Cardiovascular diseases (CVDs) are among the leading cause of morbidity and mortality worldwide. The burden of this epidemic is likely to worsen as developing countries with large populations witness rapid economic, social and cultural transition. Such changes, while leading to prosperity and increased longevity of their populations, also produce rapid epidemiological transition resulting in an increased non-communicable disease burden. Economic development, urbanization and globalization result in dramatic changes in dietary practices, inadequate physical activity, increased tobacco consumption and environmental pollution. Cheaper availability of high-fat foods and diminishing use of traditional foods result in high energy intake, whereas mechanization results in reduced physical activity and lower energy expenditure. These result in energy surplus and consequent overweight and obesity. Additionally, migration, loss of a social support system and breakdown of family networks lead to increased stress. All these fuel the CVD epidemic and hence CVDs are often termed lifestyle diseases.

We now understand that there are multiple determinants of health and several dimensions of health care, many of which span the non-health sector. Therefore, a comprehensive CVD control comprises several approaches involving policy-level changes to the management of individuals with CVD and its complications. However, what is now clear is that the decline in CVD in developed countries over the past few decades has largely resulted from policy changes aimed at promoting healthy behaviours as well as advances in clinical care. A rough estimate suggests that two-thirds of the observed decline in coronary heart disease (CHD) mortality can be attributed to population risk approach of shift in diet and smoking. In the UK, more than two-thirds of the life years gained due to reduction in CHD mortality during 1981–2000 has been attributed to a decline in smoking. Despite this, the population level influences in determining CVD risk and the role of interventions aimed at populations to reduce CVD have not been well documented.

In this issue, Chow et al. present a comprehensive review of population-level interventions and their impact on CVD risk factors and diseases. They use an iterative process in collating literature to address the role of population-level factors in CVD prevention. As exemplars they use tobacco control, built environment, dietary interventions and environmental pollution. Using a narrative review process they summarize several studies in these domains and argue the need for multidisciplinary research in evaluating population-based approaches and highlight the methodological challenges such as the deficits in the currently available instruments that evaluate diet, nutrition and physical activity. They believe that the estimates of benefits emanating from population-level interventions do not come from actual research evidence, but are obtained largely due to a ‘diagnosis of exclusion’. They suggest additional research to evaluate the role of population-based interventions.

**How valid are the conclusions of Chow et al.?**

Though population-level interventions have not been evaluated with the same rigour as interventions focused on individuals, several broad themes can be deciphered. Population-level interventions can be broadly classified into two categories: policy-level interventions and health promotion approaches. Clear benefits of policy-level interventions are available in tobacco control. Non-personal interventions, such as taxing tobacco products, have been shown to reduce the number of smokers, particularly new onset smoking. Modelled data based on such findings suggest that a 10% increase in tobacco prices can prevent between 5 and 16 million tobacco-related deaths worldwide. It would be unwise to suggest a randomized controlled trial in this area and it would be prudent to compare pre- and post-policy influences in reducing CVD mortality among developing and
developed countries. Examples of benefits of policy measures on tobacco are also available from studies demonstrating the positive impact of legislation banning smoking in public places. Helena, Montana, a geographically isolated community in the USA, experienced a 40% decline in hospital admissions due to heart attacks after imposing a ban on smoking in public places in June 2002. However, the opponents won a court order suspending the enforcement of this law and then subsequently the heart attack admission rates rose again to the original levels.\textsuperscript{7} Another study from Scotland was a prospective, evaluation of smoking status and exposure to second-hand smoke based on questionnaires and biochemical findings from all patients admitted with acute coronary syndrome to nine Scottish hospitals during the 10-month period preceding the passage of the legislation and during the same period the subsequent year.\textsuperscript{8} This study demonstrated a 17% decline in the number of admissions for acute coronary syndrome after the implementation of smoke-free legislation. Sixty-seven percent of the decrease involved non-smokers, suggesting substantial benefits for passive smokers with fewer admissions also noted among smokers. Other studies have also reported similar, but varying, reductions in hospital admissions after enactment of smoke-free legislation.\textsuperscript{9–13} The varying benefit between populations can be explained by the differences in baseline exposure to smoking. A meta-analysis of these studies suggested an overall reduction of 27% in heart disease-related hospital admissions after enactment of smoke-free laws.\textsuperscript{14}

