

JECH invited commentary

Preventing noncommunicable diseases through structural changes in urban environments

Manuel Franco^{1,2}, Usama Bilal^{1,2}, Ana V. Diez-Roux³

Affiliations:

1. Social and Cardiovascular Epidemiology Research Group, School of Medicine, University of Alcala, Madrid, Spain
2. Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA
3. Department of Epidemiology, Drexel University School of Public Health, Philadelphia, PA, USA

Corresponding Author: Manuel Franco, mfranco@uah.es Social and Cardiovascular Epidemiology Research Group, <http://www3.uah.es/cardiosocialepi/> University of Alcala, Madrid, Spain

“The primary determinants of disease are mainly economic and social, and therefore its remedies must also be economic and social. Medicine and politics cannot and should not be kept apart.” Rose G.¹

“To achieve [a reduction in overweight and obesity] is perhaps the major public health and societal challenge of the century. Potential strategies include [...] redesign of built environments to promote physical activity, changes in food systems, restrictions on aggressive promotion of unhealthy drinks and foods to children, and economic strategies such as taxation.” Willet W.²

Noncommunicable diseases (NCDs)—mainly cancers, cardiovascular diseases (CVDs), diabetes, and chronic respiratory diseases— are the main causes of death and morbidity worldwide.³ NCDs are now responsible for more than 35 million annual deaths in the world with more than 80% of this disease burden occurring in low- and middle-income countries.⁴ At the same time, NCDs are highly preventable by means of effective preventive interventions tackling shared behavioural risk factors as unhealthy diets, harmful use of alcohol, tobacco use and physical inactivity.⁵

Efforts to prevent NCDs have historically included strategies to target high-risk individuals that have shown, especially in the case of obesity and diabetes, poor results.^{6, 7} To advance the prevention of NCDs, population-wide understanding of these shared risk factors and morbidity remains crucial. The population approach to prevent NCDs, articulated by Geoffrey Rose in his article Sick Individuals and Sick Populations,¹ aims at shifting the distribution of its risk factors for the whole population, therefore affecting everyone regardless of their risk. Rose highlighted the need to measure and understand factors related to inter-population differences in the distribution of risk factors (social phenomena and social determinants or environmental factors), instead of focusing on factors related to inter-individual differences within a population (classic behavioural risk factors and genetics). The population strategy is radical in the sense that should affect the fundamental causes of the distribution of risk factors in the whole population of interest by promoting large structural social and environmental changes.

Population preventive strategies try to shift the entire distribution of risk factors. Even small shifts in the full distribution may have a larger health impact than strategies that focus on high risk individuals within a population.¹ Small changes in risk factor distribution at the population level resulting from large political or economic change⁸ and whole population campaigns⁹ have led to substantial health impacts.

Analyses of the health consequences of a tragic historical period in Cuba during the last three decades,⁸ have shown population-wide loss of 4-5 kg in weight in a relatively healthy population was accompanied by a 50% reduction in diabetes mortality falling by half and a 30% mortality reduction from coronary heart disease. Furthermore, a rebound in body weight was associated with an increased diabetes incidence and mortality, and a halting in the decline in mortality from coronary heart disease⁸ (See Figure 1 for population bodyweight changes and diabetes burden over three decades of the study). Population wide bodyweight changes over time occurred due to large economic and social changes directly related to the availability of food and fuel. Food was rationed and transportation networks had limited activity, forcing the population to walk or bike to work. This, along with the government production and importation of more than 1.5 million bikes, led to a population-wide loss of body weight with the aforementioned consequences in terms of NCDs.

