

Urbanization and Cardiovascular Risk: Moving Forward from Framingham

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Introduction

The cardiovascular epidemic in India is evolving affecting particularly the urban towns in India. Epidemiological data shows that poorer communities are being particularly affected with increasing number of risk factors (Kavita Singh, et al, 2015). The focus of cardiovascular prevention in western countries has been individualised prevention based on screening, drug management of risk factors of hypercholesterolemia, diabetes and hypertension and non-pharmacological management through diet, weight reduction, and exercises. However the primary focus of cardiovascular prevention has been on drug management through blood pressure, blood sugar and cholesterol screening and initiation of anti-hypertensives and statin therapy. In western countries, a significant proportion of the entire population is on drugs for risk factor modification. This is leading to

(Syed S Mahmood, et. al. 2014). It brought in a new conceptual framework of thinking about complex chronic disease, the risk factor approach as an explanatory framework of disease causation and risk factor based prevention.

“A new style of explaining cause and responsibility, one which used probabilistic language to link quantifiable and elementary properties of individual physiology, behaviour, and social and familial background to specific and untoward outcomes. By the late 1960’s, this type of explanation became the dominant way of expressing and conceptualising what individuals contribute to CHD.”(Aronowitz 2012)

Most importantly the Framingham study brought in a new way of thinking about public health, an individualized public health based on risk factor modification.

Shifts in Framework of Chronic Disease and Prevention with Framingham Study

Pre-Framingham	Post-Framingham
Macro-epidemiology	Micro-epidemiology
Role of epidemiology in studying infection disease in the population	Epidemiology in study of disease causation in the individual
Population at risk	Individual at risk
Risk factor- insurance concept (investment against risk of dying)	Risk factor- disease causation, clinical prediction of risk, initiation of disease prevention
Governmental mode of public health- population prevention interventions	Private mode of public health- individualised disease prevention
Method of study of etiology- through study in the laboratory (laboratory medicine)	Clinical epidemiology- clinical method of study of disease causation, disease prediction and Prevention

overmedication and high cost and is not sustainable on the long run. Such an approach also does not appear to be addressing the underlying problem that is leading to the epidemic. Is the IHD epidemic a natural consequence of development? Is there any other possible prevention approach?

The Impact of the Framingham Heart Study on Modern Medicine

Framingham study of cardiovascular risk was an epochal study. It brought in a new methodological approach in studying disease causation, the cohort study method and the use of multivariate statistics

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The Framingham Model

The model of research was not based on the social medicine model of public health to find out the social determinants of CHD (macro-epidemiology). If that was the case, then a different set of factors would have been identified and a different set of prevention strategies would have been conceptualised (Elodie Giroux 2012, Gerard Oppenheimer 2006).

The model was based on a clinical model: what are the clinical factors that can be reliably documented which are early predictors for CHD? This reflects the active involvement of cardiologists who were involved in a study of “clinical epidemiology”

(microepidemiology) of CHD and not public health and social medicine approach.

The model of prevention that was propagated by the National Heart Association was an individualised model. This has to be understood in the background of the American private health care system and also the setting of health care provision in Framingham. The model of prevention that was developed was one that could be delivered by the private health care system to the individual patient. It was a medical model of prevention for the individual patient, an individualised public health not for improved health of the population.

This has to be contrasted to other kinds of public health initiatives for population health and prevention. For example John Snow's work showing that the contamination of the hand pump had led to the cholera epidemic led to public health interventions to improve sanitation. In this case, a structural improvement led to a dramatic change in the incidence of the disease. Another example is immunisation, where vaccine is administered to the entire population to prevent disease in the population. Here, the vaccine may prevent disease in the individual. However the individual may or may not benefit from the intervention. If interventions are given to only select individuals as in the Framingham model, it can prevent disease in the individuals but may not prevent disease in the population. In order to arrive at a rational method of disease management, different models of prevention and their economic, social and biomedical presuppositions would have to be studied and analysed to arrive at a possible breakthrough.

With the risk factor model there has been the blurring the margin between normal and pathological. Each of these parameters of hypertension, hypercholesterolemia and diabetes is not defined by symptoms or signs or pathology but by a set of clinical or laboratory measurement. These asymptomatic parameters can predict risk in the future. There is an incremental increase in risk of cardiac events with elevation of each of these parameters. Even at quite normal levels cholesterol, blood sugar and blood pressure there is risk of cardiac events (i.e., there is no level below which there is zero risk to the patients). Most of the randomised controlled trials of risk factor modification treatments have been conducted by pharmaceutical companies. These drug trials have shown that as you bring BP and cholesterol lower,

there is a progressive reduction in cardiovascular risk. This has led to lowering of cut-offs for initiation of preventive treatment and new diagnostic categories such as 'pre-diabetes' and 'pre-hypertension'. The concept of risk is malleable and infinite, rendering normal and pathological indistinguishable and open to manipulation by the pharmaceutical industry.

