The DECiPHEr

The *environmental* domain of municipal influence

1. Purpose.

This note reviews the potential impact of local environmental policies on reducing cardiovascular disease (CVD) in European cities.

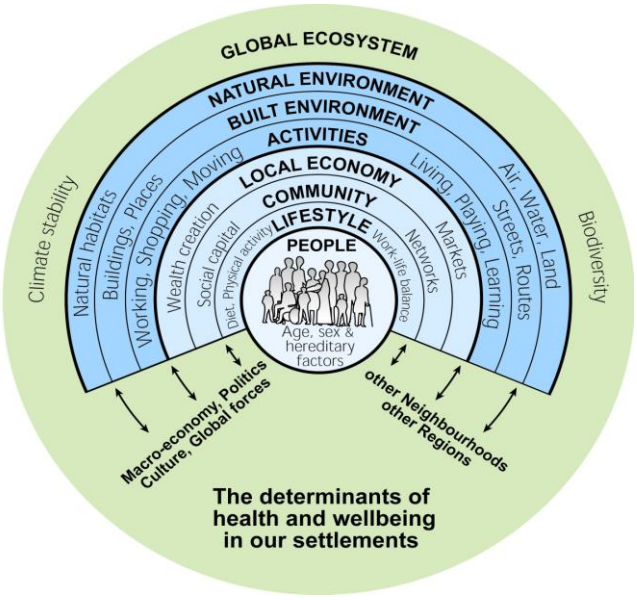
2. Rationale.

The aim of DECiPHEr is to produce a training package for municipalities which helps decision-makers optimise the mix of citywide programmes and investments to maximise public health impacts. The training package (VET) depends on a cost-benefit model, initially focusing on CVD as the biggest cause of death and disability in Europe. The first work package of DECiPHEr led by Sheffield Hallam University, includes work to enhance the extant model of 'downstream' or proximal determinants of health by incorporating 'upstream' or 'distal' determinants of health. Environment is one of the six distal domains selected by partners as a potentially important municipal influence on the prevalence of CVD.

3. Concept & Method.

Healthy Urban Planning - 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 is his conceptual model, adapted from the famous Dalgren & Whitehead social model of health.

Fig 1 The Settlement Health Map[i]



The scope of our domain is limited to the urban environment and excludes the global ecosystem covering climatic stability and biodiversity (in the outer ring) because the pathways to CVD are tenuous and the competence is primarily[ii] with central governments and intergovernmental agencies such as the UN. 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. As with our DECiPHER model, lifestyles are determined by the spatial configuration of activities.

This is a preliminary assessment of the scope, scale and potential impact of municipal investment security. First we develop a schematic model, then second, plug-in evidence from 37 scientific studies to populate the model.

4. Role and influence of European municipalities.

Municipalities have influence (and often a constitutional/legal ***competence***) over the environment domain either by (i) regulating potential environmental hazards to health (ii) providing a strategic framework for city development (iii) directly investing in the built environment (iv) regulating the zoning and form of the built environment or (v) influencing the investment programmes and services of ***partner*** agencies. In European municipalities, environmental competences are typically shared between environment/environmental health departments and urban planning departments.

(i) *environmental health*. Municipal engagement with environmental planning had its origins in the middle of the 19th century to address the squalor of housing and industrial development which incubated and spread infectious diseases. The first municipal medical officer of health - William Duncan - was appointed by Liverpool City Council in 1847, soon followed by the appointment of city engineer John Newman. Different combinations of a public health and engineering function 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 investing in a clean water supply, developing a sewerage infrastructure and regulating working conditions (see economy report).

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 [iii] whereas in Finland and Sweden, municipalities retain control of this function via city owned companies.

(ii) - (iv) *Urban Planning*. Most European municipalities have a formal competence and large degree of control over the spatial planning of their cities [iv] within a framework of directives and recommendations from central government. Though an EU report commissioned from EPSON reveals a variation,[v] planning departments of the four DEcIPHEr partner cities 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 (Table 7.1) classifies Finland,

