

**A berry picking review of the evidence on how Local Authorities
and City Councils can reduce the burden of CHD disease in the
population**

Decipher Project 2010

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The potential impact of Local Authority investments on the Burden of Cardio-Vascular Disease (CVD)

Introduction

Purpose

This report reviews the potential impact of local authority / municipality policies on reducing cardiovascular disease (CVD) in European Cities generally and the UK in particular. The paper summarises some of the evidence linking the environment in which we live and the burden of cardio-vascular disease in a population. The report is complementary to the economic modelling report which sets out the massive potential impact on future health demand if population level risk factors could be reduced even slightly. The evidence is grouped into six domains as shown below:

Domain 1: Environmental Policy

Domain 2: Housing

Domain 3: Economic Regeneration

Domain 4: Security and Fear of Crime

Domain 5: Education Policy

Domain 6: Public Health Interventions

Rationale for the report

Cardio-vascular and related diseases such as Strokes, Heart Attacks, Kidney Failure, Diabetes, Heart Failure etc are the direct consequences of a range of risk factors such as a persons body mass index (weight) blood pressure, cholesterol level, blood sugar level etc. These risk factors in turn are a consequence of our lifestyle such as what we eat, how much exercise we take, whether we smoke and how we use for example alcohol.

Our lifestyle is largely shaped by the environment in which we live, our socio-economic status, whether we are employed, availability of green spaces or leisure facilities, safety, security and fear of crime etc.

Traditionally health systems are geared up to deal with the consequences of our lifestyle and the resulting risk factors through preventative and curative treatment in primary and secondary care. If our blood pressure is found to be raised our GP will prescribe anti-hypertensive treatments. If we have a heart attach we will be admitted to hospital etc.

As the demand for healthcare continues to grow in line with an ageing population and potentially diminishing resources, health systems around the world are increasingly exploring the potential for up-stream interventions. If we encourage people to take more responsibility for their lifestyles will their risk factors reduce and as a consequence and will their future need for healthcare reduce?.

This paper begins to scope the evidence for upstream interventions and in particular the areas in which local authorities or municipalities could potentially reduce the burden of disease in their populations by shaping the environment in which people live in a way that positively encourages, promotes and enables healthy behaviour.

Concept & Method

Urban spatial planning with health impact as a major consideration has been pioneered by Prof. Hugh Barton and Marcus Grant in association with the WHO European Healthy Cities Network. Figure 1 overleaf shows their conceptual model, adapted from the famous Dalgren & Whitehead social model of health **(1)**.

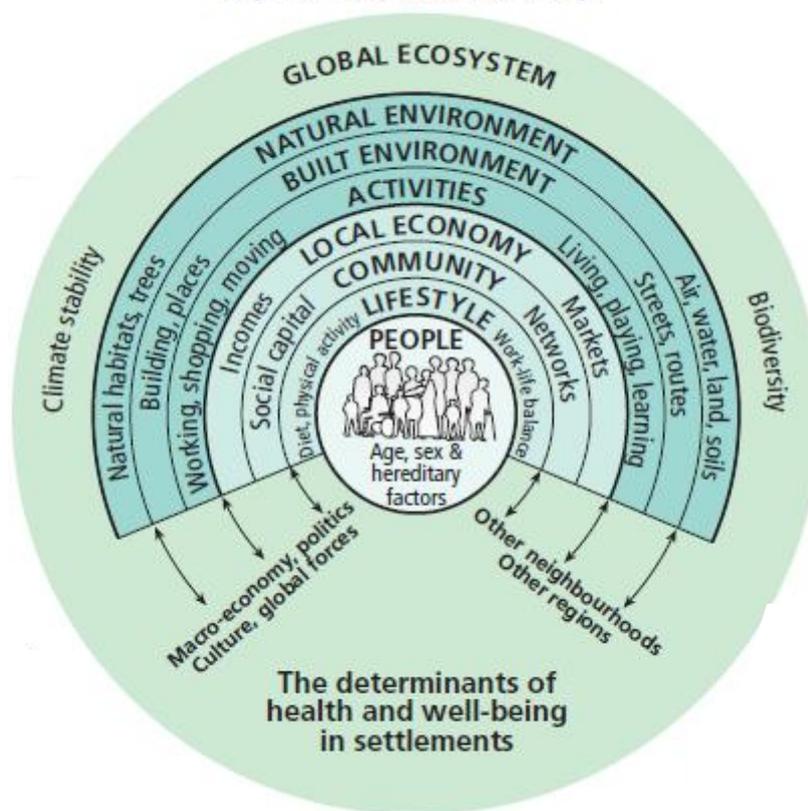
The scope of this section of the paper is limited to the urban environment and excludes the global ecosystem covering climatic stability and biodiversity (in the outer ring of figure 1).

Though there is evidence linking warmer climatic conditions to CVD **(2)** the competence for addressing this global phenomenon is primarily **(4)** with central governments and intergovernmental agencies such as the United Nations **(5)**. It is therefore outside of the scope of most Local Authorities / Municipalities sphere of influence.

Natural environments are included because they both surround cities and are found in parks and green spaces within city boundaries. Cities are characterised by the built environment of buildings, plazas, streets and routes, which facilitate human activity.

In order to undertake this is a preliminary assessment of the scope, scale and potential impact of local authority investment we developed a schematic model, then plugged in evidence from 46 scientific studies to populate the model, finally we have highlight key municipal interventions which reduce the risk of CVD.

Fig 1. A settlement health map³



Source: adapted from Barton & Grant

Role and influence of local authorities / municipalities

Municipalities have influence (and often a constitutional / legal competence) over the environment domain either by

1. regulating potential environmental hazards to health
2. providing a strategic framework for city development
3. directly investing in the built environment
4. regulating the zoning and form of the built environment
5. influencing the investment programmes and services of partner agencies.

In European and the UK local authorities / municipalities, the environmental competences are typically shared between environmental health departments and urban planning departments (6).

Domain 1: Environmental policy influences

Environmental Health: Local Authority / Municipal engagement with environmental planning has its origins in the middle of the 19th century. The task was to address the squalor of housing and industrial development which incubated and spread infectious diseases. The first municipal medical officer of health in a European city – Dr. William Duncan – was appointed by Liverpool City Council in 1847. This post was soon followed by the appointment of a city engineer John Newlands. Different combinations of a public health and engineering functions were adopted by European municipalities as cities industrialised in the second half of the 19th century and first half of the 20th century. Priorities were clean air and water and sanitation. Many municipalities responded by investing in a clean water supply, developing a sewerage infrastructure and regulating working conditions.

In the second half of the 20th century the public health function in Western Europe was medicalised and often transferred to provincial, regional or central governments. Municipalities typically retained control of the environmental health function, regulating food safety and environmental hazards such as air, water and noise pollution. In some European states, for example in England and Italy, water supply and sanitation has been privatised or part privatised (7) whereas in Finland and Sweden, municipalities retain control of this function via city owned companies.

Urban Planning: Most European municipalities have a formal competence and large degree of control over the spatial planning within their cities (8) within a framework of directives and recommendations from central government. An EU report commissioned from EPSON, however, reveals quite a wide variation in the way this function is discharged across Europe (9).

In the UK, planning departments have a primary role in regulating the zoning and density of housing, public facilities such as schools and sports centres, commercial and industrial enterprises and the transport infrastructure of roads, pavements, stations and interchanges. The EPSON report classifies Finland, Sweden, Italy and the UK as having a 'powerful local level' control over these issues but maps a gradual move from government to governance arrangements to exercise this control, often in tandem with local partners and higher tiers of provincial and regional government.

Partnership at the Local authority level is exemplified by transport. Since cities must be connected to their hinterland, local authorities / municipalities have to cooperate with adjacent local authorities / municipalities (Finland, Sweden, United Kingdom) and provincial governments (Italy) to plan and/or provide an efficient transport infrastructure, roads, pavements, plazas, and ports. Public transport (buses, trams) previously owned by local authorities / municipalities are now often privatised.

Three pathways to reducing CVD through Environmental initiatives

There is no doubt that environmental improvements in living and working conditions in all European countries have improved health, reduced the prevalence of infectious and respiratory diseases.

Some argue that these reforms, especially to water supply, (10) often led by the environmental health departments of municipalities had more impact on health in the 20th Century than medical advances, (11) (12) though this is contested (13). However the new challenge is non communicable disease, including heart disease. This is by far the biggest killer and cause of disability and dependency in European cities. Healthy urban planning aiming to redesign cities could promote the intermediate influences on reducing CVD, improving diet, enhancing social capital, increasing exercise and improving air quality.

Figure 2 identifies three sub-domains of environmental intervention:

1. The built environment
2. Transport
3. The natural environment

Fig 2 shows the schematic pathways to a reduction of CVD risk via the intermediate variables of diet, social capital, exercise and air quality.

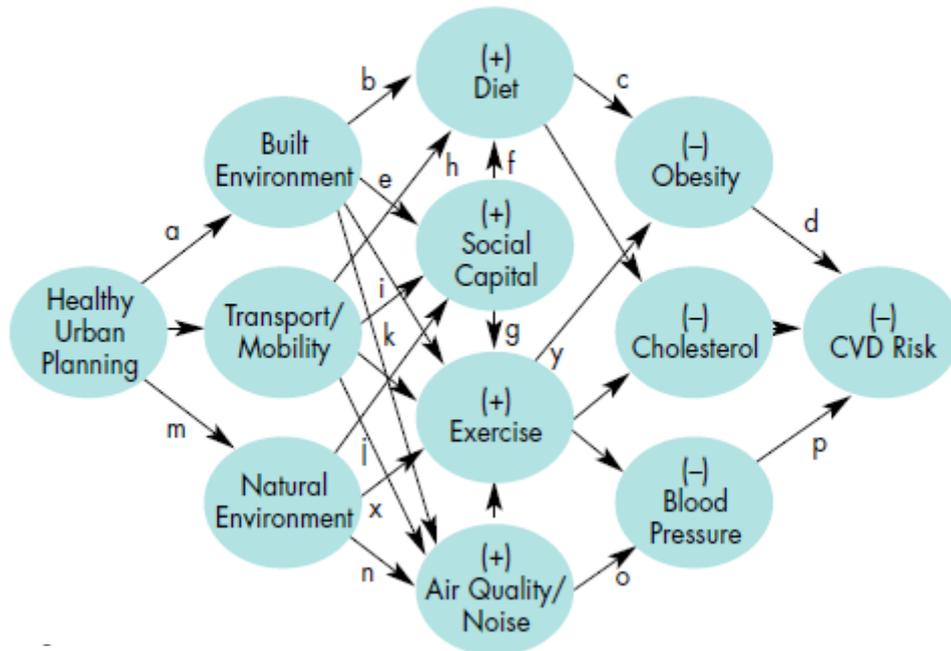
The Built Environment: The spatial configuration of commercial, industrial and residential buildings governs the pattern of social and economic activity in a city and influences all four of the intermediate variables. Although a mix of market forces and public provision of services determines activity in the built environment, planning departments guide its location.

Diet: This is linked to the location and offer of food retailers. In Europe generally and the UK in particular, there is a secular trend away from neighbourhood shops towards fast-food takeaways and peripheral supermarkets. Evidence on the links between spatial planning and CVD are not conclusive (14).

However, in a study of obesity, (15), Michael et al reported a significant interaction between built environments, individual eating out, physical activity and obesity (pathway a-b-c), and CVD risk factor (d). Li et al (16) linked a 1-SD increase in the density of fast-food outlets with a 7% increase in overweight/obesity. Wang et al showed how growth in local stores stocking unhealthy food contributed to obesity (17).

Social capital: is the second intermediate variable. In a key book on Social Epidemiology, Sally Macintyre and Anne Ellaway maintain that the contextual features of a neighbourhood contribute independently to residents' health over and above their socioeconomic status (18). These features include activities and conditions associated with the built environment and socio cultural features, specifically the degree of community integration. Kevin Leyden (19) compares the built environment of neighbourhoods in Ireland and demonstrates that persons living in walk able, mixed use neighbourhoods have higher levels of social capital compared with those living in car-oriented suburbs (pathway e). Ichiro Kawachi and Lisa Berkman reviewed compelling evidence linking social capital to health (20). Kawachi et al, (21) Eng et al (22) and Kaplan et al (23) found that the protective effects of social interaction on CVD, though the impact on proximal determinants is under reported. In their chapter, Kawachi and Berkman review evidence of how social networks may reinforce health promoting behaviour (pathways f and g).

