Review
DIABETES–SOCIAL AND ECONOMIC PERSPECTIVES IN THE NEW MILLENIUM

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ABSTRACT

Prevalence of diabetes is increasing in pandemic proportions, particularly in developing countries like India. The recent reports from the World Health Organization rates India as the country with the largest number of diabetic subjects in the world. The Chennai Urban Population Study (CUPS), The Chennai Urban Rural Epidemiology Study (CURES) and the National Urban Diabetes Survey (NUDS) revealed rising prevalence of diabetes in India. Some of the significant risk factors associated with diabetes are similar worldwide, but their intensities vary between races, regions and countries. The reason for escalation of diabetes prevalence in India could be attributed to a combination of genetic factors and environmental factors due to urbanization and industrialization, which has led to sedentary lifestyle, physical inactivity, stress and obesity arising from energy and fat rich diets. The long-term complications of diabetes occurring during the most productive years of their lives create a devastating burden of morbidity and mortality, which poses an economic and social burden both at the individual and at the national level. Compared to non-diabetic individuals, diabetic individuals are more than twice as costly to treat, mainly due to the high costs related with management of associated complications. Prevention seems to be the need of the hour to tackle this epidemic. This article highlights the social and economic implications of diabetes in India and emphasis the measures required to prevent diabetes.

KEY WORDS: Indians; Diabetes; CURES; CUPS; Health economics.

INTRODUCTION

As we enter the new millennium, diabetes mellitus has become a problem of epidemic proportions. It touches us in every walk of life – physician and scientist, family and friend, even governments and communities – and it exacts a costly toll.

Diabetes mellitus is defined by the American Diabetes Association (ADA) Expert Committee in their 1997 recommendations as "a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both. The chronic hyperglycemia is associated with long-term damage, dysfunction and failure of various organs, especially the eyes, kidney, nerves, heart and blood vessels." Thus, diabetes covers a wide range of heterogeneous diseases (1).

Type 2 diabetes is by far the commonest form of the disease globally with rapidly developing countries being at the forefront of this epidemic. Current estimates – almost certainly conservative - are that at least 150 million people worldwide have diabetes, of which two-thirds live in developing countries (2). The total number of people with diabetes is predicted to rise to about 300 million by 2025, with one-third of affected individuals living in India and China alone. The largest increases in the diabetic population in developing countries are projected to be in the most economically productive age groups (3).

DIABETES – INDIAN SCENARIO

India with its dubious distinction of being called, "the diabetic capital of the world" is presently estimated to have over 30 million individuals affected by this deadly disease. India is ahead of China and USA, which are in second and third place respectively. Figure 1 depicts the projected number of people with diabetes among adults in India in the years 1995, 2003 and 2030. This represents a three hundred percent increase in the number of people with diabetes between 1995 and 2030 (3). A striking example of the rise in prevalence of diabetes in India is the fivefold increase from 2.1% to 12.1% seen from 1970 to 2000 (4-9). Two population based studies, the Chennai

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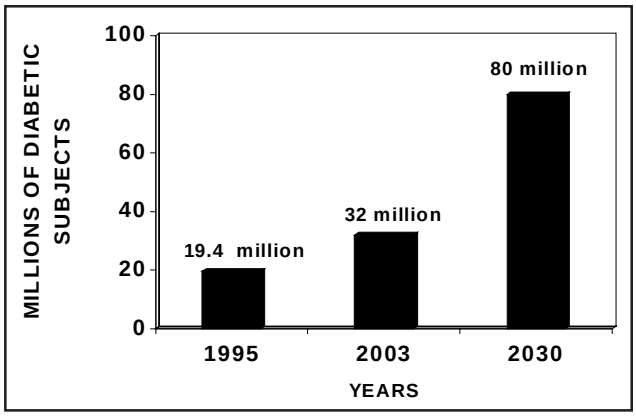
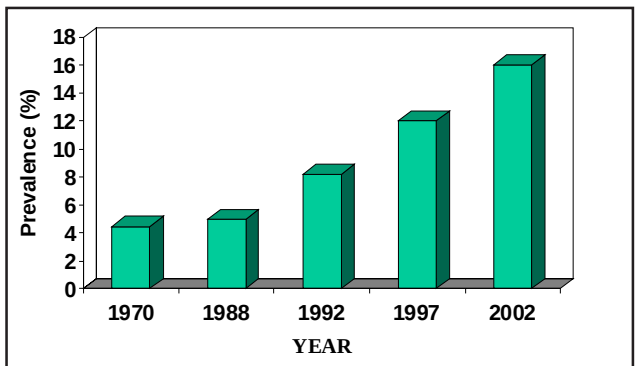