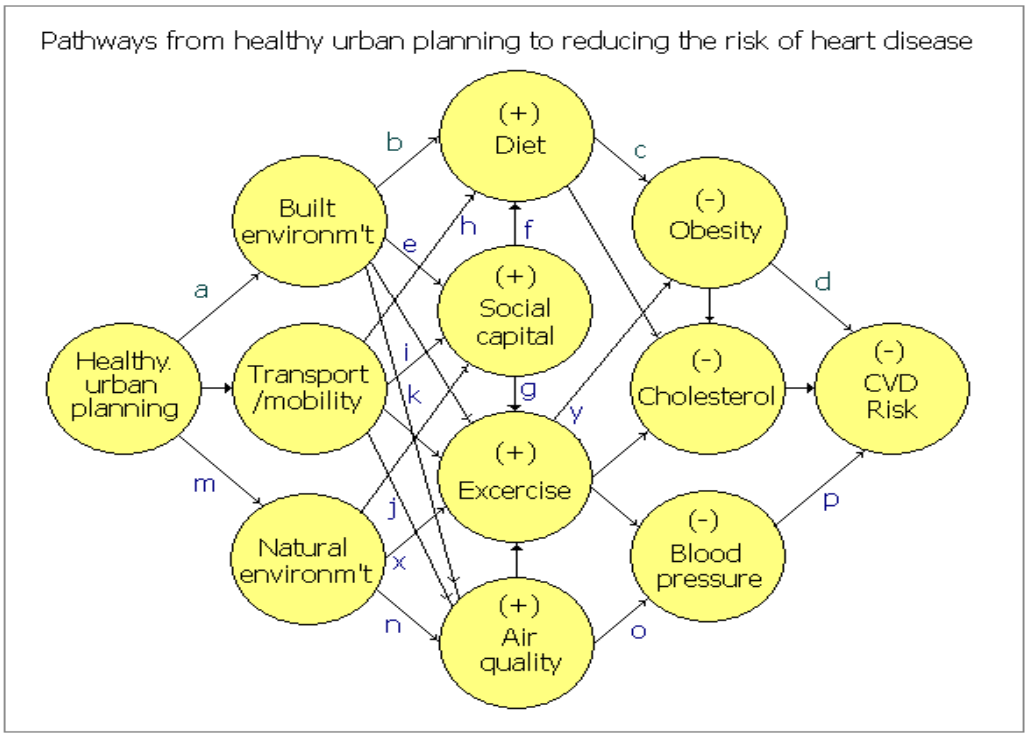
Sweden, Italy and the UK as having a 'powerful local level' but also (map 8.2) moving from government to governance with local partners and higher tiers of provincial and regional government. Partnership is exemplified by transport. Since cities must be connected to their hinterland, municipalities cooperate with adjacent municipalities (Finland, Sweden, UK) and provincial governments to plan and/or provide an efficient transport infrastructure, roads, pavements, plazas, and ports. Public transport (buses, trams) previously owned by municipalities is now often privatised.

5. Three pathways to reducing CVD: healthy urban planning to improve transport/mobility, and the built and natural environments.

There is no doubt that environmental improvements in living and working conditions in all European countries have improved health, reducing the prevalence of infectious and respiratory diseases. Some argue that these reforms, especially to water supply,[vi] often led by the environmental health departments of municipalities had more impact on health in the 20th Century than medical advances,[vii] [viii]though this is contested. [ix] However the new challenge is noncommunicable disease, including heart disease, the biggest killer and cause of disability and dependency in European cities. Healthy urban planning aims to redesign cities to 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 (i) the built environment (ii) transport and (iii) the natural environment and shows the schematic pathways to a reduction of CVD risk via the intermediate variables of diet, social capital, exercise and air quality.

Figure 2



(i) *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. Though a mix of market forces and public provision of services determines activity in the built environment, planning departments guide its location. Take *diet* first. This is linked to the location and offer of food retailers. In Europe, most marked in the UK, there is a secular trend away from neighbourhood shops towards fast-food takeaways and peripheral supermarkets. In a study of obesity,[x] Michael et al reported a significant interaction between built environments, individual eating out, physical activity and obesity (pathway a-b-c), a CVD risk factor (d). Li et al [xi] 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.[xii]

Second, social capital. 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.[xiii] These features include activities and conditions associated with the built environment and sociocultural features, specifically the degree of community integration. Kevin Leyden[xiv] compares the built environment of neighbourhoods in Ireland and demonstrates that persons living in walkable, mixed use neighbourhoods have higher levels of social capital compared with those living in car-oriented suburbs. (pathway e). Ichiro Kawachi and Lisa Berkman review compelling evidence linking social capital to health:[xv] Kawachi et al,[xvi] Eng et al[xvii] and Kaplan et al[xviii] detect 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).

(ii) *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, contributing to the decline of neighbourhood shopping centres and modifying diets[xixxx] [xxi](pathway h).

There are three more downsides to car ownership. *First,* Urry describes[xxii] how increasing car ownership and the spatial fragmentation between home, workplace, shops and services have acted to destroy community ties and social capital. (pathway i). *Second*, road transport accounts for an increasing proportion of air pollutants in cities. (pathway j). The European Environment Agency begins its report[xxiii] 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.