The combination of shifting goal posts for initiating risk factor reduction, an individualised model of cardiovascular risk reduction and a privatised health care industry has led to a situation where there has been a change in the nature of health care. Most of health care delivery for cardiovascular prevention is focussed on drug therapy not to treat pathology, but to treat risk in the future. We moved to the age of a risky society, where health care is governed by cardiovascular risk.

Problems of Risk Factor Model for India

How relevant are the risk score calculators based on the Framingham study for India? Can they be used for calculation of 5 and 10 year risk of cardiac events? We know that there are differences in the relationship of risk factors and cardiac events in India. The contribution of smoking and hypertension to cardiac events is greater. The relationship of BMI and cardiac events shows increase in cardiac events at lower BMI. Abdominal obesity is considered to be a cardiovascular risk factor in India even at normal BMI. Data also seems to suggest that risk of cardiac death in patients presenting from lower socioeconomic background is higher. If the relationship between risk factors and cardiac events is population specific, is it possible to have uniform cutoffs for risk factor definition and initiation of treatment guidelines? Is it possible to extrapolate results of cardiovascular risk reduction treatment guidelines from one population to the other?

Is there Another Way to Conceptualise Cardiovascular Risk?

In India we know that there are larger development changes that are leading to the cardiovascular epidemic: large scale urbanisation with poor living conditions, reduced physical activity related to urban occupations, use of motorised transport and lack of physical space, high carbohydrate diet with increased fat intake due to high cost of vegetables and fruits and urban stress and smoking. There has been reversal of coronary risk factors with improvement in socioeconomically better off and worsening in the lower socioeconomic groups.

The point is that there are larger development forces that are leading to cardiovascular epidemic. Viewing the problem from an individualised risk factor model renders invisible the larger development forces that are leading to the epidemic.

Studies of Chronic Disease in Gudalur

Our work with the Gudalur Adivasi hospital provides interesting insights into the link between development and cardiovascular epidemic (Zachariah and Srivatsan 2015). There are four tribes in the Gudalur valley who together form the Adivasi Munetra Sangham. Our studies examined changes in development, cardiovascular risk factors and mortality.

Changes in Development

The tribes used to live in the forests and off the land till the 1970's. During the last 30-40 years within one generation there has been large scale development change. They have entered a cash economy. The current adults remember that in their childhood they had a wide food basket which was primarily obtained from the land and forest. This included range of cereals, millets, tubers, leaves and fruits from the forest, a variety of hunted meat and fish from the streams. Although there were periods of starvation, the food quality was better. Today their primary food source is PDS rice. Most of the food is bought with scanty amounts of vegetables and fruits, minimal protein and fat. Although physical activity has reduced from their

childhood, the most members interviewed are still very active. The levels of stress are quite high related to entering a cash economy (education, health care, alcohol, jobs, loans, house construction etc).

In short, the processes of urbanization, i.e., the development of small towns in the vicinity and the entry of urban concepts, processes and organizations like health care, education, wage labour, and development/community health groups have all led to changing health profiles among the adivasis.