Figure 1: Estimated Number of People with Diabetes in India, 1995 to 2030.

Urban Population Study (CUPS) and Chennai Urban Rural Epidemiological Study (CURES) showed a marked increase in the prevalence of diabetes within a short span of five years. The CUPS study conducted in the year 1997 revealed that 12% (crude prevalence rate) of the Chennai population to be affected by diabetes (5, 6). The National Urban Diabetes Survey (NUDS), carried out in six cities in the year 2001, reported the age-standardized prevalence rates of 12% for diabetes for urban India (9). The age-standardized prevalence of diabetes in Chennai according to this study was 13.5 %. In addition the study also reported that 14% had impaired glucose tolerance (IGT). The city of Hyderabad showed the highest rates of both diabetes (17%) and IGT (30%). In Chennai, Bangalore, Hyderabad and Mumbai, the prevalence of IGT exceeded those of diabetes (9). The large population based study, CURES conducted on 26,001 individuals in the year 2001- 2002, showed that according to the ADA criteria 19% had diabetes in Chennai and this scaled down to 16% when WHO criteria was used (10). This modification was based on an extrapolation of the results of oral glucose tolerance test on a sub-sample population (n=2000). Figure 2 shows the progressive rise in estimated prevalence of diabetes in urban India based on the available data (5).



Reference	City	Reference
Ahuja et al	New Delhi	4
Ramachandran	Kudremukh	7
Ramachandran	Chennai	8
Mohan et al	Chennai	6
Mohan et al	Chennai	10

Figure 2: Increase in the Prevalence of Diabetes in Urban Indians from 1970 to 2002

Interesting differences are observed in the age-wise distribution of the diabetic population in the developed and developing countries. While in the developed world, the majority of diabetics are aged 65 years and above, in the developing world, the majority of diabetics are in the age group of 45-64 years. According to the CUPS study the prevalence of diabetes between the ages of 45 to 60 years was nearly 25%, which was similar to that seen among individuals above the age of 65 years in developing countries (8). Figure 3 compares the age of newly diagnosed subjects in the CUPS study. These data have a lot of significance since diabetes sets in during the most productive period of their lives (8). This in turn, has major implications with respect to health care needs.

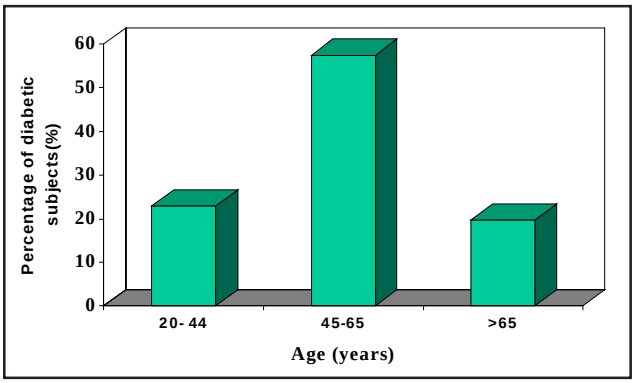


Figure 3: Age at Onset of Diabetes in Indians–the Data are Obtained from the newly Diagnosed Subjects from CUPS and the Numbers Refer to Percentage of Diabetic Subjects