Fig 2. Pathways from healthy urban planning to reducing the risk of heart disease



Transport/Mobility: In the 19th and early 20th Century European cities had a compact built form where distances between different social and economic activities were minimised. Walking was the predominant mode of transport. In the second half of the 20th Century, municipal planners redesigned cities to facilitate motorised transport.

Cars are now the dominant mode of transport in most European cities, providing easy access to peripheral supermarkets and business parks, contributing to the decline of neighbourhood shopping centres and modifying diets (24)(25)(26) (pathway h)

There are four more downsides to car usage.

1. Increasing car ownership and the spatial fragmentation between home, workplace, shops and services have acted to destroy community ties and social capital. (27) (pathway i).
2. Road transport accounts for an increasing proportion of air pollutants in cities. (pathway j). The European Environment Agency begins its report (28) on 'Air Pollution at street level in European cities: *Traffic-related air pollution is still one of the most pressing problems in urban areas. Evidence of the adverse health effects of fine particulate matter is continuously emerging and it is alarming that most of the traffic-related emissions are in the fine particulates range (< PM2.5). Human exposure to increased pollutant concentrations in densely populated urban areas is high. The improvement of air quality is therefore imperative. Air quality limit values, which are aimed at protecting public health, are frequently exceeded especially in streets and other urban hotspots. There is compelling evidence of the link between air quality and CVD (29) (30) (31) including an analysis of air pollution and stroke in Sheffield (32).*

3. Traffic noise, especially in densely built up areas and alongside main roads has an impact on CVD. In their review of evidence van Kempen et al (33) conclude that 'traffic noise exposure increases the risk of myocardial infarction, Stroke and ischemic heart disease.' In their cross sectional survey of the Swedish population in Scania, Bodin et al (34) produced evidence of an association between 'road traffic noise and high average levels of self reported hypertension in middle-aged men.'
4. Transport infrastructure geared to car use produces barriers to walking as a negative side effect. There is compelling evidence that neighbourhood 'walk ability' increases pedestrian activity (pathway k) reducing the risk of CVD. A Belgian study (35) showed that residents of a highly walk able neighbourhood did indeed walk more. A study (36) of 120 neighbourhoods on the relationship between built environment and blood pressure reports that neighbourhoods with high walk ability may ameliorate the risk of hypertension at the community level and promotion of walk ability could play a significant role in improving population health and reducing CVD risk.

The Natural Environment: Though the natural environment, in the form of city parks or peripheral countryside, helps improve air quality (37) thereby reducing the risk of CVD (pathway m, n, o) the main route is by promoting exercise and reducing obesity (pathway x, y, d) as confirmed by another Swedish study by Bjork et al. (38) This study also identified a buffering effect on stress, potentially reducing blood pressure and the risk of CVD.

A secondary analysis of a European cross-sectional survey (39) also found that respondents whose residential environment contained a high level of greenery, were three times more likely to be physically active and 40% less likely to be obese. A study of the whole population of England (40) below retirement age, identified the independent effect of green space on lower mortality from circulatory disease.

Cost-benefit: scale & scope

Healthy urban planning by European municipalities aims to counter the economic imperatives which limit land use for the natural environment and shape the built environment and transport systems to reduce the risk of CVD. Obesity is a key and measurable risk factor and *reduction* in the prevalence of obesity a key benefit. The obesity epidemic identified by the World Health Organisation (41) is particularly prevalent in European countries, translating into between 9% (Italy) and 20% (Finland) of the adult population (aged 15+) being defined as obese (weight >30kg/height in m) (42). The International Obesity Task Force (43) shows how the prevalence of obesity and overweight in children varies between countries.

There are few intervention studies designed to test how healthier diets may be secured by measures to enhance the built environment and transport/mobility. In their study (44) of food retail regeneration, Cummins et al found only a negligible impact on the consumption of fresh food. It is easier to model the *benefits* of physical exercise promoted by environmental interventions (pathways J, k, z).

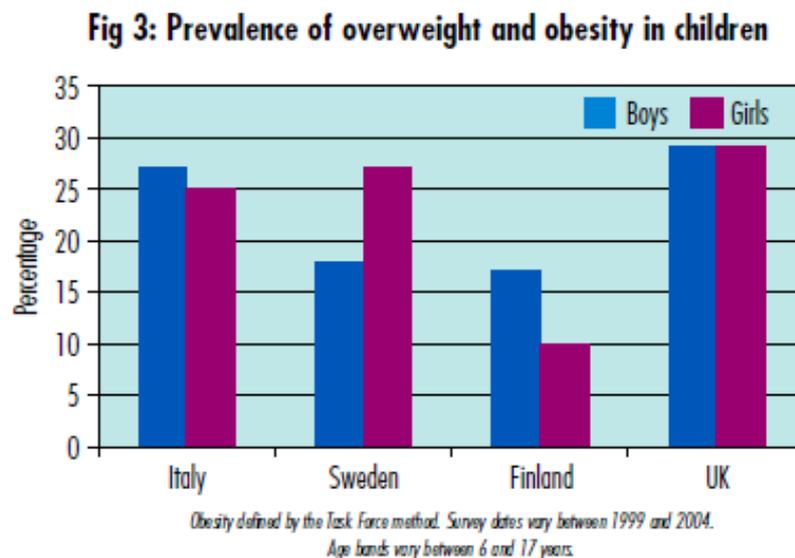
The United Kingdom's National Institute for Clinical Excellence summarised the evidence from a systematic review (45) of scientific studies and reported that:

1. Closing or reducing the capacity of roads can lead to long term increases of walking and cycling within the area of the scheme
2. Traffic calming interventions may be useful in enabling children to benefit from physical activity outdoors in the long and short term
3. The introduction of cycle infrastructure can lead to long term increases in levels of cycling within the area of the scheme
4. Modification and promotion of parks may increase walking and cycling and can raise awareness of leisure facilities. There are reasonably consistent associations between physical activity levels and the accessibility of physical activity and other facilities, the density of residential areas, land use mix and urban 'walk ability' scores.

In assessing cost-effectiveness the report highlights interventions in the walking and cycling infrastructure to help people avoid long-term chronic diseases, leading to incremental cost effectiveness ratios (ICERs) of approximately £130 – £25,000 per quality adjusted life year (QALY).

The Swedish study cited earlier indicates that residents living in neighbourhoods with high natural environmental values are 44% more likely to engage in moderate physical activity.

The strength of association between air pollution and CVD is well understood. The technical report by the European Environment Agency (cited earlier) models the impact of traffic on street level air pollution in 20 European cities. The model may be used to estimate the improvement in air quality should a municipality invest in measures (public transport) or regulate (close roads) to reduce car use.



Summary

This summary report begins to describe the range of evidence linking environmental policy in Local authorities / Municipalities and the burden of disease in their population. It is clear that where we live effects how we live and how we live effects how long we live and the quality of our life, at least in health terms.

Domain 2: Housing Policy Influences

Regulation: Led by the Napoleonic reforms in France following the 1787 Revolution, European Local Authorities / Municipalities have a historic role in regulating sanitary conditions. Environmental health was a key component of the municipal public health function which developed in response to the industrialisation of many European Cities in the 19th Century. In the late 20th Century, as now, environmental health is a municipal function in most European states, whereas health services (and to a lesser extent) public health, are most often the responsibility of national and regional governments. (46)

Provision: Responding to a shortage of good quality housing, many European municipalities built and administered their own stock from the early 20th Century onwards. By the turn of the second Millennium, owner-occupation had largely replaced private renting as the dominant tenure form in most European states and 'social' housing provision had become more complex. (47) In Sweden, circa 25% of the housing stock is rented from municipal housing companies with boards appointed by the municipality. In Britain circa 20% of the housing stock is 'social,' mainly owned by municipalities, though often managed by housing associations. France has a similar proportion of social housing, owned and managed by a 'weaker form' of municipal housing company. Finland has a small proportion of socially rented housing (circa 16%) with two-thirds managed by municipal housing companies.

Finance: Often as agents of central government, municipalities provide financial subsidies to reduce the cost of housing. Systems vary across European states but most provide subsidies to the capital costs of construction (by sub-market interest rates and land purchase) or to cover the rents payable by the poorest tenants.

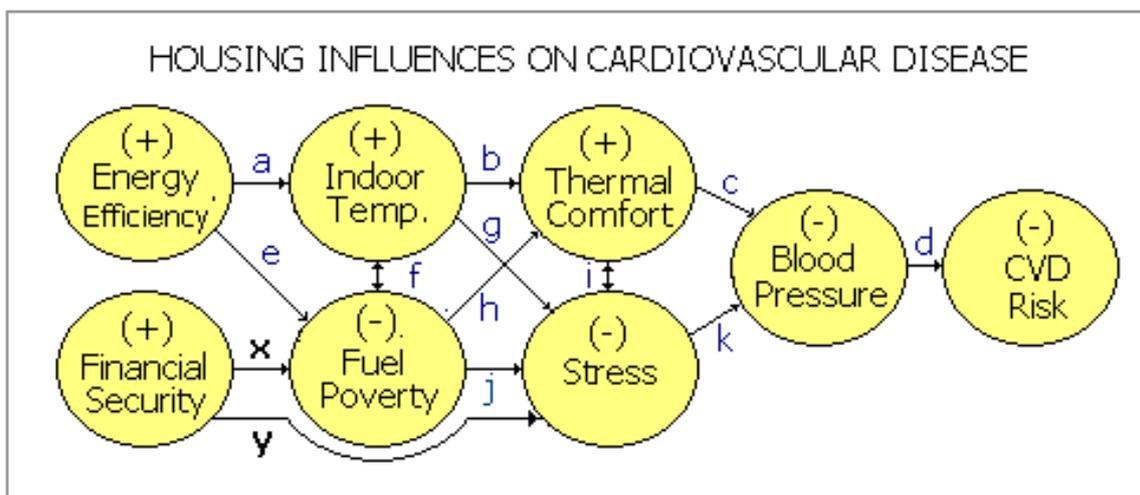
In Finland, France, Germany and Sweden (and to a lesser extent in Britain) owner-occupiers can also claim a housing allowance. Additionally, many municipalities provide housing support services such as advice and advocacy.

Two pathways to reducing CVD: increasing warmth and reducing stress.

Historically the environmental health function of municipalities was to curtail the spread of infectious diseases. By the mid-20th Century, success in eliminating these major causes of death gave rise to a 'health revolution' or 'epidemiological transformation.'(48) Non communicable diseases such as cancer and CVD have replaced communicable diseases as the biggest causes of death in Europe. Though it is necessary to maintain high levels of investment in housing infrastructure and sanitation to prevent the return of infectious diseases, the focus is now on additional investments which would modestly reduce the risk of CVD. Scientific evidence indicates there are two main pathways from housing to CVD, with (i) cold living conditions and (ii) financial insecurity as the main drivers.(49) Schematic figure 4 indicates how investment in home energy efficiency measures could increase temperatures, increase thermal comfort and reduce the risk of CVD.

Also, more complex are the pathways via which financial security reduces stress. These segmented pathways are elaborated below.

Fig 4: Housing influence on CVD



Living conditions: There is substantial evidence that living in cold conditions raises blood pressure and thereby increases the risk of CVD (d in figure 1). Early Lancet editorials by Mckee (50) and Khaw (51) highlight the connection and Goodwin (52) reviews the compelling scientific evidence, both biological and epidemiological. Thermal comfort mediates the relationship between temperature and the risk of CVD (b-c in figure 1). Residents may preserve body temperatures by wearing more clothing or adapting in other ways to relieve cold strain (53). Evidence from the health impact evaluation of the UK government’s Warm Front shows that energy efficiency measures raised indoor temperatures. Therefore we can confidentially assume the segmented pathway (a-b-c-d) of this form of housing investment on the risk of CVD.

Financial security: Stress is a key mediating variable in the route from financial insecurity to raised CVD risk. Public perception of chronic stress as an important cause of heart disease (54) (k-d in figure 1) is supported by scientific evidence (55) though the relationship is complex and contested (56). In *Social Determinants of Health: Solid Facts*, (57) the popular publication commissioned by the WHO European Healthy Cities Network, Richard Wilkinson and Michael Marmot distinguish short term from long term psychosocial stress: ‘if the tension goes on for too long, [people] become more vulnerable to a wide range of social conditions including infections, diabetes, high blood pressure, heart attack, stroke, depression and aggression.’ Depression is intimately linked to stress and has an independent effect on CVD (58).

Upstream, there are multiple pathways from financial security to the alleviation of stress and depression. The Warm Front evaluation team found that the alleviation of fuel poverty (via increased energy efficiency) had a more significant impact on health (e-j-k) than raised indoor temperatures (a-b-c). Removing the difficulty of paying fuel bills reduced stress and improved mental health (59).