Another example of large structural changes includes the North Karelia Project. People in this area of Finland presented the highest rates of coronary heart disease in the world during the 60s.¹⁰ The determinants of these incidence rates involved, as Geoffrey Rose previously stated,¹ factors acting as mass influences on the entire population. The question shifted from “why did this individual develop CVD” to “why do population rates of CVD vary so much between East Finland and other parts of the world?”.⁹ Based on this concept, the North Karelia Project (that included consultations from Geoffrey Rose himself⁹) designed a large scale intervention that included partnership with a previously reluctant food industry, subsidies for the production of healthier foods (produce) and large built environment changes.¹¹ The results of this project were so encouraging that it was expanded to the whole country of Finland in 5 years and led to large reductions in cardiovascular mortality of around 80% from 1970 to 2006.⁹

These two examples provide evidence on the potential for prevention of NCDs of the population strategy. Nonetheless and as pointed out by Frohlich, there is “a common misinterpretation of the population approach, which considers it simply to mean programmes or policies having an impact on a large number of people”.¹² Rose’s definition of population approach relies on ‘upstream’ factors as contextual determinants or policy-level determinants. The same line of thought is expressed by Willet when referring to the Cuba study by Franco et al.⁸ highlighting the need for structural changes directly related to the levels of physical activity and healthy eating of the population as a whole². As detailed by Geoffrey Rose in an earlier paper, individual strategies (like medication) adopted in a grand scale are not part of the population approach, because “to influence mass behaviour we must look to its mass determinants, which are largely economic and social.”¹³

Urban environments present unique opportunities for research and policy evaluation of population approaches to prevention. By definition cities are dense, and characterized by substantial man-made components to their environments and by frequent social interactions. These characteristics make cities excellent candidates for policy interventions on social and physical factors affecting large numbers of people. In addition, cities are internally heterogeneous, with large within city variation in social and physical environments which have been shown to be associated with NCD.^{14, 15} Cities also encompass multiple contexts relevant to health, such as the larger metropolitan area, the city itself, and neighborhoods within the city.

Cross-city comparisons may also be informative for example contrasting the distribution of NCDs risk factors in comparable populations of two different cities (e.g. Copenhagen and Madrid). Studying how the distribution of NCDs risk factors within cities may change in Madrid in two very different moments in time; 2015 and 2030 may also shed light to prevent NCDs.

Studying population prevention strategies in urban areas presents the limitation that social phenomena such as transportation or food policies may come into force above urban areas at the city or the national level. Nevertheless, other features of the

environment as healthy food availability and affordability and walkability of the area do actually happen differently across urban areas. Nonetheless, in order to understand why rates of disease vary within or across cities, characteristics of the environment (social or physical) must be measured and analyzed.¹⁶

The development of population strategies in cities requires identification of the social and environmental drivers of behavioral patterns both across and within cities.

A number of observational studies have examined associations between social and physical environments of neighborhoods and non communicable diseases. An example of a recent neighborhoods and health study can be found in Figure 2, from the Heart Healthy Hoods project in Madrid.¹⁷ Studying the upstream factors that affect non-communicable diseases requires studying the socioeconomic composition of the neighborhoods in close relation to environmental domains of neighborhoods as tobacco, physical activity, alcohol and food environments. These four domains of the urban environment can be understood and measured in terms of the social norms and physical resources that make up these environments (left side of Figure 2). These four urban environment domains may very importantly have a direct relationship with the well known and well studied individual NCD risk factors, namely tobacco use, physical inactivity, harmful use of alcohol and unhealthy diets. The effect of social determinants measured at the individual level (like individual gender roles) should also be studied, especially as a effect modifier of more upstream factors (right side of Figure 2).

Although much can still be learned from observational studies, strengthening causal inference will require other study designs. It will be very useful to capitalize on naturally occurring changes and quasi-experiments (whenever available)¹⁶. By natural experimental studies, we mean the methodological approaches to evaluating the impact on health or other outcomes of interventions or policies which are not under the control of researchers, but which are amenable to research.^{18, 19}

Measuring neighborhood level determinants of individual behaviors can help us answering the population-level question of “how would rates of NCDs change in impoverished Madrid if healthy food was more affordable?” or “how would rates of NCDs change in Madrid if transportation policies were similar those of Copenhagen?. Bicycling as an active form of transportation has been encouraged in Copenhagen by major municipal campaigns and investments in a cohesive bicycle infrastructure after large protests in the 70’s and 80’s²⁰ by the Copenhagen residents. Answering this type of questions may require the use of natural experiments allowing researchers to study if urban changes (not always health related) have had a sizeable effect on health.

