Physical Activity and Cardiovascular Disease Prevention

in the European Union

The European Heart Network – December 1999

Report prepared by the European Heart Network's Expert Group on Physical Activity

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Getting Europeans to be more physically active offers the greatest potential for reducing cardiovascular disease (CVD) rates in the European Union (EU). Physical inactivity is now established as a major risk factor for heart disease and there is a new consensus that even small amounts of activity confer a health benefit.

This paper is intended to draw attention to the importance of physical activity for CVD prevention. It summarises the evidence and the biological mechanisms which explain why activity decreases CVD risk and outlines a series of policy recommendations for creating an environment that fosters a more physically active life. These require support from the European Union's action programmes in public health and EU legislation that has an impact on environment, transport, the workplace and leisure-time activities.

The European Heart Network (EHN)

The European Heart Network is a Brussels-based alliance linking 28 national heart foundations and other national non-governmental organisations committed to the prevention of cardiovascular disease (CVD), including coronary heart disease and stroke, in 24 countries across Europe. It aims to achieve concerted action on cardiovascular disease prevention within Europe and to promote the exchange of experience and co-operation on CVD prevention between members.

Who should read this document?

Physical Activity and Cardiovascular Disease Prevention in the European Union summarises the latest evidence relating a sedentary lifestyle to CVD risk. It is intended to inform and update decision makers and health professionals at European, national and local levels as to the implications of new research findings on physical activity. These show the great value for cardiovascular and general health of the promotion of even modest levels of physical activity. The challenge now is for policy makers to work together to create living environments that favour a more physically active life, and for health professionals to put more emphasis on physical activity in CVD prevention programmes. EHN makes a series of recommendations for action.

Contents

Executive Summary

A continuing threat: Cardiovascular disease (CVD) is the number one killer in Europe, accounting for nearly half of all deaths. Based on current disease trends and the growing number of elderly people in the European population, CVD is expected to continue to be the major killer disease in Europe well into the next millennium.

Double the risk: Physical inactivity is now established as a major risk factor for coronary heart disease and cerebrovascular disease. Inactive populations have around twice the risk of CVD compared with active populations (Relative Risk ~2). This is of the same order as the risk of smoking, high blood pressure and raised blood-cholesterol levels.

A best buy: Raising physical activity levels amongst the general population has been described as 'today's best buy in public health.' This is because physical activity has such a strong effect on CVD risk and because activity levels in the European population are so low. Inadequate physical activity is more common at the community level than any of the classic risk factors for CVD – smoking, hypertension, raised blood cholesterol and overweight. The proportion of CVD incidences that could theoretically be prevented if the European population were more physically active – the Population Attributable Risk (PAR) – is estimated to be around 30–40%.

Changing lifestyle: Taking up a more physically active lifestyle, even in middle or older age, is associated with lower rates of death from coronary heart disease (CHD) and all causes. The decrease in risk is of the same order as cessation of smoking.

Low activity is better than none, but more is always better: The relationship of physical activity to health is continuous – the more a person does, the lower their risk, whatever the existing level of activity. Most studies have found the greatest difference in CVD rates between the completely sedentary and those being moderately active. There is a new consensus that even low intensity physical activity may reduce risk of CVD without having any notable influence on fitness. The public health message is that any physical activity exceeding a completely sedentary lifestyle will produce health benefits.

Accumulated activity: Another new conclusion is that short bursts of physical activity accumulated throughout the day can also be health enhancing. Short-duration activities, such as climbing stairs or walking up a hilly street, can be included in health promotion programmes.

EHN recommends 30 minutes most days:

EHN recommends that every European adult should accumulate 30 minutes of moderate intensity physical activity most, and preferably every, day of the week. The activity should be of sufficient intensity to leave the participant slightly out of breath, but still able to talk. The actual intensity of the exercise will depend on the existing fitness level of the participant: a moderate-intensity brisk walk for a fit person will be much faster than for an unfit person. Physical activity needs to *be habitual, current and lifelong.* Young people (aged 5–18) should accumulate at least an hour a day of moderate-intensity activity to promote optimal growth and development and to help foster appropriate activity patterns into adulthood.

Daily, moderate and accumulated: The new recommendations for daily moderate accumulated activity mean that physical activity needs to be part of everyday life, and not necessarily vigorous activity in a sports centre. This is a shift from heart-health recommendations of the 1980s. It provides a new direction for health policy and planning to foster greater opportunities and to encourage people to engage in physical activity as part of daily life. This strategy offers the best hope that at least the minimum requirements of regular health enhancing activity can be met by the largest possible proportion of the population in the most economic and ecological way.

2% of the day: Substantial increases in regular physical activity among people of all ages throughout the EU are called for to improve both cardiovascular and general health. There has been a progressive elimination of physical activity from normal daily living. Estimates of current levels in EU countries suggest that the majority of adults (66%) are physically active for less than the recommended 30 minutes a day – that is just 2% of the day. The widespread inactivity of Europeans has broad health implications on, for example, cancer, diabetes, osteoporosis, arthritis and psychological aspects as well as on CVD. Getting Europe active promises to become a public health necessity to counteract the health problems of the EU's ageing population.

Recommendations for the European Union

Pan-European initiatives: Support pan-European initiatives designed to facilitate the uptake of and regular participation in physical activity and to raise awareness of the health benefits of physical activity.

EU policy: Develop an EU policy on health that enhances physical activity and develop a broad strategy for implementation in a range of sectors. This should be linked to other policies that affect opportunities for physical activity, such as economy and finance, employment, transport, environment, regional policies, education and tourism.

EU surveys: Monitor EU citizens' participation in physical activity through regular surveys.

Research into special groups: Conduct pan-European research on physical activity patterns and identification of effective promotion among children, women, the elderly and lower socio-economic groups.

Information exchange: Encourage information exchange on the effectiveness of physical activity intervention programmes among relevant pan-European networks in areas such as health, education and training, environment, and transport.

Recommendations for action at a national level

Information: Raise awareness among key professionals of the importance of physical activity as a risk factor for CVD.

A new message: Raise public awareness of the modern health message that even low levels of physical activity are beneficial and that these can be achieved through the activities of daily life.

Environment and transport: Encourage changes in infrastructure and policy that increase the opportunities for physical activity as part of daily life.

Facilities: Increase opportunities and facilities for appropriate sport and active recreation for individuals and families.

Workplace: Promote physical activity through the workplace and encourage commuting on foot or by bicycle.

Education and physical activity skills: Develop school and teacher-training programmes that emphasise enjoyable non-competitive physical activity and that foster the acquisition of essential sports and leisure skills and a lifelong physical activity habit.

Older people: Promote appropriate physical activity for older people that emphasises the development of social networks and enhances quality of life and independence.

Community involvement: Encourage whole-community approaches to the promotion of physical activity to all sectors of the population.

Access for the disabled: Develop clear well-structured physical-activity programmes for disabled people.

Equal access: Reduce the inequality in provision that affects black and minority ethnic groups, the long-term unemployed, and people from lower socio-economic groups.

Challenge or opportunity: Getting Europeans to be more physically active not only promises to produce health-enhancing effects for the individual and the community, it is also fully in accordance with parallel initiatives aimed at creating a greener and more ecologically-aware society. Raising physical activity levels needs to be seen not as a challenge, but as an opportunity waiting to be seized. The EHN hopes that this document will help to put physical activity higher up the political agenda in the transport, planning, social and employment spheres as well as in public health.