Other housing programmes to promote generic household security (x and y) are more difficult to evaluate because not easily separated from a wider socio-economic context. Glasgow researchers show how the home provides existential security, specifically giving occupiers control over their environment and providing a haven for both renters and owner-occupiers in an increasingly uncertain world (60). Financial pressures on owners erode this existential security causing anxiety and depression (61). Analysis of unsustainable housing commitments by Mark Taylor and colleagues underlines chronic financial insecurity (distinguished from shorter term events) as the more important cause of anxiety and depression (62). Assuming that these processes are reversible by interventions from central and municipal governments, then evidence supports the two pathways (x-j-k-d and y-k-d) to reducing the risk of CVD.

Cost-benefit: scale & scope

Municipal priorities will depend on:

- (a) the scale of the problem
- (b) the efficacy of measures to remove or mitigate the problem and
- (c) the cost of these measures.

Cold Conditions: A marker of the impact of cold living conditions is the Excess Winter Mortality (EWD) or Coefficient of Seasonal Variation in Mortality (CSVM) evident in all European countries and cities. Expressed as a ratio of average monthly deaths in the winter compared with monthly deaths in the summer, Europe exhibits a 'paradox of EWD' with higher mortality rates generally found in less severe, milder climates such as the UK and Ireland (table 1) (63). The main determinants of CSVM appear to be energy efficiency levels, with cavity wall insulation, double glazing and floor insulation all significant at the 5% level.

The headline figure of EWD is politically charged in the UK and has generated many of the intervention studies. Though on a shallow downward trajectory, a CSVM of 0.18 translates into circa 40,000 excess deaths a year, with circa 20,000 of these attributable to living in cold condition (64) (65). Cold conditions in another 40,000 households are so harmful to health they result in occupiers seeking medical attention (66). Circa 10,000 EWD are attributable to CVD and cold conditions also increase the risk of non-fatal strokes and heart attacks.

Even in the UK, with one of the largest populations in the European Union (c60 million) the scale of the problem of CVD arising from cold conditions is modest. In the city of Sheffield with a population of 530,000, EWD are circa 400 with circa 100 attributable to living in cold conditions and 50 of these attributable to CVD. In another 100 dwellings cold conditions will cause occupiers to seek medical attention for CVD. The scope for proportionate improvement in Ireland, Portugal, Greece and Spain – all with higher CSVMs – is greater, though these countries have smaller populations. There is probably no scope for improvement in Finish and Swedish cities where energy efficiency measures are exemplary.

Table 2: Season variation in mortality, external winter temperature, domestic energy efficiency and fuel poverty

	(1) CSVM	(2) Mean winter temperature °C	(3) Cavity wall insulation (% houses)	(4) Double glazing (% houses)	(5) Fuel poverty (% households)
Austria	0.14	+1.4	26	11	6
Belgium	0.13	+3.7	42	12	10
Denmark	0.12	+2.1	65	63	4
Finland	0.10	-3.5	100	100	5
France	0.13	+7.0	68	24	10
Germany	0.11	+1.6	24	15	5
Greece	0.18	+11.6	12	6	33
Ireland	0.21	+5.8	42	22	9
Netherlands	0.11	+4.3	47	27	6
Norway	0.12	low	85	88	-
Portugal	0.28	+13.5	6	2	50
Sweden	0.12	low	100	100	-
Spain	0.21	+6.5	-	-	32
UK	0.18	+5.4	25	4	9

Source: Healy (2003) Original data from Eurostat, 1994-1997.

The objective for the poor performing countries and cities should be to reproduce the energy efficiency prevailing in the best and eliminate cold-induced CVD deaths. There is some preliminary UK evidence on the cost-effectiveness of energy efficiency measures. The Warm Front Study Group estimates that for a dwelling containing a married couple of 65 years of age, the average cost per life year saved ranged from £13,000 @ 2004 prices (€15,000 @ 2009 exchange rate 1:1.13) for insulation measures to around £30,000 for heating plus insulation over a 10 year horizon, and £4000 for insulation and £21,000 for heating plus insulation over 20 years **(67) (68)**.

Financial Security: The deep global recession (2008 – 2009) stimulated by the 2007 ‘credit crunch’ exposed the fragility of housing markets and the vulnerability of ‘sub-prime’ owner-occupiers to a decline in property values. In all European countries rising unemployment has increased the proportion of households with difficulty meeting mortgage repayments. The extent of unsustainable housing commitments varies across European countries, with highly deregulated markets, such as the UK, faring worst **(69)**.

As an indication, of the proportion of households experiencing difficulty sustaining mortgage repayments, at the height, in 1992, of the previous UK economic recession, 396,300 households were between 6-12 months in arrears with their mortgage payments, an additional 260,900 were more than 12 months in arrears and 68,600 properties were repossessed by mortgage suppliers (70).

Taylor et al (cited earlier) shows how male heads of households with housing repayment problems score 1.3 higher (range 0-36) on the GHQ measure of anxiety and depression. Those in arrears score 1.95 higher. The equivalent scores for female heads of households are more modest, those in difficulty scoring 0.62 points higher, but no higher than this for those in arrears.

Nettleton & Burrows (also cited earlier) utilize a similar analysis of the British Household Panel Survey to report the 'onset of mortgage problems leads to a 1.64 point increase in GHQ12 score (significant at $P < 0.001$) and for women is even higher at 2.51. Kamphius et al reveal how depressive symptoms in a population cohort drawn from Italy, the Netherlands and Finland increased the risk of cardiovascular mortality by 37%.

Macro-economic policies by European states are the primary means of addressing the structural problems which put households at financial risk. Already there is evidence that historically low interest rates have eased the difficulty of mortgage repayments even for sub-prime borrowers. However, municipalities and their partners from the third (voluntary) sector have an actual or potential role in providing social support. In their review of 81 studies Uchino et al (71) distinguish emotional support of the kind that is provided by families and friends, from appraisal support (assessment, advice) of the kind that may be provided by the housing support services of a municipality. Both types act as a buffer against stress and reduce the risk of CVD.

Summary:

An initial schematic model suggests two routes to reducing the risk of CVD: alleviating cold conditions and reducing financial insecurity. Evidence from a number of scientific studies indicates the scale of impact for each segment of the principal routes. An indication of the cost of intervention is given.

Domain 3: Economic Policy Influences

Economic development: The macro-economic policies of the European Union (EU) and of European central governments combine to have the greatest impact on city economies. However, local authorities / municipalities have an increasing role in transforming their local economies into '*dynamos of national and regional economies rather than economic liabilities.*' (71) Often with Regional Development Agencies, they invest in skills, training and economic infrastructure. They may (as in Udine Italy) form partnerships with economic organisations and private enterprises to promote economic development or (as in Turku, Finland) directly own companies and enterprises with board members nominated by the city council.

Most invest in a supportive social and environmental infrastructure because they understand that economic policy '*should recognise the linkages between housing, education, transportation, health and welfare policies and not treat them separately.*' (72) Many city health development plans, and overarching municipal plans, acknowledge this interdependency (73). Healthy Urban Planning adopted by many member cities of the WHO European Healthy Cities Network promotes spatial strategies which acknowledge the interdependence of health and sustainable development (74) (75).

Neighbourhood and area-based regeneration: Generic local economic development strategies may not address persistent economic inequalities between regions and within cities (76). The EU is the largest investor in programmes, such as those meeting Objective 1 to promote convergence and reduce disparities between European sub-regions. Within member states, regional agencies and governments also address disparities within their domain and cities address disparities between neighbourhoods. As with generic economic development policies, investments in poor neighbourhoods invariably link economic development to a more supportive social and environmental infrastructure.

Municipal employment: Following the decline of large industrial enterprises in the later decades of the 20th Century, municipalities became the biggest employer in most European cities; with the health sector (often influenced/controlled by municipal nominees on the board) the second biggest employer. During this period left-leaning members of the policy community maintained that public sector employment boosted the local economy. In the closing two decades of the 20th Century, the dominant counter-trend was to outsource some municipal and health services. However, municipalities retained influence by incorporating beneficial working conditions and payments in contracts with private or third sector suppliers of goods and services.

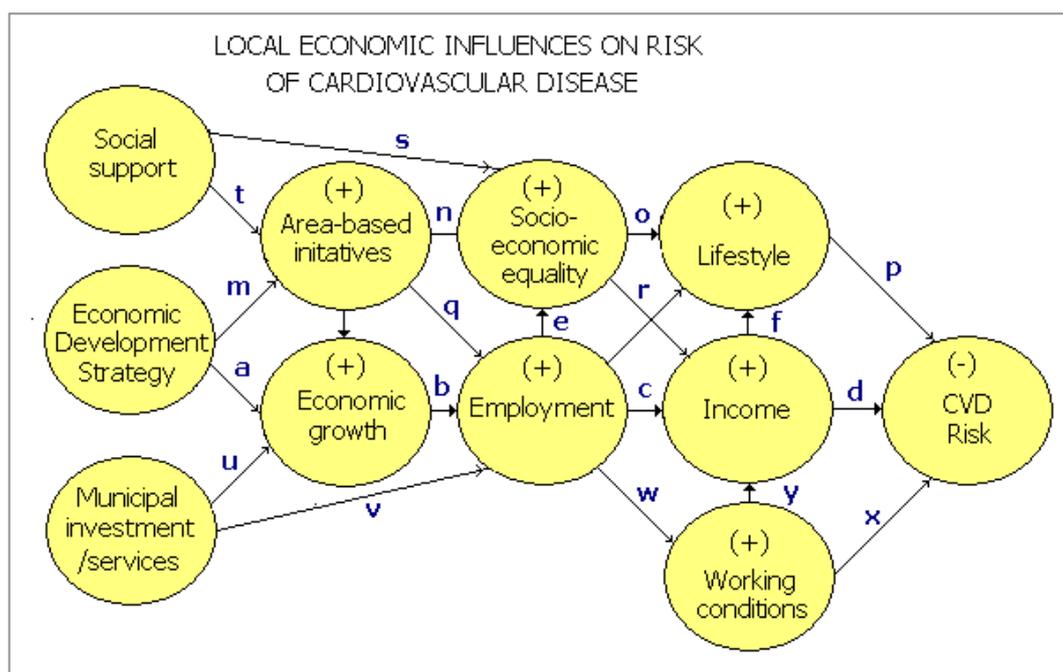
Financial support: The level and scope of subsidies to low income households, ill or unemployed individuals, are generally determined by European central governments. Municipalities may administer certain subsidies as an agent of central government, such as Housing Benefits in the UK. Additionally, many municipalities provide support services such as advice and advocacy.

Three economic pathways to reducing CVD

Schematic figure 5 shows pathways from three economic interventions to three proximal determinants of CVD risk.

Economic development strategy and social support: Though there is an enormous amount of grey literature on local economic strategies, there is no consensus on their added value. The assumption of municipal policy-makers and their partners is that local interventions will promote more economic growth than would otherwise prevail, (77) leading to higher rates of employment and higher incomes for the newly employed (route a – b –c in figure 1). Insofar as the new entrants into the labour market were previously unemployed or dependent on relatively low state benefits, then this ‘trickle-down’ process from mainstream economic development will tend towards equalising incomes across city populations of working age (route e). In addition, municipalities and their partners may adopt a more focused approach to addressing inequalities via special economic and social initiatives in poor neighbourhoods of their cities, leading to greater socio-economic equality (route m – n) because of higher levels of employment and income (route q – c). Social support, either as an element of a neighbourhood initiative (route t – n) or to individuals (s) should lead to greater socio-economic equality.

Fig 5: Economic influence on CVD



There is compelling evidence of a social gradient in health (78) and epidemiological evidence that prevalence of CVD is highly correlated (route r – d) with socio-economic status (SES) (79). In their study of *Framingham Offspring*, Loucks et al show how cumulative exposure to socio-economic disadvantage across the life course maybe associated with CHD (80): those with low SES are more likely to exhibit the CVD risk factors of high blood pressure, obesity, high cholesterol, and high glucose levels.

However the mechanisms linking SES to risk factors are not fully clear. There are two conundrums. *First*, is the risk of CVD lessened by a general increase in income levels (and the material wealth) of a city's working age population or only lessened by flattening the SES gradient – the '*sprit level*' according to Richard Wilkinson? (81) In the later decades of the 20th Century, as absolute poverty was progressively eliminated from Western Europe, sociologists emphasised the saliency of 'relative deprivation' (82). Relative deprivation may lead to social-exclusion, stress and depression which are CVD risk factors. Therefore municipal programmes which boost income generally but maintain income differentials may have no positive impact on CVD.