URBANIZATION AND DIABETES

The rapid epidemiological transition occurring in India with increased urbanization and westernization, have already contributed to a substantial rise in diabetes. The current urbanization rate is 35% compared to 15% in the 1950's and this could have major implications on the present and future disease patterns in India with particular reference to diabetes and coronary artery disease (3, 11). All over the world,

traditional lifestyles and dietary patterns that have sustained people over generations are disappearing. Socio-economic development over the last 40-50 years in India has resulted in a dramatic change in lifestyle from traditional to modern, leading to physical inactivity due to technological advancement, affluence leading to consumption of diets rich in fat, sugar and calories and a high level of mental stress. All these could adversely influence insulin sensitivity and lead to obesity. This is reflected from results of prevalence studies conducted in southern and northern parts of India comparing urban and rural populations, showing the prevalence to be 2.4% in rural population as compared to 11.6% in urban population in south India (7, 8, 12, 13) while in north India (Moradabad) the prevalence of diabetes was 2.8% vs. 6.0 % respectively in rural and urban areas (14).

In developing countries, the prevalence of diabetes is lower among those with a low income than among more affluent groups (6, 15, 16). The impact of urbanization on the prevalence of diabetes in India is clearly shown in the CUPS study. The higher socio-economic status (SES) group had two-fold higher prevalence of diabetes compared to the lower socio-economic group (6). The reason for high prevalence has been attributed to the consumption of unhealthy diet like foods rich in calorie and fat and lack of physical activity in the higher SES group. The same study also demonstrated that the prevalence of components of the insulin resistance syndrome, which includes diabetes, hypertension, dyslipidemia and obesity are more common among the higher SES, compared to lower SES (6, 17, 18). The higher prevalence of diabetes mellitus in the urban strata of Indian society adds on to the serious implications on the economy of our country. . It is also shown that SES also plays a significant role in diagnosis of diabetes. In Bangalore Urban district Diabetes (BUD) Study a four-year delay in diagnosis of diabetes was observed between the highest and lowest SES groups (19).

In a study conducted in Bangladesh (15), the age-adjusted prevalence of type 2 diabetes was higher in urban (7.97%) compared to rural population (3.84%). Adoption of western lifestyles has lead to increasing prevalence of type 2 diabetes and obesity in urban compared to rural African communities (16).

In a population-based study conducted with the aim of studying the anthropometric and metabolic characteristics among the rural-urban migrants settled in urban slums in North India (socio-economic transition), the overall diabetes prevalence was 10.3% (20). It was also observed that the prevalence of diabetes mellitus, obesity, dyslipidemia, generalized and regional obesity was found to be high particularly in females. This study clearly states the need for immediate attention in terms of prevention and health education in economically deprived populations in urban settings.

In the developed countries, most studies suggest that higher prevalence of type 2 diabetes, associated risk factors and diabetic complication rates vary inversely with socio-economic status i.e., in the lower SES population (21, 22). The reason for the higher prevalence of type 2 diabetes among subjects with lower socio-economic status could be unhealthy life style (23), nutritional inadequacies and psychological stress (24). An increased rate of obesity, smoking and physical inactivity was observed by Malmstrom et al (25) in socially deprived areas.

It has been demonstrated that risk factors for cardio-vascular diseases particularly smoking are more common among people with diabetes with lower SES in population and clinic-based studies in the developed countries (26, 27, 28) and individuals belonging to lower SES have an increased incidence of retinopathy and nephropathy (26, 27). In a study conducted in southern India (29) similar observation was reported, that diabetic subjects from a lower SES have a higher prevalence of cardiac disease, neuropathy and cataract but a lower prevalence of retinopathy compared to those from a higher SES and the risk variables including hyperglycemia, dyslipidemia, hypertension, smoking and alcohol consumption were more in the low SES group. This study suggests that while the prevalence of diabetes is higher among the urban higher SES group, higher rates of complications of diabetes are observed in the lower SES group in the developing countries.