Section 1: Introduction – The Context

1.1 A massive enemy: Cardiovascular disease

During the last half century, CVD has been the number one killer in Europe accounting for nearly half of all deaths. Today, CVD is overwhelmingly the most common disease in the countries of the European Union (Table 1) and causes nearly twice as many deaths as all cancers put together (Figure 1). On the basis of current trends in the prevalence of different diseases and the growing number of elderly people in the European population, CVD is expected to continue to be the major killer in Europe for many years to come (Table 1).

Trends in deaths from CVD show a striking pattern (Figures 2 & 3). In many western and northern European countries, which originally had the highest rates of CVD, there has been a sharp decline in CVD deaths in people under 75, especially in men. This follows favourable changes in risk-factor behaviour which are largely the result of concerted long-term health promotion programmes. There has been a substantial increase in CVD rates in eastern European countries where trends in risk-factor behaviour are the reverse. Even amongst

Figure 1: Causes of death in the European Union according to main groups of causes (in thousands) in 1991[1]

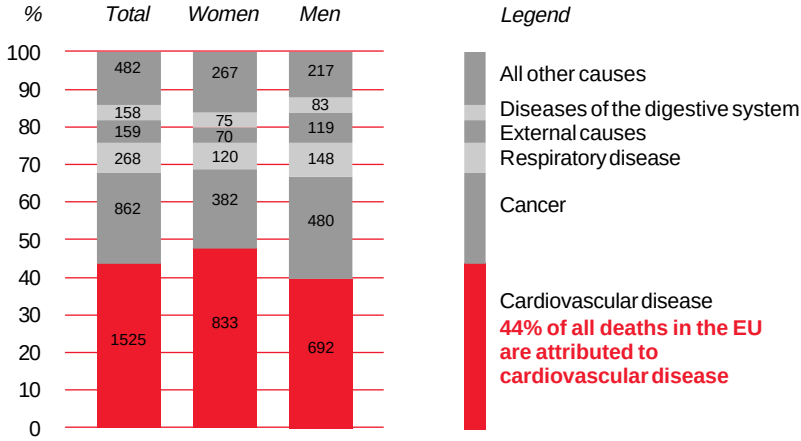


Table 1: Ranking of the five leading clusters of disease/conditions in the European Region (selected years, indicative list, WHO 1998)[2]

Disease category	*1960*	*1980*	*1997*	*2025 predicted*
Circulatory system	1	1	1	1
Malignant neoplasms	2	2	2	2
Respiratory system	3	4	4	
All external causes	4	3	3	3
Infectious and parasitic	5	5		5
Mental and behavioural			5	4

countries of western, northern and southern Europe, and between different sectors of the population, great differences in CVD death rates remain. The fact that trends in CVD death rates match trends in risk factors suggests that changing risk-factor behaviour can reduce CVD mortality and morbidity.

Figure 2: Time trends in mortality of men aged 45–74 from all causes in selected countries, 1970–92[3]

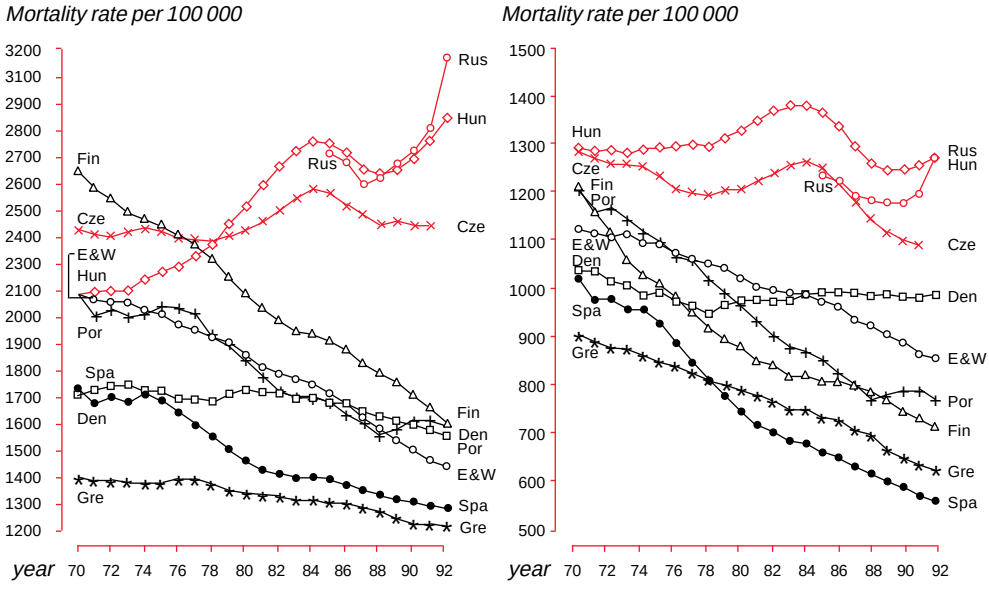
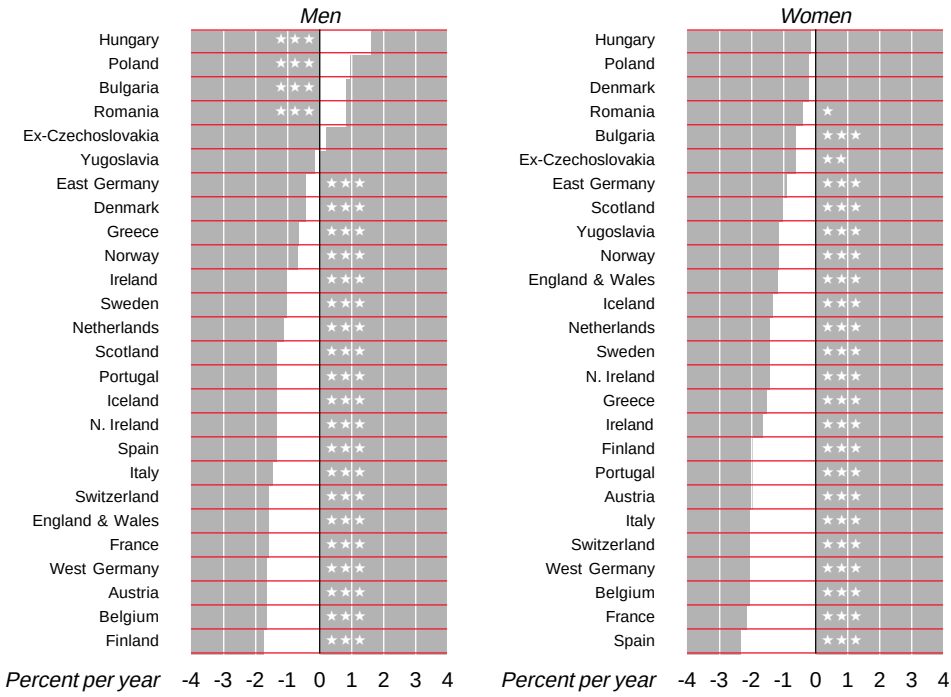


Figure 3: Annual percent change in mortality rates of men & women aged 45–74 from all causes in European countries, 1970–92[3]



★ $P<0.01$, ★★ $P<0.001$, ★★★ $P<0.0001$

Causes of cardiovascular diseases

By far the most common and lethal cardiovascular diseases are ischaemic or coronary heart disease and cerebrovascular disease that causes stroke. These are characterised by a gradual obstructive process – atherosclerosis – usually ending in an obstruction of the arteries that bring nutrients and oxygen to the heart and brain respectively. Atherosclerosis is caused by many factors; some genetically determined, many based on lifestyle habits and some related to the environment. The power of a few of these factors to induce the development of atherosclerosis, particularly of the coronary arteries, is so great that the probability or risk of developing CVD can be predicted by measuring these factors. Traditionally the three 'major' risk factors are cigarette smoking, high blood pressure, and high serum cholesterol concentration and other blood lipid abnormalities. Over the years, the role of a number of other factors contributing to the risk of developing atherosclerotic arterial disease has been detected and proven. Physical inactivity now needs to be added to the list of established major risk factors for CVD (Table 2).