The second conundrum is the relationship between SES and lifestyle and their relative contributions to CVD risk. Some associations are clear. In the later decades of the 20th Century the inverse relationship between smoking and SES became pronounced as the *Framingham Offspring study* highlights. However, in their study of 22 European countries, Mackenbach et al reveal a more complex relationship between lifestyle risks and SES (83). CVD mortality was relatively high in the relatively egalitarian Scandinavian states and lower more unequal states of Southern Europe, possibly because of their 'Mediterranean' diet. 'Diseases of affluence' is a popular paradigm which associates greater disposable income with unhealthy lifestyles and therefore a higher risk of CVD. Ezzati et al rethink the concept (84), first acknowledging the association but then identifying a tipping point where those higher socio-economic adopt healthier lifestyles.

Municipal Employment / Contracts: As indicated above, municipalities in the 21st Century now have a limited role in regulating the working conditions of private enterprises. However, as the biggest employers within most European cities, they have a direct influence over the working conditions of their staff and contractors (route v-w). In his famous studies of the British Civil Service (The Whitehall studies) Michael Marmot showed how in a common office environment, staff with little control over their pattern of work are at greater risk of CHD than those with more control (85). He and Richard Wilkinson argue in *Solid Facts* that '*mechanisms should therefore be developed to allow people to influence the design and improvement of their work environment, thus enabling employees to have more control, greater variety and more opportunities for development at work.*'

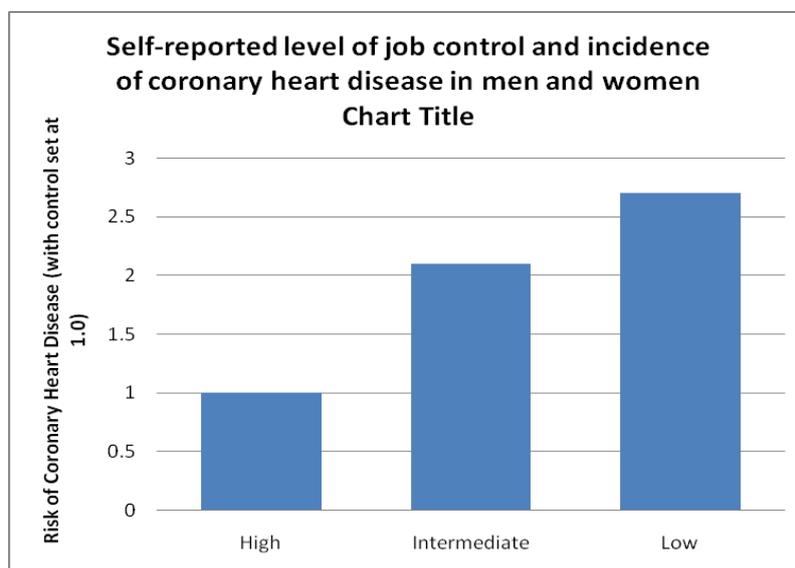
Cost-benefit: scale & scope

At this stage the pathways from local economic development are too complex and uncertain to predict the potential scale of their impact on CVD risk. There are at least three uncertainties. *First*, upstream, the scale of municipal economic investment is difficult to determine and difficult to separate from supporting investment in environmental, social and educational infrastructure. In the next stage of DECiPHEr it should be possible to disaggregate municipal budgets, allocating for example a percentage of the €1.1bn annual (2009) expenditure of Turku municipality and £1.4 bn (€1.6bn, 2008) of Sheffield municipality.

Second, there is a contentious methodology for measuring the impact of these investments/interventions on economic growth, employment, income and socio-economic equality. Third, the mechanisms which convert these values into risk factors are not fully clear given the complicated relationship between socio-economic inequalities and lifestyle.

The evidence on working conditions is more straightforward. Figure 2 extracted from *Solid Facts*, shows the increased risk of CVD arising when employees have little control of their working environment and work processes. Employees with low control are 2.7 times more likely than those with high levels of control to suffer from CHD. It should be feasible to use protocols from the Whitehall studies to establish a baseline of job control for municipal employees, estimate the potential for improving working conditions and predict the reduced risk of CVD.

Fig 6. Self reported job control (86)



Summary.

An initial schematic model suggests three routes to reducing the risk of CVD: economic development with special focus on reducing socio-economic inequalities, social support and improving the working conditions of municipal employees and sub-contractors. Evidence from a number of social scientific and medical studies indicates the principal routes. At this stage it is very difficult to make even a broad estimate of the scale of potential impacts of economic development policies. Estimating the potential of improved working conditions for municipal employees and contractors is an easier task.

Domain 4: Security and fear of crime

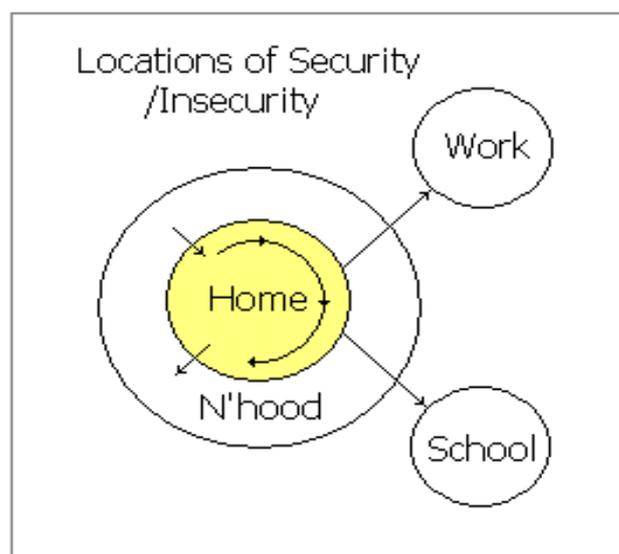
Many European cities have Crime Prevention Partnerships or Community Safety Partnerships with the objective of preventing crime. Often the municipality has a lead role. For example, in Helsingborg the Council for Crime Prevention is chaired by a municipal politician and includes representation from the police, social services, department of risk and security, department of sustainable development and sometimes the school and department of urban planning.

There are four settings in which municipalities have an influence over security -

1. in the home
2. in the neighbourhood
3. at work and
4. in schools.

The last two settings are covered in our reports on the domains of economy and education. The arrow from neighbourhood to home represents a threat to security by intruders; this is analysed in the report on the housing domain. Here we consider two security settings. First the health impact of domestic violence or Intimate Partner Violence (IPV). Second the security of the neighbourhood outside the home.

Fig 7: Security influences on CVD



Domestic violence: Primary and hospital health services, often controlled by Central and Regional Governments, may screen patients for the prevalence and consequences of domestic violence. The police service, which is often controlled by the Central Government Ministries of Interior, has a primary competence for bringing perpetrators to justice.

However, municipalities have primary responsibility for preventing domestic violence via their social work departments. Many European states require municipal social service departments to work collaboratively with the police and health services to manage households at risk from violence or abuse, either to partners or children (90). The Italian Framework Law is a good example (91).

Neighbourhood security: Though central and regional governments provide macro-economic policy guidelines for local development, European municipalities have a primary legal competence for neighbourhood planning and development.

Municipal planning departments undertake this function, liaising with external agencies, including the business sector, and internally with transportation, education, housing and welfare departments. In the last decade, in Phases III and IV of the WHO European Healthy Cities Network, many municipalities added a health dimension by undertaking Healthy Urban Planning. Helsingborg in Sweden has produced an exemplary municipal plan which integrates healthy urban planning, sustainable development and safety and security (92). Municipal plans may also include a security dimension.

Two pathways to reducing CVD domestic violence and security

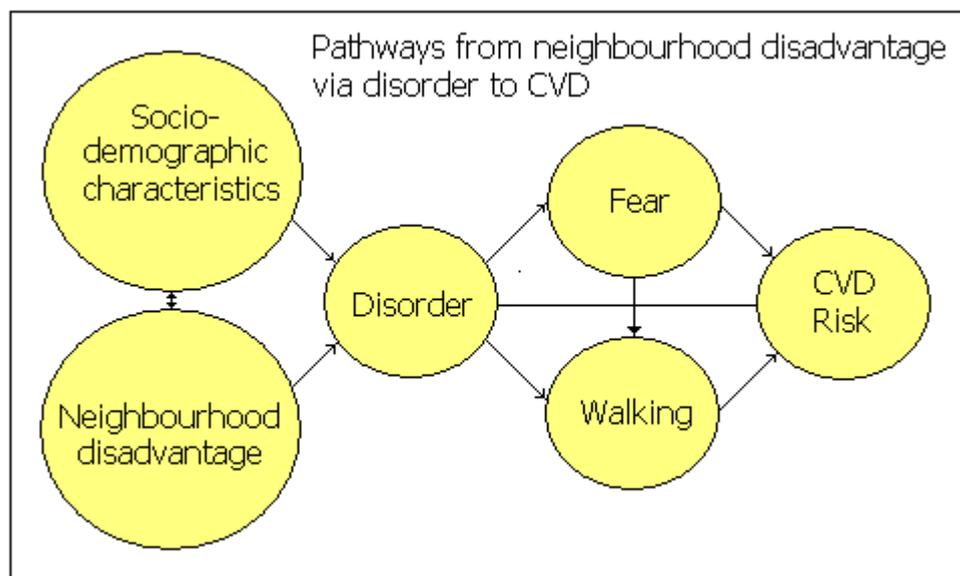
Domestic violence: An EU Daphne II project on domestic violence in Europe defines it as '*controlling behaviour by the intimate partner or ex-partner, which includes, but is not limited to physical and sexual violence, emotional abuse, isolation, economic abuse, threats, intimidation and stalking* (93).' Popular headlines highlight physical violence and there is little scientific evidence linking such trauma to CVD. However, more sustained controlling and repressive behaviour by the perpetrator leads to stress on the victim and stress is clearly linked with CVD (94). The United States Centre for Disease Control found that more women with a 'lifetime history of intimate partner violence victimisation' experienced high blood cholesterol, stroke and heart disease, compared with those with no such history (95). The relatively small percentage of men with such a lifetime history experienced similar risk factors.

Neighbourhood security: There are many scientific articles which evidence a strong link between neighbourhood disadvantage and risk of CVD. These are summarised the environment domain. Many neighbourhood factors interact to reinforce a vicious cycle of decline or a virtuous circle of improvement. A key objective of scientific studies is to account for the independent effect of neighbourhood violence and disorder. Using sophisticated modelling techniques, Kristina Sunquist et al showed how an increase in the rate of violent crime in areas of Stockholm was associated with an increased risk of CVD (96). Catherine Ross and John Mirowsky characterise disorder prevalent in neighbourhoods where residents '*report noise, litter, crime, vandalism, graffiti, people hanging out on the streets, public drinking, run-down and abandoned buildings, drug use, danger, trouble with neighbours and other incivilities associated with a breakdown of social control.*'(97) They tested for the mechanisms of fear and reducing walking in neighbourhoods of Illinois using the model in figure 2. (We have substituted CVD risk or Health).

They found a significant relationship between fear and health which included heart disease and high blood pressure as two of 10 markers of health.

This pathway is also supported by our evidence from social housing estates in Liverpool showing that fear of neighbourhood crime and stress are highly correlated with health (98).

Fig 8: Neighbourhood influence on CVD



The evidence on walking is not so compelling. Ross and Mirowsky hypothesise that neighbourhood disorder and fear will inhibit walking as an outdoor exercise, but find no significant association with health. Contrary evidence is supplied by Roger Harrison and colleagues in their study of two districts in North East England (99). They found that people who felt safe in their neighbourhood were more likely to be physically active.

Cost-benefit: scale & scope

Domestic violence: It is difficult to estimate the prevalence of lifetime domestic violence, which is more likely than short term episodes to have an influence CVD. The definition can embrace intimate partners, including sexual partners and parents, plus non-intimate household members. The influential *WHO Multi-country study of Women's' Health and Domestic Violence Against Women* reports big variation in prevalence between countries, ranging from 10% to 30% of women experiencing violence from an intimate partner (100). The study by the Centres for Disease Control (CDC, cited earlier) indicates that 24% of women and 11.5% of men over 18 have a lifetime history which includes partner violence victimisation. A UK study by the UK Government Ministry of Interior reported similar prevalences, 23% of women and 15% of men between 16 and 59 (101). A study by the Finnish Ministry of Social Affairs and Health gave a similar prevalence of 22% of women victims of physical or sexual violence by their partner.

