Rethinking the "diseases of affluence" paradigm in global health

Patterns of obesity and other nutritional risk factors in relation to economic development

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Introduction

Cardiovascular diseases and their risk factors are among the leading causes of mortality and morbidity globally (Figure 1), and have been predicted to rise dramatically in the coming decades. Aging of the world's population is a key driver of the expected increase because cardiovascular disease rates tend to increase with age. In addition to this demographic change, an epidemiological change which involves increases in age-specific rates of cardiovascular diseases in developing countries has also been predicted in some analyses. The basis for this epidemiological change is a predicted population-wide rise in cardiovascular disease risk factors including obesity, blood pressure, cholesterol and tobacco with increasing income, leading to the "diseases of affluence" paradigm. A number of challenges have been made to the diseases of affluence paradigm. For example, it has been observed that cardiovascular diseases and at least some of their risk factors (e.g. smoking) may decline once they have peaked. More recently, it has been documented that in high-income countries cardiovascular risk factors are increasingly concentrated among lowest socioeconomic groups.

Despite these challenges in specific populations, at the global level, predictions about rising levels of cardiovascular disease risk factors in developing countries with economic development continue. The global health aspect of the diseases of affluence paradigm is particularly important because it implies that a large proportion of the world's population, who live in middle-income countries, will face both aging and rising age-specific cardiovascular disease rates, and require policies and interventions to reduce the enormous resulting burden of cardiovascular diseases. Yet the specific shape of the proposed policies remain extremely general and need to be better defined. The "diseases of affluence" paradigm would also imply that cardiovascular disease risk factors are not currently an issue for low-income populations.

We systematically examine population level relationships between three leading cardiovascular risk factors – overweight and obesity, and elevated blood pressure and cholesterol – and a number of economic variables using data for over 100 countries. Focusing on multiple cardiovascular risks shows more complex economic-epidemiological patterns than those predicted by simple descriptions such as the "diseases of affluence" paradigm. More importantly, focusing on multiple risk factors provides a more complete perspective on intervention and policy options. The implications for societies at various stages of development are discussed.

Methods

We examined the relationship between average population blood pressure, cholesterol, and BMI and three economic variables: national income, average share of household

expenditure spent on food, and proportion of population in urban areas. National income is the commonly used indicator for a society's material well-being. In addition to food type, the subject of much of the literature on the nutritional transition, the amount of food consumed (total calories) is also an important determinant of nutritional risk factors, especially for BMI. The share of household expenditure spent on food is a measure of how household economic resources may constrain food purchase. If food forms a large proportion of the total household expenditure, households may limit the total amount of food consumed (which should result in lower weight and possibly lower levels of other risk factors if they are affected by over-consumption); or households may switch to less expensive, but lower quality, foods which may increase dietary risk factors such as blood pressure, even if total caloric intake does not increase. The proportion of population in urban areas is an indicator of a number of environmental and lifestyle variables such as physical activity in occupational and transportation domains or access to specific food types. For example, rural populations may have higher levels of physical activity as a part of agricultural occupations or walking longer distances for day-to-day activities.

Data sources

Data sources for risk factors and economic indicators were population surveys and systematic reviews of scientific literature. The countries were divided into three broad categories of high mortality developing, lower mortality developing, and economically and demographically developed, the last group being the industrialized countries of Europe, North America, and the Western Pacific which have completed the process of demographic transition. Systolic blood pressure (SBP), cholesterol, and body mass index

(BMI) were age-standardized using the WHO standard population. Age standardization is needed to compare risk factors with age gradients across populations with different age structures. The new WHO standard population is a better representation of the current age structure of populations that older reference populations (e.g. SEGI) that give very little weight to older age groups.

Statistical analysis

A local regression model was used to estimate the income – risk relationships. A local regression model estimates the association across income levels without assuming a parametric model. Rather the data determine the fitted curve, which is preferred when no theoretical model for the shape of the association exists.

Summary Results

Countries with highest and lowest levels of SBP included the full spectrum of development stages. Those with highest cholesterol levels were developed countries, although some lower-mortality developing countries (e.g. Jordan, Seychelles, and United Arab Emirates) also had high levels of cholesterol, ranging from 4.8 to 6.0 mmol/l. Overweight and obesity showed a more mixed pattern between lower-mortality developing countries and developed countries (median BMI for developed countries was 26.6 kg/m^2 for men and 26.5 kg/m^2 for women; for lower-mortality developing countries, it was 24.7 kg/m^2 for men and 26.8 kg/m^2 for women), with females in some lower-mortality developing countries in the Eastern Mediterranean region having the highest

BMI (e.g. Jordan, Kuwait, Bahrain). Lowest BMIs were generally in high-mortality developing countries, and a number of developed countries in Asia such as Japan.

When considered in relation to national income, both BMI and cholesterol rose rapidly, then flattened, and eventually declined. BMI increased most rapidly until a purchasing-power-adjusted per-capita income of about I$5,000 and peaked at about I$12,500 for females and I$16,000 for males. Cholesterol's point of inflection and peak are at higher income levels than those of BMI (about I$8,000 and I$18,000, respectively). The BMI decline at higher incomes relative to the peak was larger for females (3.5 kg/m^2) than for males (1 kg/m^2).

Cardiovascular diseases have multiple well-established behavioural, environmental, and physiological determinants. Less established is the patterns of these risks *at the population level* in relation to one another and to economic variables like income. If current income-risk relationships observed in this analysis hold as economies grow, rapidly increasing BMI, coupled with the role of elevated blood pressure as a cardiovascular risk factor at all levels of economic development, will increasingly concentrate two major risk factors (blood pressure and obesity) in populations with currently low-mid income levels; and all three risks in mid-income countries. Implications for interventions and policies are discussed.