Table 2: Factors that increase the risk of cardiovascular diseases

Living Habits	*Biochemical and physiological factors (that can be modified)*	*Personal factors (that can not be modified)*
Sedentary lifestyle	Raised blood pressure	Age (high)
Smoking	Fitness level	Sex (male)
Unhealthy diet	Raised serum cholesterol levels (high LDL: HDL cholesterol ratio)	Early arterial disease in close relative (male under 55, female under 65)
Excessive calorie intake	Raised serum triglyceride levels	
Heavy alcohol consumption	Diabetes	
	Obesity	
	Thrombogenic factors	

1.2 Physical inactivity: *a recently-accepted risk factor*

It has been suspected since the 1950s that physical inactivity increases the risk of developing CHD, but it was not until the beginning of 1990s that sufficient evidence had accumulated to justify including physical inactivity among the major risk factors for CHD.[4] Physical inactivity is now also considered an established risk factor for diabetes II, obesity and hypertension, one of the main causes of cerebrovascular disease or stroke. For example, in 1999 the National Stroke Association of the United States began recommending physical activity as a measure for stroke prevention.[5]

1.3 Raising physical activity levels: *the greatest potential for reducing CVD in Europe*

Physical inactivity is a strong risk factor for CVD. The risk-increasing effect of being physically inactive as compared with being physically active (relative risk) is around 2. This is of the same order as the relative risk of cigarette smoking, high blood pressure and raised blood-cholesterol levels.[6,7]

Raising physical activity amongst the general population has been described as 'today's best buy in public health'.[8] This is because physical activity has such a strong effect on CVD risk and because activity levels in the European population are so low. Inadequate physical activity is more common than any of the classic risk factors for CVD – smoking, hypertension, raised blood cholesterol and overweight. The proportion of CVD incidences that could theoretically be prevented if the population belonged to the exposure group with the lowest risk – in this case, if everyone were physically active – is known as the Population Attributable Risk (PAR). For physical activity, PAR values in the region of 30–40% are found. This compares with PAR values of 10–35% for smoking and around 3–10% for obesity and 10–20% for cholesterol.[9] This means that, theoretically, increasing physical activity levels has the potential to reduce the number of incidences of CHD by up to 40%.[10]

The need for and value of physical activity is not limited to primary prevention amongst those who do not yet have CVD. It is also important for people who already have CVD in order to lower the risk of heart attack and improve functional capacity and quality of life. Physical activity needs to be part of cardiovascular rehabilitation and secondary prevention.[11]

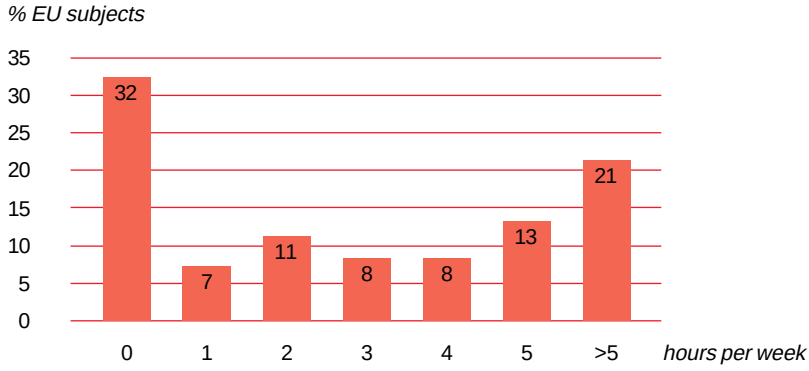
1.4 Europe's inactive population

Since the 1950s there has been a progressive elimination of physical activity from normal daily living. For the majority of people, little physical activity is involved in their work, domestic life or means of transport. Increasingly, children are driven to school, commuting is rarely on foot or by bicycle, and even a daily walk to the shops has been displaced by a weekly drive to the out-of-town supermarket. Although there has been an apparent boom in leisure-time activity (usually using exercise facilities which you have to 'go out' to and pay for) this is restricted to certain ages and socio-economic groups, and is far outweighed by the real decline in the physical activity of daily life. There is evidence in the UK, for example, that walking has increased as a leisure-time activity, but declined as a means of transport.[12] This reduction in physical activity has been accompanied by an increase in obesity rates in many countries.[13]

1.5 The health burden of physical inactivity in Europe

Estimates of current levels of physical activity in EU countries suggest that the majority of adults are physically active for less than 3 hours per week (Figure 4). Sixty six percent do less than the recommended 30 minutes a day (see Section 3).[14] Precise comparisons between activity levels in different countries are hampered by linguistic and cultural factors in

Figure 4: Percentage of EU subjects participating in various durations of leisure time physical activities in a typical week[14]



responding to interview questions, but there seems to be considerable geographical variation (Figure 5, p.27). The widespread inactivity of Europeans is even more worrying when the whole spectrum and scale of the association between of physical inactivity and poor health is taken into consideration, for example, cancer, diabetes, osteoporosis, arthritis, hypertension and psychological problems (Annex 1, p.35). Regular physical activity is one of the corner-stones of a healthy life and long-lasting health and functional capacity. It promises to become a public health necessity to counteract the health problems of the ageing population of Europe.

Section 2: The Evidence

2.1 Epidemiological evidence

Habitual physical activity decreases coronary heart disease morbidity and mortality. This has been documented in numerous large prospective population studies. No study has found a higher risk of CVD in the physically active.

Pioneering studies

The first study of the effects of physical activity on CHD risk was published in 1953 by Morris *et al.* in London.[15] Morris found that bus drivers had a 40% higher incidence rate of CHD than bus conductors. The drivers and conductors were comparable in most aspects of their lives except that the bus conductors spent their day actively climbing the stairs between the floors of the double-decker bus, whilst the drivers had a sedentary occupation. Since the 1950s there has been a dramatic decline in the number of occupations that involve physical labour, and differences in physical activity levels are now largely due to differences in leisure-time physical activity. The Harvard alumni study, which began in 1962, pioneered research into the effects of leisure-time activity on CVD. Using a detailed questionnaire to assess leisure activity it found that the relative risk of CHD was increased by 84% in the sedentary group.[16]

Problems in estimating the relative risk of being sedentary

In most recent studies, the relative risk of being sedentary has been estimated at around 2.[6,7,17,18] This is widely considered to be an underestimate attributed to two methodological problems specific to studies of physical activity. First, physical activity is a complex behaviour pattern in which the type, intensity, frequency and duration of the activity have different physiological effects and, therefore, different protective effects against CVD. Accurately assessing activity levels is complicated and subjects are often misclassified at baseline in prospective studies. This leads to a dilution of the real differences between active and sedentary groups and an underestimation of the relative risk. The early studies of physical activity suffered from this type of dilution.