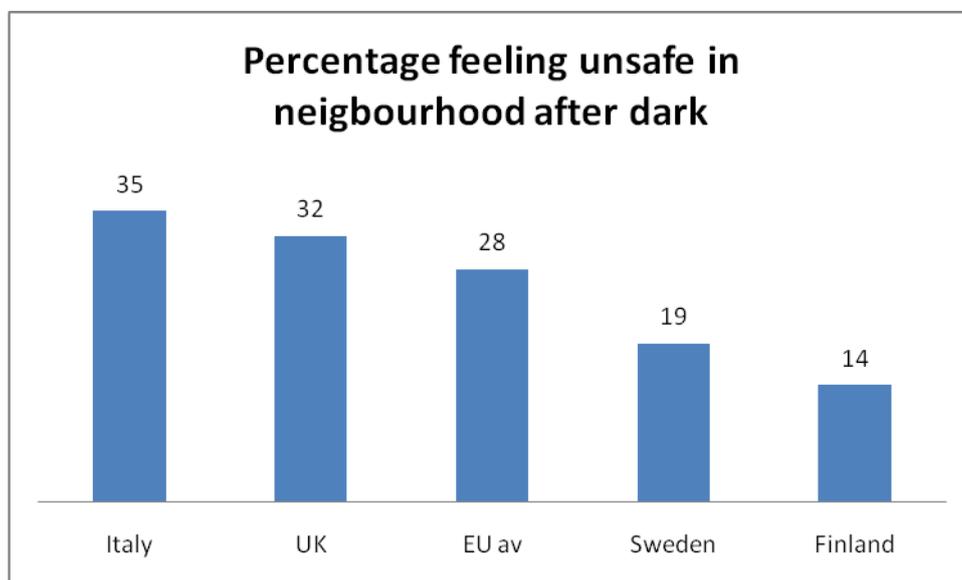
On the cost side of the equation, the same (unsourced report from the Finnish Ministry) calculated that the social cost to society of one act of domestic violence costs €22,000 (1997 prices) compared with only €900 to treat an assailant with 3 months evaluation and 15 group therapy sessions.

On the benefit side of the equation, the CDC study indicated that stroke was more common in women who had experienced IPV compared with no IPV women (3.2% compared with 2.0% of the sample). There were similar ratios for heart disease (4.2%:3.0%) and high blood cholesterol (36.7%:34.0%) though not for blood pressure.

Neighbourhood security: A key reference report (102). funded by the EU on the burden of crime draws on the *European Crime and Safety Survey* in 18 EU countries by Gallup. Representative population surveys general give a more accurate picture on prevalence than official recorded crime statistics and facilitate comparability between member states. On average, 15% of the EU18 adult population was a victim of crime in the previous year (UK 20%, Sweden 16%, Italy 13%, Finland 13%). Many of the crimes may be perpetrated in a victim's neighbourhood. The prevalence for assaults is UK 5.5%, Sweden 4.0%, Finland 2.5% and Italy 0.9% and robbery is UK 1.5%, Sweden 1.3%, Finland 0.3% and Italy 0.2%.

Fear of crime is not correlated with prevalence of crime, though there is a high correlation (+.79) with the proportion of the population coming into contact with drug-related problems. This may imply a set of correlations with the characteristics of a disorderly neighbourhood cited by Ross and Mirowsky. The variation in the percentage of adults feeling unsafe out after dark in their neighbourhoods is shown in Figure 3.

Fig 9: Fear of crime



Ross and Mirowsky report a highly significant correlation between neighbourhood disorder and fear (+.422) and a modest but significant correlation between fear and composite health (-.054) which includes measures of heart disease and high blood pressure.

Green et al. report a very high correlation between fear of crime and stress and between both of these and mental health.

The quantum association between stress and coronary heart disease is elaborated in the report on the housing domain. Roger Harrison and colleagues (cited earlier) estimate that of their sample of 15,461 responders, the number of physically active people would increase by 3290 if feelings of 'unsafe' during the day were removed and by 11,237 if feelings of unsafe during the night were removed.

Summary.

An initial schematic model suggests two routes to reducing the risk of CVD: reducing domestic violence and improving neighbourhood security. Evidence from a number of social scientific and medical studies indicates the principal routes.

Domain 5: Education Policy Influences

In a response to an EU Green Paper on migration and mobility,(103) the Council of European Municipalities and Regions defined education widely as '*a concept that is not limited to schools only, but includes day care facilities for children, family centres, cultural and sports centres.*'(104) However, pro tem, the scope of our domain is limited to city schools for children between the ages of 3-19,segmented into nursery school (pre-5) primary (5-11) and secondary (12-18).

Over the past two decades, two counter-trends have determined the degree of municipal scope and influence on school education (105). *First*, devolution from central, regional and provincial government has transferred power and influence to local authorities and municipalities, especially in Scandinavian countries. The education authorities in the UK are traditionally dominated by the local authority. In Italy the education authority for primary and secondary education is controlled by municipalities but the provincial government manages higher school education. For example, teachers in Italy are employed by central /regional government; in Sweden and England by either the municipality or the school board, in Finland by the school board. Overall public expenditure on schools is determined centrally in Italy, locally in Finland and Sweden and by the municipality or school board in England.

A trend towards school autonomy has reduced the scope of municipal control. The current position on school autonomy for EU27 is tabulated in *Key data on education in Europe* reported by the European Commission (106). School boards have decision-making power over the school educational plan in 10 of the EU 27 including Italy and England: in Finland and Sweden the power depends on the extent of devolution from the municipality.

There is a compulsory minimum curriculum, set by central government, in Finland, England, Italy and Sweden. School boards have full autonomy over both the curricula content and choice of teaching methods for optional subjects.

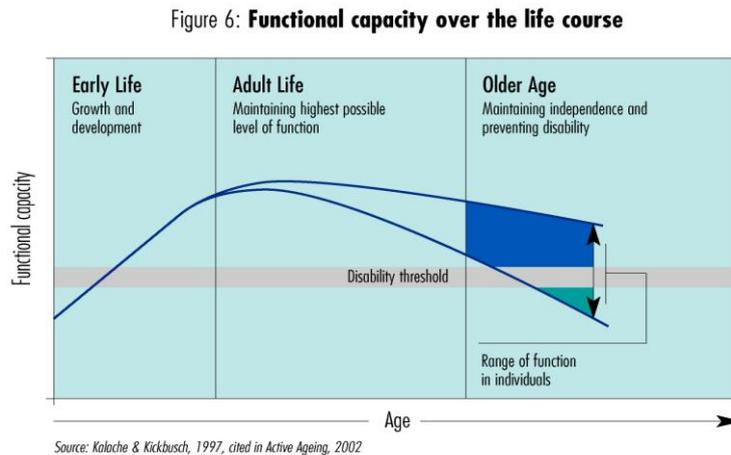
Three pathways to reducing CVD: socialization, health promotion in the school setting and curriculum.

We must take account of two contextual issues when seeking the specific contribution of schools' education to reducing the risk of CVD.

Education or SES: Though many scientific studies identify a clear negative relationship between education and coronary heart disease, they do not refer to education per se but as a proxy for socioeconomic status, especially in US literature. Davey Smith and colleagues (107) distinguish these two determinants in their prospective observational study and conclude that '*CVD was the cause of death most strongly associated with education, while the non-CVD, non-cancer category was the cause of death most strongly associated with adult social class.*' Education may be linked to CVD risk by two pathways, either (a) via SES and better material circumstances (see report on the economy domain) or via health promotion, by improving ' health literacy' (108) as an independent determinant of positive attitudes and behaviour.

Life course: Very few children have CVD, even fewer die in childhood. Schools programmes will not have an immediate impact on CHD but will have an effect in later life. (109) (110) Figure 10 shows the familiar life course model developed by WHO (111) which focuses on dependency in later life. These are matched by models of chronic disease epidemiology (112) which focus on disease and death. These models imply that any costs associated with healthy schools are front-loaded but the benefits (in terms of reduced illness and dependency) are delivered later in the life course (113).

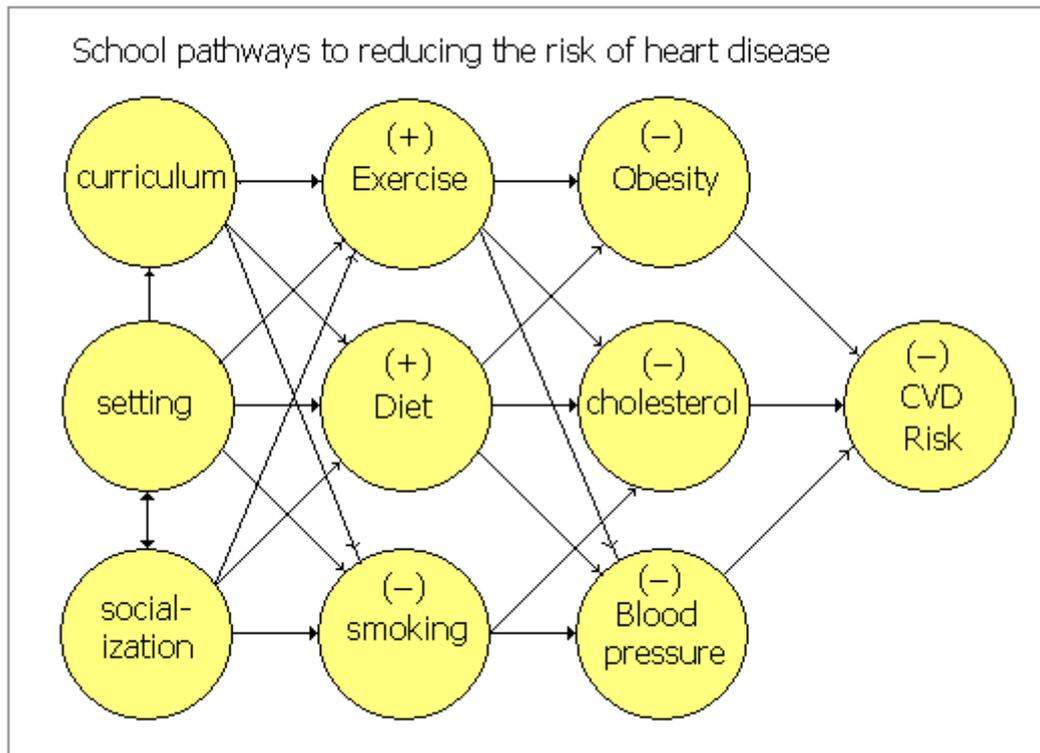
Fig 10: Functional capacity over life course



There is scope for municipalities and their local health authority partners to adopt a '*health promoting schools*' approach pioneered by WHO (114). This is a comprehensive 'whole school' approach. Constituent programmes are designed to discourage children's lifestyles which would lead eventually to CHD (115).

The potential pathways from school interventions to reduction of CVD are easy to identify and illustrated in figure 11. There is also robust scientific evidence which links the intermediate lifestyle segments of the pathways (exercise, diet, and smoking) to the risk factors of CVD (obesity, cholesterol and blood pressure) and modest evidence of impact in later life course (116) (117).

Fig 11: Education influence on CVD



Upstream, schools may include health promotion in (a) their curriculum, in (b) the school setting and (c) via socialization. A 'whole school approach' aims to combine all three. For example the natural and social sciences curricula may improve 'health literacy;' dedicated sports is also part of the school curriculum in all EU27; the school setting can promote walking and cycling to school as a counter trend to being driven by car. Schools can also promote a healthy diet by providing healthy school meals and also educating children and how to buy, grow and cook food. Socialization may be promoted in the curriculum and occurs naturally in the school setting. There is evidence that social integration helps prevent health damaging behaviours and reinforces health promotion messages (118).

There is also evidence that these school interventions have a positive impact on behaviour, though the backcloth in nearly all EU27 countries is bleak. Tobacco smoking has declined, but otherwise there is a negative trend of less exercise, poorer diets and an increase in childhood obesity.

The European Commission has highlighted a childhood obesity epidemic in Europe (119). However, the legendary North Karelia project indicates that a concerted effort to change behaviour at a regional level can produce a dramatic reduction in CVD (120). Our challenge is to isolate the potential impact of school interventions. A systematic review of 30 studies of school programmes to increase fruit and vegetable consumption concluded that '*School schemes are effective at increasing both intake and knowledge.*'(121) Increased understanding of the cessation process may help in developing effective tobacco control interventions for novice smokers (222).

There is evidence that adolescent smoking, physical activity, and food choice behaviours are consolidated in adolescence and retained through the later life course (223). More evidence will become available from the WHO Collaborative Cross-National Study of Health Behaviour in School-aged Children, reported in a special supplement of the International Journal of Public Health (224).

Cost-benefit: scale & scope

The scale of benefits from a concerted regional programme to address diet, exercise and smoking may be gauged by evidence of the impact of the North Karelia programme. The tables are extracted from the summary produced by the Finnish National Institute for Health and Social Welfare cited in table 3 below.