In UK, higher morbidity and mortality in diabetic subjects has also been associated with SES (37,30), but in a Finnish study no such correlation was found (31) and concluded that education for diabetic people appeared to be effective in all socio-economic strata. Disparities in health by SES among people with diabetes could reflect the direct effects of deprivation on health or could result indirectly from the effects of unfavorable health behaviors linked to lower SES. Another potential reason could be the 'inverse care law' whereby access to and use of services is reduced, and the quality of care provided is substandard, for patients with the greatest need (32).

ECONOMIC IMPLICATIONS

Diabetes imposes a considerable burden on health

systems and societies. The cost implications of diabetes to society are multifold: direct costs to people with diabetes, their families and to the health care sectors, indirect costs to society and government, which are the productivity costs; and intangible costs, which means adverse effects on quality of life (Table 1). Very little is known about the economic impact of diabetes in the developing world where predicted increases in prevalence are highest. Diabetic individuals compared to non diabetic individuals are more than twice as costly to treat (33), mainly due to the high costs related with management of diabetes associated complications (33, 34) and the economic loss due to lost man-days or lost economic opportunity (34). Thus diabetes affecting the earning or active member of the family, affects not only that individual but might often have significant effect on the family.

Table 1: Costs of Diabetes

Direct Costs		Indirect Costs	Intangible Costs
Medical	Non medical		
Consultation	Transportation	Man days lost	Reduced life expectancy
Investigation	Time utilized for care	Low productivity	Pain and discomfort
Medication		Disability payment	Stress
Management		Social security	Anxiety
Hospitalization		Depression	
Treating Complications			Insecurity
			Inconvenience
Health programs			Lower quality of life

The economic burden of diabetes is increasing as the epidemic grows. As per WHO estimates, diabetes drains a significant percent of the health budget by cost towards direct diabetes care and diabetes related disabilities. Diabetes associated complications account for 60% of diabetes related direct health care costs and almost 80-90% of indirect costs (35). In Australia, at least US$ 720 million was spent on diabetes health care in 1995. It is projected that by 2010, costs will have risen by a further 50%. In New Zealand, 5% of the health budget is spent on direct diabetes care and a further 5% on diabetes related disability allowances. In Japan, the annual direct cost to the health care sector of diabetes is about US$ 16.94 billion (6% of the total health budget in 1998). In China, the estimated direct cost of care for people with diabetes in 1996 was US$ 3.5 billion (36). In South Asia, the direct cost of diabetes management is US$ 5 billion, while indirect costs total US$ 10 billion.

In India, the per capita expenditure on health care is only 6.4% of the average world spending, while India accounts for 23.5% of the world's disability adjusted life years lost due to diabetes (DALYs) (37). There is a paucity of information on the economic costs of diabetes in the subcontinent. According to our estimates, India presently has an annual estimated treatment cost of Rs 10,000 to 12,000 crore which is likely to witness a scaling upto as much as Rs 1,26,000 crore by 2025 (Mohan et al, unpublished observations). This figure includes direct costs (cost of routine treatment, monitoring and laboratory and hospital costs), indirect cost (cost arising from absenteeism, lowered productivity and disability benefits) and cost for treating diabetic complications using conservative estimates.

Recently few studies (38, 39, 40) have been published on the costs and sociological factors that contribute to diabetes care in India. In the Bangalore Urban district Diabetes (BUD) Study (38) it was estimated that, in 1998 the annual direct cost for routine care in Bangalore was about 191 US dollars; the mean direct cost per hospitalization for a diabetes-related event was about 208 US dollars. The Cost of Diabetes in India (CODI) study (39) revealed that the mean direct annual cost for outpatient care for diabetes individuals was Rs. 4724/- and the total indirect cost for non-earning diabetic patients was estimated to be Rs. 9748/- while for earning members it was Rs. 16831/-. When comparing the cost per hospitalization in the BUD and CODI studies, it was estimated to be Rs.9944/- vs Rs.10688/- respectively. In the CODI study those without complications had an 18% lower cost while those with three or more complications had a 48% higher cost.