Secondly, subjects change their behaviour during the long period of follow-up (usually more than ten years) so that people classified as being

'active' at the start of a prospective study, may be less active (or vice versa) during the subsequent years. This phenomenon is unique to studies measuring physical activity exposure; smokers and non-smokers rarely change exposure group during follow-up, but more than half of all subjects change exposure level to physical activity during follow-up.

A sedentary lifestyle doubles the risk of CVD

Many recent studies have made a thorough assessment of physical activity levels taking intensity, type and frequency of activity into account. Results from these studies suggest that a sedentary lifestyle more than doubles the risk of CVD[19–22] and that the risk may be as high as five-fold.[30] Meta-analyses of the existing literature find a relative risk of just under 2,[6,7,17] but, allowing for the dilution effect due to changes in activity during follow-up, a relative risk just over 2 is most likely to be found.

Few studies on physical activity and CVD have been carried out with women as subjects. The incidence of CVD in women is less than half that of men and therefore studies would need to include twice as many women to achieve the same statistical power as studies on men. The few published studies available suggest there is little difference in the relationship between physical activity and CVD in men and women[23–28] and that it is safe to assume a similar reduction in CVD risk by increasing physical activity.

The benefits of becoming more active

Perhaps even more important than the health advantage of being physically active at a given time of life is the benefit of becoming more active. Four comprehensive and thorough studies have found that taking up a more physically active lifestyle in middle or older age was associated with lower rates of death from CHD and all causes. Paffenbarger *et al.*[29] found that when subjects started a moderately vigorous sports activity, equivalent to brisk walking, the relationship was proportional – the greater the increase in activity, the greater the decrease in CHD rate and vice versa. Data from the Cooper Clinic[30] which examined more than 10 000 men twice in five years found that the age-adjusted relative risk of death was more than 2 in men who became active compared with those who remained sedentary. Similar results were obtained in men in the British heart study[31] and in women from Gothenbourg.[24] These findings are important because they show that it is possible to reduce the risk of CHD by making lifestyle changes even relatively late in life – in middle or older age. The decrease in risk was of the same order as cessation of smoking. They also help establish a causal relationship between inactivity and CVD.

Becoming more active has been shown to help the prevention and treatment of a whole range of health conditions and diseases. Some examples are given in Annex 2 (p.38).

2.2 How physical inactivity influences CVD risk: *biological mechanisms*

Physical inactivity is an independent risk factor for CVD. There are substantial plausible biological data supporting a causal relationship. The biological mechanism for the beneficial effects of physical activity may work directly on the cardiovascular system by decreasing the workload of the heart (lowering peripheral resistance and increasing blood volume) or by improving the ability of the heart to work. It may also work indirectly through metabolic changes, particularly in insulin sensitivity, that affect other major risk factors such as blood pressure, HDL/LDL cholesterol ratios, fibrinolysis and sympathetic nervous activity.[32] In turn this reduces the risk of a number of diseases related to increased CVD risk, namely diabetes II, hypertension and obesity. These changes tend to occur over the weeks or months after beginning regular exercise. Some of the most significant changes are described below.

Lower heart rate

Physical activity has a training effect on the heart which lowers the heart rate both at rest and during a given submaximal dynamic workload. This is because physical activity increases total blood volume so that the heart fills better and lowers the resistance of peripheral blood vessels to blood flow (peripheral resistance). The lower the peripheral resistance, the easier it is for the heart to pump blood around the body, so that for a given workload the heart of a physically active person will have less work to do than the heart of an unfit person. This is particularly important for patients with CHD and *angina pectoris*.

Raised insulin sensitivity

The level of the hormone insulin circulating in the bloodstream has a profound effect on sugar and lipid metabolism and on blood pressure. 'Insulin sensitivity' refers to the body's ability to respond to insulin. 'Insulin insensitivity' means that the body requires higher levels of insulin to achieve a response. Physical activity may increase insulin sensitivity by 25% so that circulating concentrations of insulin and adrenaline are much lower in a physically active person.[33] This could be because physical activity

causes more insulin receptors to be formed on the membrane of a trained muscle cell, or because it makes the transportation of sugar within the cell more efficient. Insulin insensitivity causes Diabetes II, therefore physical activity reduces the risk of diabetes and physical training can be a component in the treatment of diabetic patients.[34]

Lower blood pressure

Blood pressure is influenced by cells in the brain (in the hypothalamus) that are sensitive to circulating insulin. The cells are activated by high levels of insulin, and high insulin levels are translated into an increase in blood pressure. Analyses of published studies show that over a training period of a few months, blood pressure can be lowered by an average of 13/8 (systolic/diastolic) mmHg in people with elevated blood pressure, but that there is a large variation in individual response.[35]

Raised HDL/ total blood cholesterol ratio

The reduction in insulin levels achieved by physical activity has a favourable influence on blood lipids by increasing levels of beneficial high-density lipoprotein (HDL cholesterol) and decreasing levels of deleterious low-density lipoprotein (LDL cholesterol). The nature of the changes differs between men and women, but in both sexes physical activity raises the HDL to LDL or total cholesterol ratio by between 5% and 15%, thereby reducing risk of CVD.[11,36,37]

Help in weight control

Obesity and overweight are important risk factors for CVD. Physical activity can help control weight in several ways. Doing more exercise increases energy expenditure and in the longer term may raise total muscle mass so that even resting energy expenditure may increase. But, more importantly, physical activity alters fat metabolism so that a higher percentage of fat is used as a fuel source. This means that weight loss strategies that combine diet and physical activity are much more successful than either when used independently. Furthermore, the person losing weight benefits from changes in other risk factors affected by the physical activity (as described above) as well as from the weight loss.[11,13,18]

2.3 Summary

Evidence that regular physical activity has a protective effect against CHD is now overwhelming.[18,38] Corresponding evidence related to cerebrovascular disease (stroke)[39–41] and, to a lesser extent, peripheral arterial disease, is substantial. The preventative effect is evident in both primary and secondary prevention (rehabilitation)[11] of CVD and it is seen in men and women of all ages. The reduction in risk attributed to moderate physical activity is of the same order as that of the other major behavioural risk factors and increases with the amount and intensity of the activity. There is growing consensus that a sedentary lifestyle more than doubles risk of CVD, but relative risks as great as 5 have been found when the activity is intense. Taking up physical activity even relatively late in life still has a protective effect.