Further work is required to ascertain the contribution to these benefits of schools programmes, taking account of (a) evidence of programme impact on child behaviour and (b) the extent to which healthy behaviour is sustained throughout the life course.

Theoretically the cost of school health promotion programmes could be minimal if there were modification of the existing curriculum, alteration to the school setting and sensitizing socialisation to health promotion messages.

Summary.

An initial schematic model suggests three routes to reducing the risk of CVD: increasing exercise, improving diet and sensitizing socialization to health messages. Evidence from a number of social scientific and medical studies indicates the principal routes.

Table 3. Main risk factors in North Karelia between 1972 and 2007 among men and women aged 30-59 years

Year	Men			Women		
	Smoking (%)	Serum cholesterol (mmol/l)	Blood pressure (mmHg)	Smoking (%)	Serum cholesterol (mmol/l)	Blood pressure (mmHg)
1972	52	6.9	149/92	10	6.8	153/92
1977	44	6.5	143/89	10	6.4	141/86
1982	36	6.3	145/87	15	6.1	141/85
1987	36	6.3	144/88	16	6.0	139/83
1992	32	5.9	142/85	17	5.6	135/80
1997	31	5.7	140/84	16	5.6	133/80
2002	33	5.7	137/83	22	5.5	132/78
2007	31	5.4	138/83	18	5.2	134/78

Table 2. Mortality changes in North Karelia among 35-64 years aged men in 1970-2006 (per 100 000, age adjusted)

	Rate in 1969-1971	Rate in 2006	Change from 1969-1971 to 2006
All causes	1509	572	-62%
All cardiovascular	855	182	-79%
Coronary heart disease	672	103	-85%
All cancers	271	96	-65%
Lung cancers	147	30	-80%

Age-adjusted mortality rates of coronary heart disease in North Karelia and the whole of Finland among males aged 35-64 years from 1969 to 2006.

Domain 6: Public Health Interventions

Risk level reduction: How would the PCT go about achieving the risk reduction levels modelled in this exercise? There is growing evidence worldwide that these risk factors are reducible. Some examples of interventions are shown below:

Smoking cessation - studies: A study published in *Drug and Alcohol Review* (125) (November 2006) demonstrated that many national policies were quite effective. For example, they found that a 10% increase in cigarette prices, through taxation for example, will reduce overall cigarette smoking by 2.5% to 5.0%. Similarly, restrictions in smoking, such as workplace smoking bans, reduced smoking prevalence among adults by 5%, while it reduced cigarette consumption among continuing smokers by 10%.

Changes to health information and counter advertising led to significant reductions in cigarette smoking. Initial declines in smoking of between 4% and 9% in the short term and longer-term cumulative declines of 15 – 30% were achieved. Bans on advertising and promotion, in high-income countries, have been shown to reduce tobacco consumption by over 6%. This study concluded that partial bans have little impact on smoking behaviour.

Clearly this type of approach is beyond the scope of the PCT, although the principles might be useful in re-enforcing the messages in high risk communities.

A review of studies published in *The Annals of Internal Medicine* (126) (2006) showed that at 1 year after cessation, quit rates were 11.2% for low-dependence smokers who were receiving a placebo. Rates were 19.5% for those receiving 2-mg nicotine replacement gum, and 18.4% for those receiving 4-mg nicotine gum ($P = 0.20$ for linear trend). For high-dependence smokers, quit rates at 1 year were 6.1%, 15.7% and 20.7% respectively.

A Polish study in 2007 (127) used a systematic review to show that the non-pharmacological smoking cessation methods available in Poland, namely the physician's advice and individual or group counselling, increased the probability of smoking cessation and smoking abstinence for 12 months to up to twice the level of those trying to quit unaided. The number of patients who need to be treated for each quitter was estimated at about 30 for more intensive counselling and 60 for straightforward advice from a clinician.

A meta-analysis of the effectiveness of smoking cessation therapies in 2006 (128) examined studies where nicotine gum or NRT patches, nicotine inhalers, nasal sprays and lozenges, or a combination of these was used.

The control interventions included placebo, no treatment and other pharmacological agents. The duration of treatment, where reported, ranged from 2 weeks to 24 months.

The study demonstrated that nicotine replacement therapy (NRT) significantly improved smoking cessation rates at 1 year, compared with any control. (OR 1.71, 95% CI: 1.55, 1.88, $p < 0.0001$). The results were similar for NRT versus placebo only studies (OR 1.78, 95% CI: 1.60, 1.99, $p < 0.0001$; 49 studies), NRT gum (OR 1.60, 95% CI: 1.37, 1.86, $p < 0.0001$; 33 studies) and NRT patch (OR 1.63, 95% CI: 1.41, 1.89, $p < 0.0001$; 23 studies).

Smoking cessation – guidance: Comprehensive evidence based recommendations on the treatment of tobacco dependence was produced by the WHO in June 2001 (129). They recommend the use of 3 main types of intervention:

1. pharmacotherapy
2. intensive support delivered by treatment specialists
3. brief opportunistic interventions

Any initiative in a City could be based on this guidance.

Obesity – studies: A study published in the International Journal of public health in 2007(130) undertook a systematic review (with meta-analysis) and included studies which were randomised clinical trials of lifestyle interventions in overweight and obese people. The minimum observation period was one year. 13 studies were selected in the prevention of obesity and 17 in the treatment of obesity.

The study concluded that lifestyle interventions were efficacious in the mid- to long-term prevention and treatment of obesity, leading to a significant reduction in body weight and cardiovascular risk factors.

A Cochrane review examining the impact of exercise on obesity (131) examined 43 studies including 3,476 participants. The studies were primarily randomised controlled trials that examined body weight change using one or more physical activity. The review concluded that exercise combined with diet resulted in a greater weight reduction than diet alone.

A study looking at the impact of weight reduction as a primary prevention for strokes (132) suggest that obesity seems to be associated with an increased risk of stroke and a weight loss may lead to a reduction of stroke occurrence.

Obesity – guidance: The Royal Pharmaceutical Society of Great Britain produced comprehensive guidance on the management of obesity in 2005 (133). The guidance included information on weight loss; reducing energy intake through a diet relatively low in saturated fat; and increased physical activity.

Similarly a cross-government strategy for the NHS in England (134) was introduced in May 2008. This strategy focuses on 5 key areas in the reduction of obesity. These are: the healthy growth and development of children; promoting healthier food choices; building physical activity into our lives; creating incentives for better health; and personalised advice and support.

Cholesterol – studies: A Cochrane review of twenty-seven studies (135) (including 40 intervention arms and 30,901 person-years) showed that although there was no significant effect from cholesterol-lowering interventions on total mortality (rate ratio 0.98, 95% CI 0.86 to 1.12), there was a trend towards protection from cardiovascular mortality (rate ratio 0.91, 95% CI 0.77 to 1.07), and significant protection from cardiovascular events (rate ratio 0.84, 95% CI 0.72 to 0.99).

A study published in 2007 (136) supports the conclusions from previous meta-analyses that cholesterol lowering is clinically beneficial in patients with CHD or at elevated CHD risk. Among all patients, for every 1-mmol/L decrease in total cholesterol, there was a 17.5% reduction in relative risk for all-cause mortality; 24.5%, for CHD-related mortality; and 29.5% for any CHD event. Corresponding reductions for every 1-mmol/L decrease in LDL-cholesterol were 15.6%, 28.0%, and 26.6%, respectively. Similar relationships were observed in patients without CHD.

A 2008 Cochrane Review of dietary advice (137) concluded that dietary advice reduced total serum cholesterol by 0.16 mmol/L (95% CI 0.06 to 0.25) and LDL cholesterol by 0.18 mmol/L (95% CI 0.1 to 0.27) after 3-24 months. Mean HDL cholesterol levels and triglyceride levels were unchanged.

Cholesterol – guidance: Advice on cholesterol-lowering strategies can be found in the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (138).

Diet therapy is the primary method of lowering cholesterol; exercise and weight control are its components. Drug therapy should be considered for patients at high risk of heart disease who do not respond to dietary therapy.

Systolic blood pressure – studies: A Cochrane review of the effect of modest salt reduction on blood pressure (139) examined twenty trials of individuals with elevated blood pressure (n=802) and 11 trials in individuals with normal blood pressure (n=2220). In individuals with elevated blood pressure the median reduction in urinary sodium was 78 mmol/24h (4.6 g/day of salt), the mean reduction in blood pressure was -5.06 mmHg (95%CI:-5.81 to -4.31) for systolic and -2.70 mmHg for diastolic.

A study examining the long term effect of weight reduction on blood pressure (140) found that reduction of BP was higher in patients treated with weight loss diets (systolic BP [SBP]: weighted mean difference [WMD], -6.3 mm Hg; diastolic BP [DBP]: WMD, -3.4 mm Hg) or Orlistat (SBP: WMD, -2.5 mm Hg; DBP: WMD, -2.0 mm Hg). Systolic BP increased with sibutramine treatment (WMD, 3.2 mm Hg).

Systolic blood pressure – guidance: Guidance on dietary interventions to control blood pressure can be found in the British Hypertension Society Guidelines for the Management of Hypertension (141). The document recommends engagement in regular aerobic physical activity such as brisk walking (30 min per day, most days of the week); alcohol consumption of no more than 3 units/day in men and no more than 2 units/day in women; consumption of a diet rich in fruit and vegetables (at least five portions per day); and consumption a diet with reduced content of saturated and total fat.

The World Health Organisation WHO and International society of Hypertension ISH guidelines (142) demonstrate how treating hypertension has been associated with about a 40% reduction in the risk of stroke and about a 15% reduction in the risk of MI. It recommends lifestyle modifications which reduce incidence of hypertension: weight loss, physical activity, moderation in alcohol intake, a diet with increased fresh fruit and vegetables, reduction of dietary sodium intake, increased dietary potassium intake.

CHD - diet - studies: A meta-analysis of observational studies on fish intake and coronary heart disease (143) compared fish consumption with little to no fish consumption in diets. They found that this was associated with a relative risk of 0.83 (95% confidence interval 0.76 to 0.90; $p < 0.005$) for fatal CHD and a relative risk of 0.86 (95% confidence interval 0.81 to 0.92; $p < 0.005$) for total CHD. The results indicate that fish consumption is associated with a significantly lower risk of fatal and total CHD. These findings suggest that fish consumption may be an important component of lifestyle modification for the prevention of CHD.

A review of studies on diet and CHD (144) recommended that total fat intake should not constitute more than 30% of calories, cholesterol intake not more than 300 mg per day and that regular fatty fish consumption and a high intake of fresh fruits and vegetables is recommended. Moderate alcohol intake can be protective.

CHD - exercise - studies: Using a random effects model, the effects of aerobic exercise on glycosylated hemoglobin (HbA1c) (mean, 95% confidence interval, -0.9%, -1.9% to 0.03%), resting systolic blood pressure (-6.9 mm Hg, -9.1 to -4.6 mm Hg), low-density lipoprotein cholesterol (-3.1 mg/dL, -6.1 to 0 mg/dL), and body mass index (-1.3 kg/m², -2.5 to -0.1 kg/m²) were either statistically significant or demonstrated a trend for statistical significance (145).

The changes corresponded to estimated 5-year reductions in CHD mortality of 14%, 17%, 1.5%, and 5%, respectively. The results of this review reinforced the idea that aerobic exercise is an important non-pharmacological intervention for improving selected CHD risk factors.

A meta-analysis of the independent relationship between physical activity and coronary heart disease (146) concluded that the relative risk of the independent relation of physical inactivity to CHD is 1.37, with a 95 percent confidence interval (1.27-1.48)

A meta-analysis of physical activity in the prevention of coronary heart disease (147) concluded that the relative risk of death from coronary heart disease was 1.9 (95% confidence interval 1.6-2.2) for sedentary compared with active occupations.

An American study on physical activity levels and coronary heart disease (148) demonstrated that moderate intensity, dynamic, endurance-type of exercise (such as walking or jogging about 20 miles per week) or at least one hour of intermittent hard physical labour are required to obtain the optimal effect of exercise on coronary heart disease rates.

CHD - exercise - guidance: The European Society of Cardiology “Cardio metabolic risk in essential hypertension”(149) argues that the minimum requirements for long-term effectiveness include caloric restriction in the range of 500-1000 Kcal with a 7%-10%, weight loss in 12 months and regular aerobic exercise of 30-45minutes/day.