Cardiovascular Risk Factors

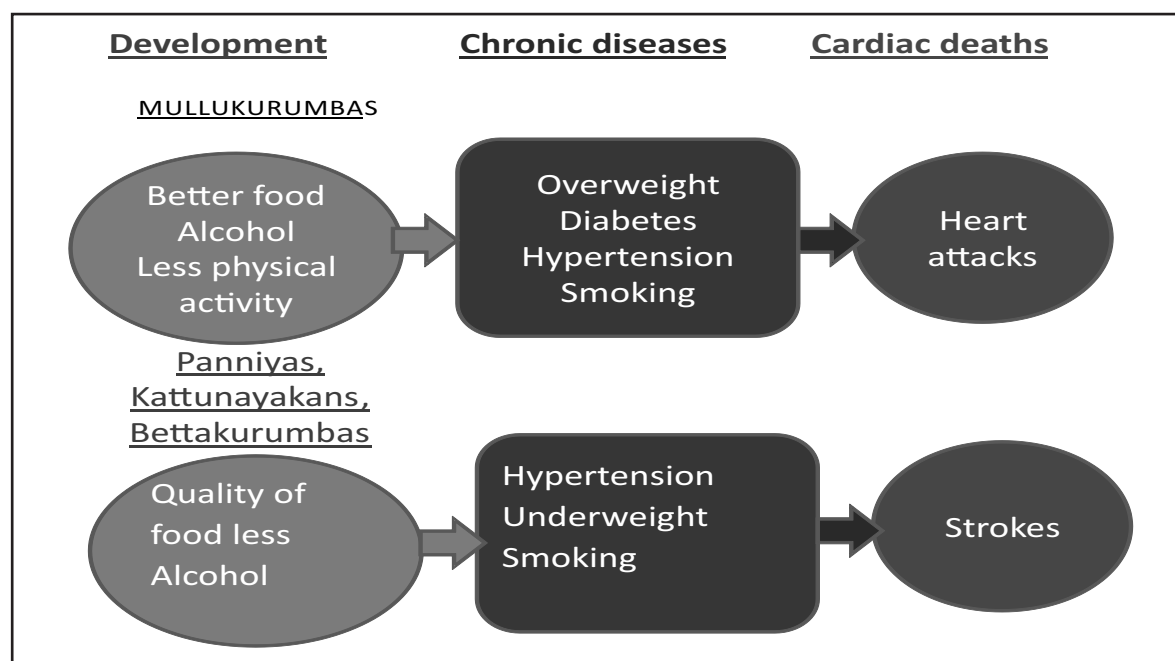
The Mullukurumba tribe which is socioeconomically better off has higher rates of diabetes, obesity and hypertension. All the other three tribes had almost non-existent diabetes, moderate rates of hypertension and high rates of low BMI (chronic energy deficiency). The villages which were more developed had higher rates of diabetes, hypertension and obesity. The villages which were less well developed had higher rates of hypertension and low BMI.

From this data we inferred that the villages and tribes had different cardiovascular risk profiles based on their development parameters.

Cardiovascular Mortality

Review of community mortality statistics showed that the foremost cause of death in the community was heart attacks and strokes. The overall rates of deaths

Figure 1: Development and Vascular Disease in Tribes of Gudalur Valley



due to strokes and heart attacks are equal to urban Kerala. In Mullukurumbas, the main cause of death was heart attacks probably secondary to obesity, diabetes, hypertension and less physical activity. In the other three tribes the chief cause of death was stroke probably due to wide-spread hypertension.

Model of Cardiovascular Disease in Gudalur

We suggested that the current cardiovascular epidemic in Gudalur may be linked to large scale development change in the tribal communities. Development and urbanization are differentially affecting different tribes causing different chronic disease risk factor profiles (See Figure 1). All tribes had increased cardiovascular deaths though they were mediated through different risk factor profiles. The risk factors of blood sugar, BP and BMI can be conceived as intermediate risk markers in the true sense of the word. The proximal development factors that are leading to these changes may include changes in food, activity, stress and economic changes. Exactly how this web of development changes exerts itself through the risk factors to cause heart attacks in Mullukurumbas and strokes in other 3 tribes is unclear.

Implications for Cardiovascular Prevention in Gudalur

One approach to cardiovascular prevention in Gudalur is the individualised model of risk factor prevention based on the Framingham approach. However the Gudalur community is a democratic community, consciously making decisions about its mode of development for the future. Does the community have development choices it can exert in addressing the cardiovascular epidemic? For instance, can the traditional knowledge about gathering food from the land and forest be used to widen the food basket through non market modes of food security? It is important for the tribes to maintain good levels of physical activity. Can the community develop new modes of dealing with modern stress, through their main strength of strong tribal identity and sense of community. What modes of democratic action can work in Gudalur to address the cardiovascular epidemic?

Conclusion

This article discusses the limitations of our current model of cardiovascular prevention that emerges from the Framingham study. The limitations of our current model of cardiovascular prevention are (a) public

health model based on drug based individualised prevention; (b) blurring of margin between normal and pathological and downward mobility of treatment cut-offs for risk factor prevention and (c) market approach to prevention using private health care.

It discusses the limitations of application of this model in India. The relationship of risk factors to cardiac events in India is different and hence risk factor calculation and guidelines developed in other countries may not be readily application. There is a large scale epidemic among poorer section and drug based prevention will require high investment may not be sustainable.

Based on the Gudalur experience we argue for the need for a public health approach for cardiovascular prevention based on social determinants and a development model of disease. While these suggestions may be intuitively applicable to urban settings, they need to be validated by more extended studies. What are the possibilities for a model of primary care and public health that involves communities to deal with the cardiovascular epidemic that seems to accompany processes of urbanization?

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