support__advice/equality_and_diversity.aspx

195. Institute of Public Health in Ireland (2012) Building an active travel future for Northern Ireland http://www.publichealth.ie/sites/default/files/IPH%20Submission%20DRD%20Building%20an%20active%20travel%20future%20for%20Northern%20Ireland%20March%202012.pdf

196. Sustrans (2012) Moving forward: a year of delivering smarter travel choices http://www.publications.parliament.uk/pa/cm201012/cmselect/cmhealth/1048/1048vw04.htm

197. BBC (2012) The rise of the adult playground. http://www.bbc.co.uk/news/magazine-17818223

198. Rose G (1985) Sick individuals and sick populations. *International Journal of Epidemiology* 14(1):32-38. http://ije.oxfordjournals.org/content/14/1/32.full.pdf+html

199. National Assembly for Wales (2013) The Active Travel (Wales) Act http://www.legislation.gov.uk/anaw/2013/7/pdfs/anaw_20130007_en.pdf

200. Sustrans (2010) Bike belles - Information for women who want to cycle http://www.admin.ox.ac.uk/media/global/wwwadminoxacuk/localsites/estatesdirectorate/documents/travel/Bikebelles.pdf

201. Bristol City Council (2012) Evidence to NICE PDG Walking and Cycling: Experience from Bristol City Council and Cycling City (2008-2011) https://www.nice.org.uk/guidance/ph41/resources/expert-testimony-4-bristol-city-council2

202. Allen D, Bygrave S, Harper H (2005) Behaviour at cycle advanced stop lines. IN http://www.tfl.gov.uk/cdn/static/cms/documents/behavour-at-advanced-stop-lines-summary.pdf

203. Ogilvie D. (2004) For Social and Public Health Science Unit: Promoting a Transport Modal Shift for Population Health http://www.sphsu.mrc.ac.uk/research-programmes/ev/hrh/tportalt.html

204. Retting RA, Van Houten DR (2000) Safety Benefits of Advance Stop Lines at Signalized Intersections: Results of a Field Evaluation. *ITE Journal,* Sept 2000 http://www.ite.org/membersonly/itejournal/pdf/JIB00A47.pdf

205. Cavill N, Muller L, Mulhall C, Harold K, Kennedy A, Hillsdon M, Bauman A. (2009). Cycling Demonstration Towns: Surveys of cycling and physical activity 2006 to 2009. Cycling England. http://webarchive.nationalarchives.gov.uk/20110407094607 OR http://www.dft.gov.uk/cyclingengland/cycling-cities-towns/results/

206. Sustrans (2013) Route User Intercept Survey Report, Cinque Ports Way, Hastings - Connect2 http://www.sustrans.org.uk/sites/default/files/file_content_type/hastingsv3.pdf

207. Transport for London (2011) Barclays Cycle Superhighways Evaluation of Pilot Routes 3 and 7 https://www.whatdotheyknow.com/request/162841/response/402026/attach/3/BCS%20pilot%20evaluation%20report.pdf

208. NICE (2010) PH31 Preventing unintentional road injuries among under-15s http://publications.nice.org.uk/preventing-unintentional-road-injuries-among-under-15s-ph31

209. Health Education Authority (1999) Physical activity and inequalities. London: Health Education Authority

210. Daniels N (2010) What impact do amenity groups have on the English Planning Process? http://architecture.brookes.ac.uk/research/cendep/dissertations/NatalieDaniels.pdf

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