Section 3: Recommendations for individuals – *How much, how often, how hard and how long?*

A striking finding of all the epidemiological and training studies of physical activity and CVD risk is that any level of physical activity exceeding total inactivity provides benefits in relation to CVD risk.[42] A consensus is now emerging that low- to moderate-intensity physical activity may reduce the risk of CVD without having any notable influence on fitness. The public health message is that adopting a lifestyle that exceeds complete sedentariness will produce health benefits. At very low levels, these benefits may not be due to improvements in cardiovascular health but reduce CVD risk indirectly through, for example, better control of body weight and better management of psycho-social stress.[18,39]

3.1 Daily, moderate and accumulated

The activity-health continuum: *moderate is good, more is even better*

The benefit of physical activity extends across the full range of activity levels, but the relationship is not linear: people with the lowest levels of activity have the most to gain from a given increase in activity. At the top end of the activity spectrum, doing even more is likely to produce a proportionately smaller reduction in risk. Most studies have found the greatest difference in CHD incidence rates between the completely sedentary and those being moderately active.[18,39]

Given the continuous nature of the activity–health relationship, making recommendations for minimum amounts of physical activity is largely arbitrary. Even though the question 'How much exercise is enough?' is frequently asked – there is no straightforward answer. The more a person does, the lower their risk, whatever their existing level of activity. However, quantified recommendations can provide useful benchmarks to motivate individuals and to develop targets for national programmes. Current consensus recommends an accumulation of 30 minutes of moderate-intensity physical activity per day.[43]

Frequency is more important than intensity: *daily and moderate*

The consensus among scientists in the 1990s is to promote daily physical activity at moderate intensity, such as walking, cycling, using the stairs etc. This view is based on numerous studies which show that many functions related to cardiovascular health can be improved by a bout of physical activity.[42] In order to maintain these benefits the activity has to be repeated frequently, i.e. daily: one long walk during the weekend does not confer all the health benefits that are gained by shorter daily walks.

Today it is generally accepted that moderate intensity activity, demanding only 50% of VO_2 max and 60% of maximum heart rate, may confer important health benefits, particularly in relation to CVD risk, without a significant improvement in cardio-respiratory fitness. This represents a substantial shift from recommendations in the 1980s which were designed to increase cardio-respiratory fitness. They called for continuous bursts of intense activity so that participants felt sweaty and out of breath, for example, 20 minutes exercise three times a week at more than 60% VO_2 max and at up to 90% of maximum heart rate.[44,45] (See Annex 3, p.40, for an explanation of the differences between physical activity and cardio-respiratory fitness). Some studies found that only vigorous exercise, demanding a relatively high oxygen uptake, provided protection against CHD.[46,47] It is now considered that the failure to find benefits accruing from lower-intensity exercise may have been due to poor methodological assessment.

This change in physical activity recommendations has significant policy implications. Exercise to increase cardio-respiratory fitness has to be vigorous and tends to be achieved through dedicated sports or exercise activities. Moderate-intensity exercise can be achieved through the activities of daily life in an environment that favours activity.

Moderate-intensity exercise: *intensity depends on the existing level of fitness*

From a physiological perspective, the intensity of a particular activity will depend on the fitness level of the person undertaking it.[46,48] A 'moderate-intensity' brisk walk for an older or unfit person will be at a much slower pace than for a younger or fitter person. It seems plausible that, regardless of age, for very unfit individuals even activities carried out below the intensity threshold of brisk walking will not only enhance health but will also exhibit a significant training effect on cardio-respiratory fitness.[49,50] Moreover, regardless of intensity, any physical activity performed regularly

in old age may help preserve functional capacity, which is crucial for individual autonomy and quality of life.

Common examples of moderate-intensity activities for the moderately fit include brisk walking at 5–6km/h, cycling at approximately 16 km/h, walking up stairs, or heavy forms of gardening and housework.

Accumulated activity: *also effective*

A further and recent development in the health recommendations is that activity accumulated in short bouts is just as valuable as continuous periods of activity.[49,51,52] It is no longer necessary to specify a minimum of 20 minutes of continuous activity. Even short-duration activities during the day, such as climbing stairs, mowing a small lawn or walking up a hilly street, have a health enhancing effect when added together.[18]

Lifelong activity: *habitual, current and continuing*

Whilst a history of physical activity may have some health benefit, it does not provide lasting protection against CVD. Activity needs to be current and continuing.

3.2 EHN Recommendation:

Every European adult should accumulate 30 minutes of moderate-intensity physical activity most and preferably every day of the week.

(This is in accordance with recommendations from the US Department of Health and Human Services.)[53]

An example of moderate-intensity physical activity is brisk walking that leaves the participant slightly out of breath, but still able to talk.[54] The 30 minutes can be accumulated in several bouts throughout the day, carried out as a part of active daily life.

People who are currently sedentary or minimally active should gradually build up to the daily goal of 30 minutes of moderate activity by adding a

few minutes each day. This will reduce the cardiac and musculo-skeletal risks associated with suddenly increasing the amount or intensity of exercise.

Those who currently meet these standards may derive additional health and fitness benefits by becoming more physically active or including more vigorous activity.

Young people: a*n early start has a long-lasting effect*

Recent expert recommendations state that

- all young people (aged 5–18) should participate in physical activity of at least moderate intensity for one hour a day[55]
- young people who currently engage in little activity should participate in physical activity of at least moderate intensity for at least half an hour a day.

These recommendations are based on current scientific evidence and expert opinion, although it is acknowledged that neither the minimal nor the optimal amount of physical activity for young people can be precisely defined at this time. Experts felt that a higher level of physical activity may be necessary for younger people to support optimal growth and development as well as for prevention of cardiovascular diseases in later life. It should also foster the adoption of an active lifestyle – there is evidence that active children are more likely than inactive children to become active adults.[56]

3.3 Adverse effects*: they can be avoided*

The potential risks of physical activity are far outweighed by its benefits.[57] The type of increase in physical activity in daily life which EHN recommends should cause little health risk if increased gradually. Concerns about exercise relate mainly to intense, vigorous cardio-respiratory activity and even these have often been over-emphasised. However, people planning to take up more intense types of activity or formal exercise do need to consider the risks.

The most common risk in exercising is injury to muscles and joints, and this is more likely if people who have previously been inactive begin exercising too hard or for too long. Graduated activity that allows muscles, tendons and cartilage to adapt rarely causes problems.

The overall risk of CVD is reduced by physical activity, but risk may be increased during the actual activity. The most severe risks are myocardial infarction and sudden death during heavy physical activity.[58–60] This is particularly true for untrained subjects who start intense physical activity. Under 30 years of age, those at risk are people with congenital heart disease. Amongst the over 40s, people with underlying coronary artery disease are at risk. This may be completely symptomless or, in many cases, can be preceded by warning signs such as chest pain, breathlessness or fainting. Programmes designed to promote physical activity should include screening for high-risk individuals, who should be referred to their physician prior to participation. (For a self-administered screening questionnaire see Annex 4, p.41.)

3.4 Implications: *we can do better*

The new recommendations, advocating daily, moderate and accumulated activity, offer scope for new patterns of exercise and promotion of physical activity. Thirty minutes of activity means being active for just 2% of the day. Data on activity patterns in the EU (Figure 4, p.15) indicate that the majority of Europeans – 66% – do not meet the EHN recommendation of 30 minutes activity on most days. More than a third of the adult population engages in virtually no physical activity.[14]

Section 4: Policy recommendations – *The challenge and the potential for change*

Substantial increases in regular physical activity among people of all ages throughout the European Union are called for to improve both cardiovascular and general health. New findings that show that the detrimental effect of physical inactivity has previously been underestimated, and that even small increases in activity are beneficial. This has significant policy implications: physical activity needs to be promoted as part of normal daily life rather than an intermittent activity in a track-suit or at a sports centre. Policies need to foster greater opportunities for, and willingness of, people to engage in physical activity as part of day-to-day living, such as walking to the shops or climbing the stairs. This strategy offers the best hope that at least the minimum requirements of regular health-enhancing physical activity can be attained by the largest possible proportion of the population in the most economical and ecological way and in a manner which does not discriminate between socio-economic groups.