The European Guidelines on Cardiovascular Disease Prevention (150) issued by the European Atherosclerosis Society 2007 advocates:

1. Avoidance of tobacco.
2. Adequate physical activity (at least 30 min per day).
3. Healthy food choices.
4. Avoiding overweight.
5. BP below 140/90 mmHg.
6. Total cholesterol below 5 mmol/L (~200 mg/dL).

References

1. Dahlgren G., Whitehead M. (1991). *Policies and Strategies to promote equity in health:background document to WHO strategy paper for Europe*. Institute of Futures Studies. Stockholm.
2. Mchelozzi, P., et al (2005) The impact of the summer 2003 heat waves on mortality in four Italian cities. *Eurosurveillance*. Vol. 10 (7).
3. Barton H., Grant M. (2006) A health map for the local human habitat. *Journal for the Royal Society of Health Promotion of Health*. Vol. 126; pages 252-253.
4. However, municipalities may contribute to mitigating climate change via Agenda 21, the action component of the UN Rio Declaration on Sustainable Development.
5. Koppe, C., Kovats, Sari., Jendritzky, G., Mende, B. et al (2004) *Heat-waves: risks and responses*. Health and Global Environmental Change Series, No 2. WHO Regional Office for Europe. Copenhagen.
6. Green, G. (1998) *Health and Governance in European Cities: A compendium of trends and responsibilities for public health in 46 member states of the European Region*. WHO Regional Office for Europe. Copenhagen.
7. Hall D.(1997) *Restructuring and privatisation in the public utilities – Europe*. Public Services Research Institute. University of Greenwich. London.
8. Nadin V., Stead. (2008) European Spatial Planning Systems, Social Models and Learning. *disP*. Vol 172 : pages 35-47.
9. Farinos Dasi J. (ed) (2007) *Governance of Territorial and Urban Policies from EU to Local Level. Final report of EPSON Project 2.3.2*. EPSON coordination unit. Esch-sur-Alsette.
10. Cutler D. Miller G. (2005) The Role of Public Health Improvements in Health Advances: The Twentieth Century United States. *Demography*. Vol 42: pages 1-22.
11. McKeowan T (1965) *Medicine in a Modern Society*. Allen & Unwin. London.
12. McKeowan T (1976) *The Modern Rise of Population*. Academic Press. New York.
13. Colgrove J. (2002) The McKeowan thesis: a historical controversy and its enduring influence. *American Journal of Public Health*. Vol. 92: pages 725-9.
14. Cummins, S., Finley, A., Petticrew, M., Sparks, L. (2005) Healthy Cities: the impact of food retail led regeneration on food access, choice and retail structure. *Built Environment*. Vol 4:288-301

15. Yvonne L. Michael and Irene H. Yen; (2009) Built Environment and Obesity among Older Adults—Can Neighborhood-level Policy Interventions Make a Difference? *American Journal of Epidemiology*. Vol.169–: pages 409-412
16. Fuzhong Li, Peter A. Harmer, Bradley J. Cardinal, Mark Bosworth, Alan Acock, Deborah Johnson-Shelton, Jane M. Moore Built Environment, Adiposity, and Physical Activity in Adults Aged 50–75, *Am J Prev Med* 2008;35(1):38–46)
17. Wang, MC., Cubbin C., Ahn D., Awinkleby M. Changes in neighbourhood food store environment, food behaviour and body mass index, 1981–1990; *Public Health Nutrition* (2008), 11:963-970 Cambridge University Press
18. Macintyre S., Ellaway A. (2000) Ecological Approaches: Rediscovering the Role of the Physical and Social Environment. in Berkman L., Kawachi I. (eds) *Social Epidemiology*. Oxford University Press. England.
19. Leyden K. (2003) Social Capital and the Built Environment: The Importance of Walkable Neighbourhoods. *American Journal of Public Health*. Vol. 93: pages 1546-1551.
20. Kawachi I., Berkman L. (2000) Social Cohesion, Social Capital and Health. in Berkman L. Kawachi I. (eds) *Social Epidemiology*. Oxford University Press. England.
21. Kawachi I., et al. (1996) A prospective study of social networks in relation to total mortality and cardiovascular disease in men in the USA. *Journal of Epidemiology and Community Health*. Vol.50: pages 245-251.
22. Eng P. et al. (2002) Social ties and change in Social Ties in Relation to Subsequent Total and Cause-specific Mortality and Coronary Heart Disease Incidence in Men. *American Journal of Epidemiology*. Vol.155: pages 700-709.
23. Kaplan GA. et al (1988) Social connections and mortality from all causes and from cardiovascular disease: prospective evidence from eastern Finland. *American Journal of Epidemiology*. Vol 128: pages 370-380.
24. Wrigley N. (2002) Food deserts in British cities: policy context and research priorities. *Urban Studies*. Vol.39 pages 2029-2040.
25. K. Morland, S. Wing and A. Diez Roux, The contextual effect of the local food environment on residents' diets: the Atherosclerosis Risk in Communities study. *Am. J. Public Health* 92 (2002), pp. 1761–1767.
26. Laraia B. et al (2004) Proximity of supermarkets is positively associated with diet quality index for pregnancy. *Preventive Medicine*. Vol. 39: pages 869-875.
27. Urry J. (2002) Mobility and proximity. *Sociology*. Vol. 36: pages 255-274.
28. European Environment Agency. (2006) Air Pollution at street level in European cities: EEA Technical Report. No 1/2006. EEA Publications Office. Copenhagen.

29. Brook R. et al (2004) Air pollution and Cardiovascular Disease. *Circulation*: Volume 109;pages 2655-2671.
30. Simkhovich BZ., Klienman MT., Kloner RA. (2008) Air Pollution and Cardiovascular Injury. *Journal of the American College of Cardiology*. Volume 52. pages 719-726.
31. Le Tertre A. (2002) Short term effects of particulate air pollution on cardiovascular diseases in eight European cities. *Journal of Epidemiology and Community Health*. Vol. 56: pages 773-779.
32. Maheswaran, R. et al (2005) Outdoor Air Pollution and Stroke in Sheffield, United Kingdom: A small-Area Level Geographical Study. *Stroke*. Vol. 36:239-243.
33. Van Kempen, E. et al (2002) The association between noise exposure and blood pressure and ischemic heart disease: a meta-analysis. *Environmental Health Perspectives*. Vol. 110 (3):307-317
34. Boden, T., Albin, M., Ardö, J., Stroh, Ostergren, PO., Björk, J. (2009) Road traffic noise and hypertension: results from a cross sectional public health survey in southern Sweden. *Environmental Health*. Vol8 (38).
35. 36 Van Dyck, D., Deforche, B., Cardon, G., Ilse De, Bourdeaudhuij, I.(2009) Neighbourhood walkability and its particular importance for adults with a preference for passive transport, *Health & Place*. Vol. 15: pages 496–504
36. Li F. et al Built Environment and changes in blood pressure in middle-aged and older adults. *Preventive Medicine*. Vol. 48: pages 237-241.
37. Warren JL. (1973) Green space for air pollution control. Council of Planning Librarians.
38. Bjork J. et al (2009) Recreational values of the natural environment in relation to neighbourhood satisfaction, physical activity, obesity and wellbeing. *Journal of Epidemiology and Community Health*. Vol. 62e: pages 1-7.
39. Ellaway A., Macintyre S., Bonnefoy X. (2005) Graffiti, greenery and obesity in adults: secondary analysis of European cross sectional survey. *British Medical Journal*. Vol.331: pages 611-2.
40. Mitchell R., Popham F. (2008) Effect of exposure to natural environment on health inequalities: an observational population study. *Lancet*. Vol. 372: 1655-60.
41. WHO Consultation on Obesity. Obesity: Preventing and Managing the Global Epidemic. Technical report Series 894. World Health Organization. Geneva.
42. World Health Statistics. (2007) The prevalence of obesity in men aged 15 and over. World Health Organization, Geneva.
43. International Obesity Task Force. (2007) Prevalence of overweight and Obesity in Children. IOTF. London.

44. Cummins S. et al. (2005) Healthy cities: the impact of food retail led regeneration and food access, choice and retail structure. *Built Environment*. No 4.
45. National Institute for Health and Clinical Excellence. (2008)
46. Green G. (1998) *Health and Governance in European Cities: A compendium of trends and responsibilities for public health in 46 member states of the European Region*. WHO Regional Office for Europe. Copenhagen.
47. Stephens M., Burns N., MacKay L. (2002) *Social market or safety net? British social rented housing in a European context*. Policy Press. Bristol.
48. Kalache A., Barreto SM & Keller I. (2005) Global Ageing: The Demographic Revolution in All Cultures and Societies in (ed. Johnson ML) *The Cambridge Handbook of Age and Ageing*. Cambridge University Press. Cambridge. England.
49. European Commission (2009) *Impact Assessment Guidelines*. EC. Brussels.
50. Mckee CM. (1989) Cold at heart. *The Lancet*. Vol.334: pages 564-565.
51. Khaw K-T. (1995) Temperature and cardiovascular mortality. *The Lancet*. Vol.345: pages 337-338
52. Goodwin J. (2000) Cold stress, circulatory illness and the elderly, in Rudge J., Nicol N. (eds.) *Cutting the Cost of Cold: Affordable Warmth for Healthier Homes*. E&F Spon. London.
53. Critchley R., Gilbertson J., Grimsley M., Green G. (2007) Living in Cold Homes after heating improvements: Evidence from Warm Front, England's Home Energy Efficiency Scheme. *Applied Energy*. Vol.84: pages 147-158.
54. French DP., Senior V., Weinman J., Marteau TM. (2001) Causal attributions for heart disease: a systematic review. *Psychology and Health*. Vol 16: pages 77-88.
55. Marmot MG, Stanford SA. (2002) *Stress and the Heart: Psychosocial Pathways to Coronary Heart Disease*. BMJ Books. London.
56. Macleod, J., Davey Smith, G. (2003) Psychosocial factors and public health: a suitable case for treatment? *J. Epidemiology and Community Health*. Vol.57: pages 565-570.
57. Wilkinson R., Marmot M. (2003, 2nd edition) *Social Determinants of Health: The Solid Facts*. WHO Regional Office for Europe. Copenhagen.
58. Kamphuis MH.et al. (2009) The association of depression with cardiovascular mortality is partly explained by health status: The FINE Study. *Journal of Affective Disorders*. Vol 114: pages 184-192.
59. Grimsley M., Gilbertson J., Green G and the Warm Front Study Group. (submitted) Psychological routes from housing investment to health gain: evidence from England's home energy efficiency scheme.

60. Kearns, A., Hiscock, R., Ellaway A., MacIntyre S. (2000) 'Beyond four walls.' The psycho-social benefits of home: Evidence from West Central Scotland. *Housing Studies*. Vol 15: pages 387-410.
61. Nettleton R., Burrows R. (1998) Mortgage debt, insecure home ownership and health: an exploratory analysis. *Sociology of Health an Illness*. Vol. 20: pages 731-753.
62. Taylor MP., Pevalin DJ., Todd J. (2007) The psychological cost of unsustainable housing commitments. *Psychological Medicine*. Vol 37: pages 1027-1036.
63. Healy JD. (2003) Excess winter mortality in Europe: a cross country analysis identifying key risk factors. *Journal of Epidemiology and Community Health*. Vol57: pages 784-789.
64. Wilkinson P., Landon M., Stevenson S. Housing and winter death: epidemiological evidence (2000) in Rudge J., Nicol F. (eds) *Cutting the Cost of Cold: Affordable Warmth for Healthier Homes*. E&FN Spon. London.
65. Wilkinson P. Vulnerability to winter mortality in elderly people in Britain: population based study. (2004) *British Medical Journal*. Vol. 329: page 647.
66. Computed via Office of the Deputy Prime Minister (2006) *Housing Health and Safety Rating System. Operating Guidance*. ODPM. London.
67. Green G., Gilbertson J. (2008) *Warm Front, Better Health: a health impact evaluation of the English home energy efficiency scheme*. Sheffield Hallam University. Sheffield.
68. Chabli Z., Dowie J., Armstrong B., Wilkinson P. (submitted) Analysis of the health impact of England's home energy efficiency scheme (Warm Front).
69. Stephens M., Quilgars D. (2008) Sub-prime mortgage lending in the UK. *European Journal of Housing Policy*. Vol.8: pages 197-215.
70. Stephens M. (2009) *The Government Response to Mortgage Arrears and Repossessions*. Department of Communities and Local Government. London.
71. Uchino BN., Cacioppo JT., Kiecolt-Glaser JK. (1996) The relationship between social support and physiological processes: a review with emphasis on underlying mechanisms and implications for health. *Psychological Bulletin*. Vol. 119: pages 488-331.
72. Parkinson M. et al (2004) *Competitive European cities: Where do the Core Cities Stand*. Office of the Deputy Prime Minister. London.
73. Parkinson M. Et al (2006) *State of English Cities*. Office of the Deputy Prime Minister. London.
74. Green G. et al (in press) City Health Development Planning. *Health Promotion International*.