Similar health benefits have also been observed with policy measures on diet. Examples of such policy changes are available from Poland and Mauritius.\textsuperscript{15,16} Poland witnessed a sharp decline in CHD during the 1990s, even as CHD mortality rates rose in other Eastern and Central European countries. This was largely explained by an improvement in the quality of fats in the diet and increase in fruit intake.\textsuperscript{15} This period saw a decrease in animal fat consumption due to a decrease in subsidy for dairy and other animal fats and an increase in import of fruit and vegetables. Earlier, Mauritius, which combined health education of people with policy changes leading to substitution of palm oil with soybean oil as the subsidized oil, observed a reduction in multiple cardiovascular risk factors.\textsuperscript{16}

However, the role of health promotion may require a stricter verification and is amenable to research. Several studies have highlighted the role of health promotion following the publications of North Karelia study from Finland.\textsuperscript{17} A large majority of such studies came from developed countries, and all of them have been either quasi-experimental studies or pre-post analysis, with their inherent limitations. A meta-analysis of all population-based randomized control studies conducted largely in developed countries has suggested that health promotion (involving health education, mass media and community organization) does not reduce mortality significantly, but leads to a small, yet potentially beneficial, reduction in risk factor levels.\textsuperscript{18}

Several reasons have been attributed to the scepticism for health promotion. These include shorter duration of interventions, improper design (most were quasi-experimental design) to evaluate the benefits, contamination (adoption of components of health intervention by the control community) and a declining trend of CVD in developed countries during the intervention period. Most of these studies were conducted in the 1970s and 1980s in developed countries when they were already observing a decline in CVD incidence. Further, the periods of the interventions and follow-up were short and inadequate. Other potential reasons include baseline differences in the comparisons group, and ignoring the effects of design in the analysis. Additionally, the ‘dose’ of the intervention was not adequate enough to achieve the desirable change. In contrast, in the developing countries the current prevailing secular trend seems to be that of a rapidly increasing burden of CVD and its risk factors. Therefore, it is likely that a community-based approach may show the desired results of reducing CVD risk factors in developing country settings.

A large study from India demonstrates the feasibility of health promotion in certain settings.\textsuperscript{19} Prabhakaran \textit{et al}. in their demonstration project in Indian industrial population recently reported the benefits of health promotion along with other interventions in reducing CVD risk reduction among industrial workers participating in a CVD surveillance programme. They demonstrated that an effectively designed health intervention package and a comprehensive CVD prevention programme are successful in decreasing the general CVD risk factors at the population level. This study demonstrated a relative decline in mean body weight, waist circumference, blood pressure, serum cholesterol and plasma glucose levels in the intervention group as compared with a significant increase in all these risk factor level among controls. However, this success needs to be translated in other settings such as school and community level.

**What are our recommendations?**

As suggested by Chow \textit{et al}., there definitely is a need for improving the instruments used for behavioural determinants such as diet and physical activity, for multi-sectoral approaches and research on the role for health promotion. However, awaiting the results of research will result in postponement of benefits particularly in relation to policy measures. We therefore advocate the following.

1. To use ecological approaches to compare policy interventions in tobacco control, diet and nutrition and enhancing physical activities among populations. For evaluation of outcomes, using
well-defined intermediate outcomes such as population mean levels of blood pressure, blood sugar and blood lipids may be a useful approach. For tobacco policy evaluation, useful measures could be number of cigarettes or equivalent products sold, in a country over a given period of time, proportion of young smokers or comparison of cost of tobacco products between countries, using purchasing power parity or international dollars.

(2) For countries initiating policy measures, it would be advisable to limit the interventions to a few but with high expected yield. For example, recent analyses confirm the cost-effectiveness of tobacco control and salt reduction policies in saving millions of lives over the next 10 years. These two could be good starting points for several developing countries. Addition of trans-fat removal, reduction of saturated fats and sugar in processed foods, along with encouragement for consumption of fruit and vegetables, have the potential to yield higher reductions in the CVD burden. Further policies that affect production, processing and pricing will all affect population risk of CVD. In the domain of physical activity altering urban design to facilitate protected cycle lane, safe pedestrian pathways, improving existing parks and adding community sporting facilities are areas that can be evaluated.

(3) Several regulatory measures on tobacco, alcohol and diet that have been adopted by developed countries could easily be adopted by developing countries without reinventing the wheel. Contextualization of these measures may be needed for wider acceptability. A policy approach involving health education and multi-sectoral strategies of promoting healthy behaviour is a more cost effective and sustainable approach to CVD prevention (KS Reddy, personal communication).

(4) The role of health promotion in terms of community behaviour modification, information dissemination of healthy habits through mass media and other similar measures will need research evaluation. A cluster randomized trial using a settings-based approach (work site, school and community) in multiple countries may be able to answer the questions. Concurrently, an economic evaluation for assessing cost effectiveness should be considered.

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References