Making the daily lives of Europeans more physically active will take a concerted strategy on the part of many players. The EU, governments, national agencies, communities and individuals all have a part to play. The first step is to publicise the new recommendations and findings on the value and potential of physical activity for health. This includes alerting policy and decision makers, health care professionals, school administrators and teachers, land use and transport planners and media professionals to the *daily, moderate and accumulated* message. The second step is to put strategies for action in place. Evidence suggests that success is only achievable through multi-level strategies that utilise all levels of influence on health, from the individual through to community action and legislative policy change.[61,62] This section sets out recommendations for action by the EU and outlines a number of broad policy interventions at the national level that can have an effect on levels of participation in physical activity.

4.1 Recommendations for action at European Union level

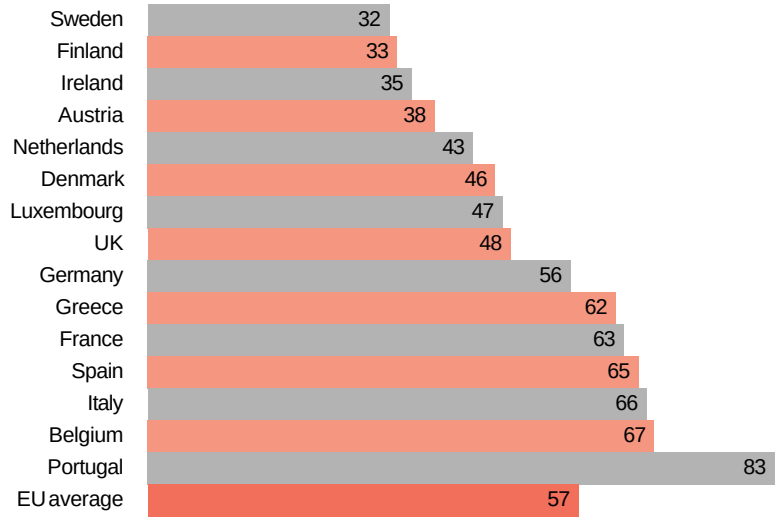
Subsidiarity is one of the key principles underpinning the functions of the EU. However, without violating the principles of subsidiarity, some

actions and initiatives carried out at a European level have more prestige and credibility than national- and local-level initiatives. People tend to pay more attention to actions that have the backing of the whole European community.

The EU has already recognised the importance of physical activity in promoting health. In 1995–6, three projects aimed at promoting physical activity received financial support from the European Community's Action Programme on Health Promotion, Information, Education and Training. These projects include a pan-EU survey on consumer attitudes to physical activity, body-weight and health; a project aimed at developing a European strategy, network and action programme for promoting health-enhancing physical activity; and a programme, *Slì na Slàinte* (Path to Health), designed to stimulate people who lead sedentary lifestyles to take up regular physical activity, especially walking, and to create pathways so that people can walk in enjoyable surroundings.

Despite the European Union's acknowledgement of physical activity as an important health determinant, only three EU Member States currently have a nation-wide government-endorsed programme to promote a physically active lifestyle – Finland, the Netherlands and the UK. Given the lack of sufficient health-enhancing activity in all European countries and the huge variation in national physical activity patterns (Figure 5) there is plenty of scope for the EU to continue and increase its supportive role in the promotion of physical activity as a health-enhancing measure.

Fig.5: Percentage of subjects in EU States that do not meet the current physical activity recommendation (of at least 30 minutes per day)[14]



Recommendations:

EU policy: Develop an EU policy on health-enhancing physical activity and a broad strategy for implementation in a range of sectors. This should be linked to other policies that affect opportunities for physical activity such as economy and finance, employment, transport, environment, regional policies, education and tourism.

Pan-European Initiatives: Support Pan-European initiatives aimed at facilitating the uptake of regular physical activity and increasing awareness of the health benefits of physical activity. These should stress that most health benefits are gained by moving from a sedentary lifestyle to one with a moderate level of daily physical activity.

Regular Surveys: Monitor EU citizens' participation in physical activity through regular surveys.

Research on special groups: Conduct Pan-European research on physical activity patterns and effective intervention among children, women and the elderly and among the lower socio-economic groups.

Information Exchange: Encourage information exchange on effectiveness of interventions in the area of physical activity among relevant Pan-European networks in such areas as health, education and training, environment and transport.

4.2 Recommendations for action at a national level

1 Information

Raise awareness among key professionals

of the importance of physical inactivity as a risk factor for CVD.

Justification: Physical activity is often left out of the discussion and practical implementation of cardiovascular disease prevention policies, strategies and measures. This may be for several reasons:

Poor dissemination: Information explaining that physical inactivity is a strong and significant risk factor may not yet have reached, been accepted or been adopted by organisations and health professionals working in the field. Unfortunately dissemination of information on physical activity

lacks the investment and support that tends to accompany information related to preventive measures using drugs or other means linked to commercial interests.

Outdated information: It may be mistakenly believed that participation in vigorous sport is required for risk reduction, and that this type of activity might be inappropriate for the people who need to make changes.

Outside the health domain: Physical activity depends on facilities and environments over which health professionals feel they have little control. This may deter them from prescribing increases in physical activity.

Too few EU countries have national policies in place that outline their approach to promoting physical activity, and strategies that set out the main objectives, the key players involved and the relevant actions to be undertaken. Whether at national, regional or local level, agreeing a strategy is important as it provides clear direction for all concerned and provides benchmarks against which progress can be measured

2 A new message

Raise public awareness

of the modern health message that even low levels of physical activity are beneficial, and that these can easily be achieved through activities as part of daily life.

Justification: Many people think of physical activity as something that is hard work and sweaty. This image can be an important barrier. The pan-EU survey found that on average 25% of Europeans cited the sporty image of physical activity as a major deterrent, this varied from 12% in Finland to 33% in Belgium and Germany and was generally more often voiced by women than by men.[14]

Education campaigns can help to promote the image of physical activity, and make it seem more appropriate. Campaigns may comprise mass media communication, leaflets, posters, educational seminars, lectures, or counselling by professionals. The core function of these activities should be that they provide some key information about healthy physical activity. They may stress a number of aspects, including:

- The health benefits of short- and long-term physical activity.
- The amount of physical activity needed to benefit health.

- How to overcome personal barriers to physical activity.
- Skills development (such as posture training, cycle proficiency).
- The experience of fun, joy and companionship while being physically active.

3. Environment and Transport

Encourage infrastructural and policy changes

that increase the opportunities for physical activity as part of daily living and transportation.

Justification: There is growing appreciation of the impact of the environment on how we live our lives and how physically active we are. Making changes to the environment to support physically active lifestyles aims to increase the *supply* of appropriate environments, where physical activity can take place, rather than attempting to further increase the *demand* for physical activity – as has been the case with most other promotional campaigns. Such environmental changes can be quite diverse as such a wide range of different types of physical activity are beneficial for health. For example, programmes can focus on green spaces or urban areas for walking and cycling as well as more traditional sports or exercise facilities.