In order to understand and develop large scale structural changes in our urban settings the input from different disciplines like epidemiology, sociology, geography, urban planning, primary care and health systems research, and public policy will be key²¹. In addition, developing population preventive strategies requires a deep understanding of how societal patterns of disease are created by political, economical and cultural decisions.²²

Differences across areas or neighbourhoods are not “natural” but rather result from specific policies (or from the absence of policies)^{16, 22}. Understanding the relationship of the social and physical environment with NCDs and developing adequate and efficient preventive strategies will require the work of multiple disciplines, often with diverse methodological approaches including large scale quantitative observational studies and qualitative studies of the ways in which people relate to and are affected by urban environments. Interdisciplinary work partnering with communities and policy experts is warranted to prevent the major public health challenge of noncommunicable diseases that we face in our cities.

Figure 1, Body Mass Index Distributions in Cienfuegos, Cuba 1990-2010 and Diabetes Burden in Cuba 1980-2010

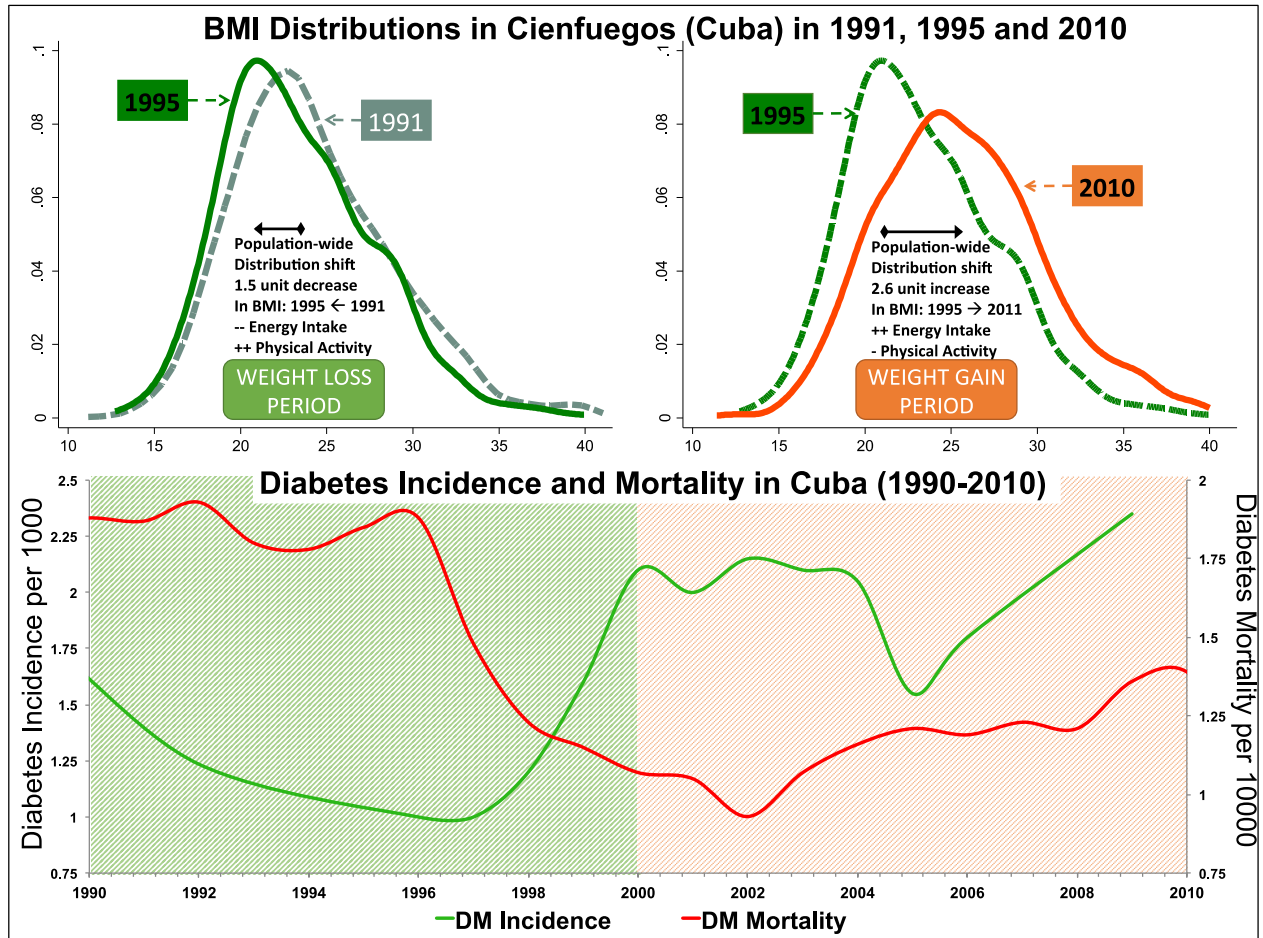
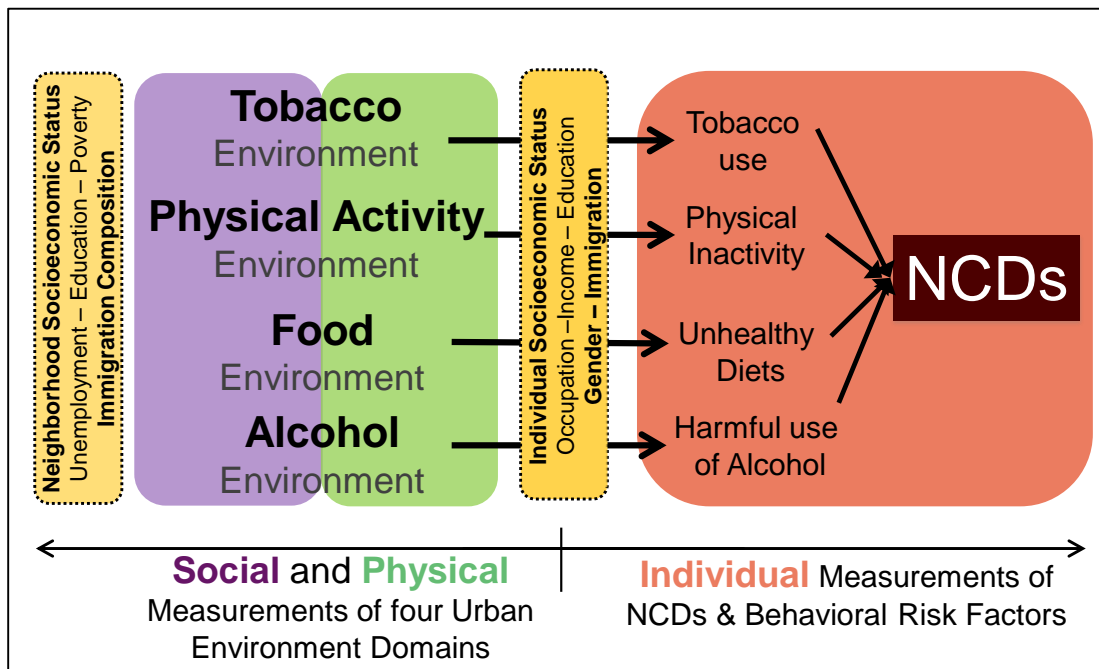


Figure 2, Characteristics of the urban environment and individual behavioral risk factors related to noncommunicable diseases



Box: Fundamental concepts and terms:

1. Noncommunicable diseases (NCDs): diseases of long duration and slow progression that are not (directly) passed from person to person. Typically the main four groups include are: cardiovascular diseases, cancer, chronic respiratory conditions and diabetes.⁴
2. Population strategy for NCDs prevention: strategy that seeks to control the determinants of incidence in the population as a whole through mass environmental interventions (large structural and radical changes) aimed to shift the entire distribution of NCDs risk factors.¹
3. Studying urban environments
 - a. Social norms: social norms are properties of societies that provide guidance for people's attitudes and exert powerful influences over their individual health behaviours.²³ The measurement of social norms relies on anthropological and sociological measurement techniques.
 - b. Physical resources: the material resources available to people according to their status and location and that allow people to fully develop their health potential.²⁴ The measurement of urban physical resources relies on tools provided by geography, sociology and economics.

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