A study conducted in families having type 1 diabetes in Chennai (41) reported that a median figure of Rs. 13,980 (US$ 310) was spent annually for diabetes by the families and the median percentage of annual income spent on diabetes treatment was 22% for the entire group (59% - low SES group, 32% - middle SES group, 18% - upper middle income group and 12% - high-income group). Another study conducted in type 2 diabetes in Chennai, revealed that diabetic individuals spent Rs. 4510 (US$ 100 approximately) (40).

The above estimates highlight the large differences in diabetes care expenditure between developing and

developed countries. From the meager data available regarding the economic cost of diabetes, it is clear that diabetes in the future will pose a severe burden on the under resourced health care system in India. Therefore action taken in early days of diabetes is more beneficial in terms of high quality of life and is more cost effective, especially if it can prevent hospitalization. Proper management/prevention requires increased awareness and education and investment for better diabetes care.

AWARENESS AND PREVENTION

Despite several advances in the field of diabetology, it is unfortunate that there exists a low awareness of the disease among public. This explains the findings of a recent study, which has shown that for every one person known to have diabetes, there are more than two people who have undiagnosed diabetes**.** This means that a substantial proportion of people with diabetes may already have developed at least one diabetic complication by the time they are diagnosed.

Diabetes awareness is an integral and essential part of diabetes care for both health professionals and diabetic individuals. Pre-diagnosis diabetes awareness may result in earlier diagnosis of the disorder, which has been demonstrated in various Indian studies (38, 39). BUDS has reported that the mean age at diagnosis was 48.3 years for those individuals who were aware of diabetes as a disorder compared to 50.1 years for those not aware and 47.7 years for those with a family history compared to 50.5 years for those without (38). In the CODI study 61% of patients' were aware of diabetes before diagnosis (39). Twice as many patients who were aware of diabetes and its consequences were free of complications when compared to those who were not aware and had similar diabetes duration (19).

Early detection and appropriate treatment are the cornerstones for delaying the onset and progression of the diabetic complications viz. retinopathy, nephropathy, neuropathy, stroke, peripheral vascular disease and ischemic heart disease. Meta-analyses and reviews of the diabetes literature have shown that diabetes education, awareness and improving motivation for self care improves care, reduces complications and may thus reduce overall economic costs of diabetes (42, 43). It has been demonstrated that in type-1 diabetes, early detection of nephropathy by screening for micro albuminuria and immediate recourse to improved control with anti-hypertensive medications, not only increases life expectancy significantly but also concomitantly reduces total health care costs (44). An intensive education program can improve the foot care knowledge and behavior of high-risk patients (45, 46).

Recent research advances in the etiology of diabetes mellitus have increased our knowledge to such an extent that both primary and secondary prevention of diabetes mellitus has now become a reality. Such prevention strategies should be the goal of targeting this disease, particularly in populations such as ours where the prevalence of diabetes is known to have increased dramatically over recent years. Primary prevention is aimed at reducing the risk of the onset of diabetes mellitus while secondary prevention includes all measures designed to reduce the morbidity and mortality in patients with chronic diabetes mellitus. 'The Cost of Diabetes in Europe - Type II (CODE-2) study' concluded that as diabetic complications have a substantial impact on the costs of managing type 2 diabetes, prevention of complications will not only benefit patients, but potentially reduce overall healthcare expenditure (47). Therefore, the need of the hour is prevention of this disease by early detection and modifications in lifestyle with the incorporation of a healthy diet, an increase in physical activity and weight reduction for those who are in the prediabetic stage (48) and appropriate treatment by oral hypoglycemic agents and insulin therapy for diabetic individuals.

Economics, it has been said, is not all about money alone but also about humanitarian considerations of the quality of life of millions affected with this dreaded disease. As healthcare professionals, for the service of humanity and the nation as a whole, let us all work towards managing diabetes to minimize long-term effects and maximize current good health and vitality.

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