Examples of environmental changes to promote physical activity:

- Developing an integrated transport strategy that emphasises walking and cycling.
- Ensuring streets are safe and well-lit to encourage walking.
- Marking-out safe routes for walking and cycling, particularly around schools.
- Providing and promoting the use of local parks and green spaces.
- Producing maps and guides of good places to walk or cycle.
- Improving bicycle parking facilities near public amenities, work-sites and residential housing so that they are secure and easy-to-use.
- Improving access to sports and leisure facilities for all sections of the community by providing, for example, free creches, discounted access for the unemployed, over 50s sessions and late-night sessions.

- Staging 'taster days' for the non-exerciser at gyms and exercise facilities.
- Ensuring stairs are prominent in new buildings.
- Encouraging the use of stairs in shops and offices through sign systems.
- Encouraging town planners to provide facilities that can be walked to and around, such as local markets, town squares, pedestrianised areas.

4. Facilities

Increase opportunities and facilities

for appropriate sport and active recreation for individuals and families.

Justification: people are more likely participate in sport and recreation if suitable facilities are available locally. Increasing the supply of such facilities should be seen as equally important to stimulating demand through marketing and promotional campaigns.

Appropriate facilities should not only be seen as traditional sports halls or gyms, but also playing-fields, parks, footpaths, inner-city basketball hoops and open spaces. These need to be carefully designed and promoted so that they appeal to people from a wide range of backgrounds who do not normally take part in sport.

5. The workplace

Promote physical activity through the workplace

and encourage commuting to work on foot or by bicycle.

Justification: The workplace has enormous potential as a setting for the promotion of physical activity. Most adults spend half their waking hours at the workplace, and the journey to and from work makes up a large part of the total distance travelled each day. Converting to walking or cycling for all or part of the daily commuting journey can be sufficient to confer substantial health benefits.

Examples of workplace interventions to promote physical activity

- Encouraging employers to produce 'green commuter plans' that put in place measures to make it easier for employees to walk or cycle to work.
- Providing access to cycles in the workplace and competitive mileage allowance rates for cycling as part of the working day.
- Encouraging employees to use the stairs in the workplace.
- Providing fitness-testing programmes and exercise facilities.
- Hosting workplace sports and activity days.
- Providing a free or subsidised company sports/health club.
- Encouraging managers and role models to set an active example.

6. Education and Physical Activity Skills

Develop school and teacher-training programmes

that emphasise enjoyable non-competitive physical activity, and foster the acquisition of essential skills and a lifelong physical activity habit.

Justification: Promotion of physical activity needs to target an early age-group, to sow the seeds for lifetime participation. Strategies should be put in place to ensure that young people have access to programmes, facilities and environments that encourage enjoyable experiences of activity. Physical activity education should focus on equipping children with the skills for a diverse range of physical activities rather than on a narrow range of traditional competitive sports.

Research suggests a number of recommended strategies:

- Appropriately designed, delivered and supported physical education curricula.
- Involving the whole family.
- Providing suitable and accessible environments.
- Involving young people in decision-making and programme design.
- Active participation of teachers and other staff as role models.

7. Older people and those at high risk

Promote appropriate physical activity

and provide opportunities for older people and for people with a high risk of complications in exercise, e.g. individuals with CVD, which give opportunities for the development of social networks and enhance quality of life and independence.

Justification: In most countries, older people tend to be less physically active, despite the enormous health benefits to be gained from activity in later life. In the pan-European activity survey, 28% of Europeans over the age of 55 said that they thought they were too old for active sports and leisure.[14] Demographic patterns point towards a rapidly ageing population. This makes older people a key target group for intervention.

Living an active lifestyle into older age can help offset many aspects of ageing that are often regarded as inevitable. It helps to delay the decline in some physical functions, avoid falls and accidents and to preserve independent living. Activities that enhance strength, flexibility and co-ordination are particularly important.

8. Community involvement

Encourage whole-community approaches

to the promotion of physical activity to all sectors of the population.

Justification: Community action can be a particularly powerful tool to improve conditions and provide motivation for physical activity. Many community-level cardiovascular prevention programmes have demonstrated the strong effect that communities can play in a multi-level health promotion programme, even though physical activity tended not to be a major factor within these projects. Although national strategy/policy is important, it will be within local communities that real change occurs, as the impact of other changes – to the environment, to education, or to legal or regulatory frameworks – is translated into action.

The promotion of physically active lifestyles lends itself particularly well to working in alliances – it may even be the best example of a subject that can be tackled in so many different ways by so many different agencies. An effective community alliance would bring to work together a range of key players including community leaders, active volunteers, and professionals from health, education, transport, and the environment sectors. A crucial element of such a community-based approach is community consultation: ensuring that the views, experiences and ideas of all sections of the community are taken into account in planning and implementation.

9. Disabled people

Develop clear well-structured physical activity programmes for disabled people.

Justification: Disabled people (whether physically or mentally disabled) suffer from unequal access to facilities and opportunities to be active. Yet physical activity can play an important role in prevention and treatment of many conditions, as well as offering valuable opportunities for enjoyment and social contact.

10. Equal access

Reduce the inequality in provision
that affects black and minority ethnic groups, the long term unemployed, and people from lower socio-economic groups.

Justification: In many countries there is a gradient in participation in physical activity according to social class, education and ethnic group. This may contribute to the large inequalities in coronary heart disease. Appropriate programmes need to be specifically targeted at lower socio-economic groups to reduce these inequalities.

4.3 Conclusion: *everything to gain*

All of EHN's recommendations on physical activity – to individuals to do more, and to the EU, national governments and organisations to create environments which facilitate active living and changes in attitudes towards being more physically active – offer great potential for benefits over and above their impact on CVD. For the individual, being more active will confer a whole range of health benefits. At national and EU level, making daily lives more physically active is fully concordant with policies to promote a greener and more ecologically aware society and environment. Raising physical activity levels in Europe needs to be seen as less of a challenge, and more of an opportunity – an opportunity that needs to be seized promptly, before we all pay the price for our predominantly sedentary lifestyles.

Annex 1
The health benefits of regular physical activity or, conversely, the health costs of inactivity

(adapted from Haskell 1998)[63]

The following table is based on a total physical fitness program that includes physical activity designed to improve both aerobic and musculo-skeletal fitness.

★★★★ Strong consensus, with little or no conflicting data.

★★★ Most data are supportive, but more research is needed for clarification.

★★★ Some data are supportive, but much more research is needed.