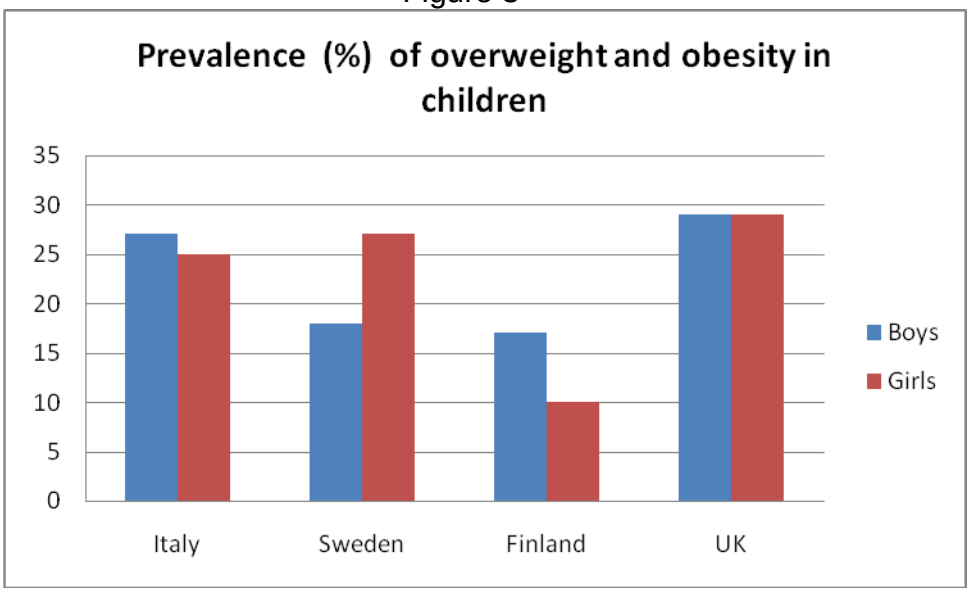
There is compelling evidence of the link between air pollution and CVD.[xxiv xxv xxvi] The *third* downside of a transport infrastructure geared to car use is the erection of barriers to walking as a negative side effect. There is compelling evidence that neighbourhood 'walkability' increases pedestrian activity (pathway k) reducing the risk of CVD. A Belgian study[xxvii] showed that residents of the highly walkable neighbourhood did indeed walk more. A study[xxviii] of 120 neighbourhoods on the relationship between built environment and blood pressure reports that neighbourhoods with high walkability may ameliorate the risk of hypertension at the community level and promotion of walkability could play a significant role in improving population health and reducing CVD risk.

(iii) *Natural environment*. Though the natural environment, in the form of city parks or peripheral countryside, helps improve air quality[xxix] and reduces 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 a Swedish study by Bjork et al.[xxx] 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[xxxi] 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[xxxii] 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 increase the risk of CVD. The obesity epidemic identified by the World Health Organisation[xxxiii] is large scale in European countries, translating into between 9% (Italy) and 20% (Finland) of the adult population (aged 15+) defined as obese (weight 30kg/height in m²). [xxxiv] The International Obesity Task Force[xxxv] shows how the prevalence of obesity *and* overweight in children varies between countries. (Figure 3).

Figure 3



Obesity defined by the Task Force method. Survey dates vary between 1999 and 2004. Age bands vary between 6 and 17 years.

DECiPHEr can model the relative influences of exercise and diet on obesity and of obesity on the risk of CVD (because there is robust evidence on the strength of these relationships.). The impact of HUP measures on diet and exercise is more difficult to calculate. 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[xxxvi] of food retail regeneration, Cummins et al found only a negligible impact on the consumption of fresh food.

Environmental interventions to promote physical exercise will be easier to model. The UK National Institute for Health summarised the evidence from a systematic review[xxxvii] of scientific studies and reported (i) closing or reducing the capacity of roads can lead to long term increases of walking and cycling within the area of the scheme (ii) traffic calming interventions may be useful in enabling children to benefit from physical activity outdoors in the long and short term (iii) the introduction of cycle infrastructure can lead to long term increases in levels of cycling within the area of the scheme (iv) modification and promotion of parks may increase walking and cycling and can raise awareness of parks (v) there are reasonably consistent [xxxviii]associations between physical activity levels and the accessibility of physical activity and other facilities, the density of residential areas, land use mix and urban 'walkability' 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 (€143 - €27,500 per quality of life year (QALY). The Swedish study cited earlier links 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.

6. Summary.

This note lays the foundations for developing the DECiPHEr model to include a cost-benefit component of healthy urban planning. An initial schematic model suggests three routes to reducing the risk of CVD: modifying the built environment, enhancing the natural environment and changing the modal split of transport towards walking and cycling. Evidence from a number of social scientific and medical studies indicates the principal routes. The next stage of developing DECiPHEr is to combine estimates of impact for each segment of the pathways.

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[ii] However, municipalities may contribute to mitigating climate change via Agenda 21, the action component of the UN Rio Declaration on Sustainable Development.

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