75. Barton H. and Tsourou C. 2000 *Healthy urban planning – a WHO guide to planning for people*. London, E&FN Spon.
76. Barton H. 2005 A health map for urban planners: towards a conceptual model for healthy sustainable settlements. In *Built Environment* Vol. 31, No. 4, 2005
77. Arnold J. Et al. (2009) *Towards a new wave of local economic activism: the future for economic development strategies*. Centre for Local Economic Strategies. Manchester.
78. Mceldowney JJ. (1997) Policy Evaluation and the Concepts of Deadweight and Additionality. *Evaluation*. Vol. 3: pages 175-188
79. Wilkinson R., Marmot M. (2003, 2nd edition) *Social Determinants of Health: The Solid Facts*. WHO Regional Office for Europe. Copenhagen.
80. Fiscella K. & Tancredi D. (2008) Socioeconomic status and Coronary Heart Disease Prediction. *Journal of the American Medical Association*. 300 (22) pages 2666-2668)
81. Loucks EB et al. (2009) Life-Course Socioeconomic Position and Incidence of Coronary Heart Disease: The Framingham Offspring Study. *American Journal of Epidemiology*. Vol.169: pages 829-836.
82. Wilkinson R., Pickett K. (2009). *The Spirit Level; Why More Equal Societies Almost Always Do Better*. Allen Lane. London.
83. Townsend P. (1979) *Poverty in the United Kingdom: a survey of household resources and standards of living*. Harmondsworth. Penguin Books.
84. Mackenbach JP. Et al. (2008). Socio-economic inequalities in cardiovascular disease mortality; an international study. *New England Journal of Medicine*. Vol. 358: pages 2468-2481.
85. Ezzati M. Et al. (2005) Rethinking the ‘diseases of affluence’ paradigm: global patterns of nutritional risks in relation to economic development. *PLoS. Med*. Vol.2: page 133.
86. Michael Marmot et al. (1997) Contribution of job control to social gradient in coronary heart disease incidence. *Lancet*. Volume 350; pages 235-240.
87. Giddens A. (1991) *Modernity and Self Identity: Self and Society in the Late Modern Age*. Polity Press. Cambridge. UK.
88. Maslow A. (1943) Theory of human motivation. *Psychological Review*. Vo. 50: pages 370-96.
89. Dock M. (2007) *Healthy Urban Planning in Helsingborg - designing for people*.
90. Department for Sustainable Development. Helsingborg Cirty Council. Helsingborg. Sweden.

91. Munday B. (2007) *Integrated Social Services in Europe*. Council of Europe Publishing. Strasbourg. France.
92. *The Framework Law for the Development of the Integrated Systems of Interventions and Social Services*. Italy. 2000.
93. Department for Sustainable Development/Municipal Executive Committee (2008) *Plan for Sustainable Development in Helsingborg*. City of Helsingborg. Sweden.
94. Work with Perpetrators of Domestic Violence in Europe (2008). *Guidelines to develop standards for programmes working with male perpetrators of domestic violence*. Daphne Project. EU
95. Marmot MG, Stanford SA. (2002) *Stress and the Heart: Psychosocial Pathways to Coronary Heart Disease*. BMJ Books. London.
96. Centres for Disease Control and Prevention. (2008) Adverse Health Conditions and Health Risk Behaviours Associated with Intimate Partner Violence _ United States, 2005. *Morbidity and Mortality Weekly Report*. Vol.57. pages 113-117.
97. Sundquist K., et al (2006) Neighbourhood violent crime and unemployment increase the risk of coronary heart disease: A multilevel study in an urban setting. *Social Science and Medicine*. Vol. 62: pages 2061-2071.
98. Ross CE., Mirowsky J. (2001) Neighbourhood Disadvantage, Disorder and Health. *American Sociological Association*. Vol. 42: pages 258-276
99. Green G., Gilbertson J., Grimsley MFJ. (2002) Fear of crime and health in residential tower blocks: A case study in Liverpool. UK. *European Journal of Public Health*. Vol. 12: pages 10-15.
100. Harrison RA., Gemmell I., Heller RF. (2009) The population effect of crime and neighbourhood on physical activity: an analysis of 15,461 adults. *Journal of Epidemiology and Community Health*. Vol.61: pages 34-39.
101. World Health Organization. (2005) *WHO Multi-country study of Women's' Health and Domestic Violence Against Women: initial report on prevalence, health outcomes and women's responses*. WHO Geneva.
102. Catriona Mirrlees-Black. (1999) *Domestic Violence: Findings from a new British Crime Survey Self-Completion Questionnaire*. Home Office. London.
103. Commission of the European Communities. (2008) *Green Paper on migration and mobility: challenges and opportunities for EU education systems*. EU. Brussels.
104. Council of European Municipalities and Regions. (2008) *CEMR Response to Green Paper on migration and mobility: challenges and opportunities for EU education systems*. CEMR. Paris/Brussels
105. Green A., Wolf A., Leney. (1999) *Convergence and divergence in European education and training systems*. Institute of Education. University of London.

106. Education, Audio Visual & Culture Executive Agency ('Eurydice' Network) (2009) *Key data on education in Europe*. European Commission.
107. Davey Smith G., et al (1998) Education and occupational social class: which is the more important indicator of mortality risk? *Journal of Epidemiology and Community Health*. Vol. 52: pages 153-160.
108. Nutbeam D. (2000) Health literacy as a public health goal: a challenge for contemporary health education and communication strategies into the 21st century. *Health Promotion International*. Vol. 15: pages 259-267.
109. National Heart Forum (2002) *Towards a generation free from coronary heart disease: Policy action for children's and young people's health and well-being*. National Heart Forum. London.
110. Larkin M (2002) *Defusing the "time-bomb of childhood obesity*. The Lancet. Vol359.Issue 9310. page 987.
111. *Active ageing: a policy framework*. (2002) World Health Organization. Geneva.
112. Kuh D., Ben-Shlomo Y.(editors) (2004) *A life course approach to chronic disease epidemiology*. Oxford University Press.
113. National Heart Forum. *A life course approach to coronary heart disease prevention. Scientific and policy review*. The Stationery Office. London.
114. WHO (1997) *Promoting Health through Schools*. Report of the WHO Expert Committee on Comprehensive School Health Education and Promotion. WHO Technical Report Series 870. Geneva.
115. David Batty & David Leon (2002) Socio-economic position and coronary heart disease risk factors in children and young people. Evidence from UK epidemiological studies. *European Journal of Public Health*; 12: pages 263-272.
116. Ness AR et al. (2005) Diet in childhood and adult cardiovascular and all cause mortality: the Boyd Orr cohort. *Heart*. Vol. 91: pages 894-898.
117. Hemmingsson T., Lundberg T. How far are socioeconomic differences in coronary heart disease hospitalization, all-cause mortality and cardiovascular mortality among adult Swedish males attributable to negative childhood circumstances and behaviour in adolescence? *International Journal of Epidemiology*. Vol. 34: pages 2
118. Berkman LF., Kawachi I. (2000) Social Integration, Social Networks, Social Support and Health. in (eds Berkman LF., Kawachi I) *Social Epidemiology*. Oxford University Press.
119. Obesity epidemic: (15/03/05). *Markos Kyprianou pledges action as data shows more children overweight*. EU Press release. Europa IP/05/292.

120. *The North Karelia Project*. <http://www.ktl.fi/portal/11694> Updated: 9.4.2009, accessed 12/09/09. National Institute for Health and Welfare. Helsinki. Finland. 60-267.
121. De Sa J., Lock K. (2008) Will European agricultural policy for school fruit and vegetables improve public health? A review of school fruit and vegetable programmes. *European Journal of Public Health*. Vol. 18: pages 558-568.
122. O'Loughlin J. et al (2009) Milestones in the Process of Cessation Among Novice Adolescent Smokers. *American Journal of Public Health*. Vol. 99: pages 499-504.
123. Kelder SH., et al (1994) Longitudinal Tracking of Adolescent Smoking, Physical Activity, and Food Choice Behaviours. *American Journal of Public Health*. Vol. 84: pages 1121-1126.
124. Ravens-Sieber U. (2009) The contribution of Health Behaviour in School-aged Children to international child health research - a milestone in child public health. *International Journal of Public Health*. Vol. 54: pages S121-122.
125. Prabhat Jha, Frank J. Chaloupka,; *Reducing the burden of smoking world-wide: effectiveness of interventions and their coverage, Drug and Alcohol Review (November 2006), 25, 597 – 609*
126. Ranney L. Melvin C *Systematic Review: Smoking Cessation Intervention Strategies for Adults and Adults in Special Populations Ann Intern Med. 2006; 145:845-856.*
127. Bala MM, Lesniak W, *Efficacy of non-pharmacological methods used for treating tobacco dependence: meta-analysis. Pol Arch Med Wewn. 2007 Nov-Dec; 117(11-12):504-11.*
128. Wilson K. Dimoulas P: *Effectiveness of smoking cessation therapies: a systematic review and meta-analysis, BMC Public Health.2006;6:300*
129. www.euro.who.int/document/e73285.pdf
130. Galani C., Schneider H. *Prevention and treatment of obesity with lifestyle interventions: Review and meta-analysis. International Journal of Public Health. 52(6) (pp 348-359), 2007.*
131. Shaw K, Gennat H, O'Rourke P, Del Mar C. *Exercise for overweight or obesity (Review) The Cochrane Library 2008 Issue 3*
132. Curioni C, André C, Veras R. *Weight reduction for primary prevention of stroke in adults with overweight or obesity, BMJ 2006 154-156*
133. *Practice guidance: obesity Royal Pharmaceutical Society of Great Britain July 2005*
134. *Healthy Weight, Healthy lives A Cross Government strategy for England NHS - Guidance May 2008*

135. Hooper L, Summerbell CD, Higgins JPT, Thompson RL, Clements G, Capps N, Davey Smith." Reduced or modified dietary fat for preventing cardiovascular disease", *Cochrane Database of Systematic Reviews* 2000, Issue 2.
136. **Gould AL, Davies GM, Alemao E, Yin DD, Cook JR.** Cholesterol reduction yields clinical benefits: meta-analysis including recent trials. ***Clin Ther.* 2007 May; 29(5):778-94.**
137. Brunner EJ, Rees K, Ward K, Burke M, Thorogood M. Dietary advice for reducing cardiovascular risk (Review). *The Cochrane Library* 2008 Issue 3
138. (Adult Treatment Panel III) National Heart, Lung, and Blood Institute National Institutes of Health
NIH Publication No. 02-5215, September 2002
139. He FJ, MacGregor GA. Effect of longer-term modest salt reduction on blood pressure. *The Cochrane Library* 2008 Issue 3
140. Horvath K, Jeitler K, Siering U, Stich AK, Skipka G. Long-term effects of weight-reducing interventions in hypertensive patients: systematic review and meta-analysis. *Archives of Internal Medicine.* 168(6):571-80, 2008 Mar 24.
141. http://www.bhsoc.org/Latest_BHS_management_Guidelines.stm
142. <http://www.ish-world.com/default.aspx?Guidelines>
143. **Whelton SP, He J, Whelton PK, Muntner P,** Meta-analysis of observational studies on fish intake and coronary heart disease. ***Am J Cardiol.* 2004 May 1;93(9):1119-23.**
144. Hughes K. Diet and coronary heart disease--a review. *Annals of the Academy of Medicine, Singapore.* 24(2):224-9, 1995 Mar.
145. Kelley GA, Kelley KS Efficacy of aerobic exercise on coronary heart disease risk factors. ***Prev Cardiol.* 2008 Spring;11(2):71-5.**
146. Eaton CB. Relation of physical activity and cardiovascular fitness to coronary heart disease, Part I: A meta-analysis of the independent relation of physical activity and coronary heart disease. *Journal of the American Board of Family Practice.* 5(1):31-42, 1992 Jan-Feb
147. Berlin JA, Colditz GA. A meta-analysis of physical activity in the prevention of coronary heart disease. *American Journal of Epidemiology.* 132(4):612-28, 1990 Oct.
148. Leon AS. Physical activity levels and coronary heart disease. Analysis of epidemiologic and supporting studies. *Medical Clinics of North America.* 69(1):3-20, 1985 Jan.
149. <http://www.escardio.org/communities/councils/ccp/e-journal/volume5/Pages/vol5n37.aspx>
150. http://www.eas-society.org/athero_societies_associations.asp