Physical activity benefit		*Surety rating*
Fitness of body		
	Improved heart and lung fitness	★★★★
	Improved muscular strength/size	★★★★
Cardiovascular disease		
	Coronary heart disease prevention	★★★★
	Prevention of atherosclerosis	★★
	Treatment of heart disease	★★★
	Prevention of stroke	★★
Cancer		
	Prevention of colon cancer	★★★★
	Prevention of breast cancer	★★
	Prevention of uterine cancer	★★
	Prevention of prostate cancer	★★
Diabetes		
	Prevention of NIDDM	★★★★
	Treatment of NIDDM	★★★
	Improvement in diabetic life quality	★★★
Osteoporosis		
	Helps build up bone density	★★★★
	Prevention of osteoporosis	★★★
	Treatment of osteoporosis	★★
Arthritis		
	Improvement in life quality/fitness	★★★★

Physical activity benefit	*Surety rating*
Low back pain	
Prevention of low back pain	★★
Treatment of low back pain	★★
Asthma	
Improvement in life quality	★★★
Infection and immunity	
Prevention of the common cold	★★
Improvement in overall immunity	★★
Blood cholesterol/lipoproteins	
Lower triglycerides	★★★
Raised HDL-cholesterol	★★★
High blood pressure	
Prevention of high blood pressure	★★★★
Treatment of high blood pressure	★★★★
Weight management	
Prevention of weight gain	★★★★
Treatment of obesity	★★
Maintenance of weight loss	★★★
Psychological well-being	
Elevation of mood	★★★★
Buffering of effects of mental stress	★★★
Alleviation/prevention of depression	★★★★
Anxiety reduction	★★★★
Improvement in self-esteem	★★★★
Cigarette smoking	
Improvement in successful cessation	★★
Nutrition and diet quality	
Improvement in diet quality	★★
Increase in total energy intake	★★★
Sleep	
Improvement in sleep quality	★★★
Children and young people	
Prevention of obesity	★★★
Control of disease risk factors	★★★
Reduction of unhealthy habits	★★
Improved odds of adult activity	★★

Physical activity benefit	*Surety rating*
Special issues for women	
Improved total body fitness	★★★★
Improved fitness while pregnant	★★★★
Improved childbirth	★★
Improved health of fœtus	★★
Improved health during menopause	★★★
The elderly and the aging process	
Improvement in physical fitness	★★★★
Countering of loss in heart/lung fitness	★★
Countering of loss of muscle	★★★
Countering of gain in fat	★★★
Improvement in life expectancy	★★★★
Improvement in life quality	★★★★

Annex 2
Examples of the strength of association (indicating partially size of effect) between moderate physical activity and various health outcomes

Table based on studies cited in the US Surgeon General's Report (1996),[18] and in Vuori (1998).[64]

Health Outcome	*Association with physical activity (PA) and size of effect*	*References*
Aerobic capacity (AC)	PA decreases the rate of decrease of AC by up to 50 % and delays its decline to a level threatening independent living by 10–20 years	Shephard 1993, Rogers 1994
Functional limitations (FL)	Risk of developing FLs in the elderly in 3–5 years 2–4 times greater in sedentary than active	Simonsick *et al.* 1993, Schroll *et al.* 1997, Laukkanen *et al.* 1998
All-cause mortality	Risk of death – 19 % lower/one more mile walked/day in 12 years in 61–81-year-old men – decreased to about half in 12–14 years in 40–59-year-old men by increasing PA from sedentary to light-moderate level – increased by a factor of 2 in 6 years in 38–60-year-old women who became sedentary – about twice as high in 18 years in 25–64-year-old sedentary compared to active same-sex twins – 25–40 % higher in sedentary post-menopausal women in 7 years – increase of fitness decreased risk of death by 30–50 % in 13 years in 40–60-year-old men	Hakim *et al.* 1998 Wannamethee *et al.* 1998 Lissner *et al.* 1996 Kujala *et al.* 1998 Kushi *et al.* 1997 Erikssen *et al.* 1998

Health Outcome	*Association with physical activity and size of effect*	*References*
Coronary artery disease	Risk in sedentary about twice as high as in active	Wannamethee *et al.* 1998
Stroke	Approximately as above	Lee *et al.* 1998, Sacco *et al.* 1998
Hypertension	Risk of developing hypertension in sedentary about 30 % higher than in active; PA decreases normal systolic/diastolic (~3 mmHg), elevated (6/7 mmHg) and hypertensive (10/8 mmHg) pressure PA decreases systolic/diastolic pressure 3.6/3.1 mmHg → large reduction of hypertension, coronary heart disease and stroke predicted at population level (2 mmHg decrease in diastolic pressure → 17 % decrease in the prevalence of hypertension, 6 % decrease in coronary heart disease and 15 % reduction in the incidence of stroke and transient ischaemic attacks	Fagard and Tipton 1994, Halbert *et al.* 1997, Cook *et al.* 1995
Non-insulin dependent diabetes	Risk in active 20–60 % lower than in sedentary, dose-dependent, greatest reduction in high-risk subjects Risk decreased by 46 % during 6 years of exercise intervention	Lynch *et al.* 1996 Pan *et al.* 1997
Colon cancer	Most but not all (Lee *et al.* 1997) recent studies support the earlier findings suggesting decreased risk (40–50 %) in active subjects	Giovannucci *et al.* 1995, Longnecker *et al.* 1995, Thune and Lund 1996, Martinez *et al.* 1997, Slattery *et al.* 1997
Overweight	Prevalence of obesity and risk of becoming obese about one half in active as compared to sedentary subjects	Haapanen *et al.* 1997
Osteoporotic fractures	Risk of hip and vertebral fractures 30–50 % smaller in physically active as compared to sedentary subjects	Joakimsen *et al.* 1997, Gregg *et al.* 1998

Annex 3
Physical activity and physical fitness: *explaining the differences*

It is not known whether physical activity itself protects against CHD or whether it is the effect of physical activity on fitness, or a combination of both, that is beneficial. Physical activity is a behaviour pattern whereas fitness is a trait that is determined by physical activity, age, sex and genetics. One indicator of cardio-respiratory fitness is the maximum volume of oxygen that a person can uptake when exercising hard – VO_2 max, adjusted for body weight. Genetics accounts for only 25% of the variability in VO_2 max.[65] A much greater proportion of the variability is due to differences in the amount of high intensity physical activity a person has undertaken. Someone who has trained hard is likely to be 'fitter' in cardio-respiratory terms and have a greater VO_2 max. Amongst the active 'exercising population', genetics is probably the most important determinant of differences in fitness, but amongst the less active population, disease and inactivity have a larger influence.

Annex 4
Physical activity readiness questionnaire

Questionnaire to screen for high-risk individuals – to be completed by the person prior to taking up a programme of vigorous physical exercise.

1	Has a doctor ever said that you have a heart condition and/or recommended that you should only exercise under medical supervision?	yes ❑ no ❑
2	Do you ever experience chest pain brought on by physical activity?	yes ❑ no ❑
3	Have you developed chest pain in the past month?	yes ❑ no ❑
4	Have you ever lost consciousness or fallen over as a result of dizziness? – in the past 10 years? – as an adult?	yes ❑ no ❑ yes ❑ no ❑ yes ❑ no ❑
5	Do you have a bone or joint problem that could be aggravated by the proposed physical activity?	yes ❑ no ❑
6	Has a doctor ever recommended medication for your blood pressure or a heart condition?	yes ❑ no ❑
7	Are you aware, through your own experience or a doctor's advice, of any other physical reason that would prohibit you from exercising without medical supervision?	yes ❑ no ❑
	If you answered 'yes' to any of these questions, call your personal physician or health-care provider before increasing your level of physical activity.	

(Adapted from Shephard *et al.*[66] and Thomas *et al.*[67])

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[9] (The sum of all calculated PAR values may exceed 100%, because the risk factors are related to each other.)

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