India already faces a grave problem with the largest number of subjects with diabetes (approx 33 million in 2003) and if proper preventive measures are not taken, it will escalate further with the number increasing to 57.2 million in the year 2025 and by the year 2030 it may be 80.9 million. Diabetes mellitus is an iceberg disease in which 66% of patients are often undiagnosed. Furthermore, there is an equally large pool of people with impaired glucose tolerance (IGT), many of whom will go on to develop Type 2 diabetes in the future.

Moreover, the onset of type 2 diabetes is usually subtle and many years may elapse before diagnosis. The first indication of the presence of type 2 diabetes may actually be detected at the time of diagnosis of a complication. The present study have showed that more than 50% of the newly diagnosed type 2 diabetes patients already had indication of diabetes related tissue damage such as retinopathy, heart disease or microalbuminuria.

Indians have a racial predisposition and other unique risk factors to develop DM to a greater extent. In addition, in India, there is increasing urbanization and industrialization which has led to physical inactivity, sedentary lifestyle, psychosocial stress and obesity leading to progressive increase in prevalence of DM. Due to progressive increase in prevalence of DM; it will likely continue to be a major cause of morbidity and mortality in the future. The disease burden of diabetes mellitus is primarily due to the burden of its complication which makes it such a major public health problem. An inexplicable inertia also exists today in accepting diabetes as a preventable disease.

Primarily, based on the outcome of the study and considering the high prevalence of diabetic complications at the time of diagnosis as well as
younger age of onset of diabetes in our population, we venture to give the following recommendations:

**AT THE COMMUNITY LEVEL**

As India has no subsidized, coordinated diabetes care programme, the need of the hour is a drastic change in our approach with more emphasis on the preventive aspects of diabetes for the benefit of the community. Preventive measures for diabetes must be initiated in India at least during the pre-diabetic stage in order to decrease the spiraling epidemic of diabetes in India.

The first step towards combating rising rates of diabetes must involve improving **public awareness** about diabetes and its risk factors, particularly the overweight state. Community education about healthy weight ranges and validation of other anthropometric cut-off points that signify an increased risk of developing diabetes mellitus are strongly recommended.

The need of the hour is **early screening** for glucose intolerance in the population and institution of preventive measures at an early age.

Prevention strategies must be implemented at the community level emphasising the importance of **lifestyle intervention**. Intervention studies in the West have provided hope that both lifestyle and pharmacological intervention can prevent diabetes. Though pharmacological measures have shown favorable results, they should be considered only when intensive lifestyle interventions are unsuccessful or at least in combination with lifestyle modification.

The **target population** has to be defined for this purpose. Obese individuals, those with family history of diabetes in first and second-degree relatives, signs of insulin resistance (acanthosis nigricans) or conditions associated with
insulin resistance (hypertension, dyslipidaemia, polycystic ovary syndrome) are important target groups.

There is an urgent need to **develop a cost-effective protocol** for diabetes care aimed at improving disease control and therefore preventing, delaying or limiting the development of complications in both Type 1 and Type 2 diabetes. Such a protocol must be integrated into both undergraduate and postgraduate medical education. Education, supported by an appropriate incentive programme, is particularly important for the GPs who play a key role in the care of patients with diabetes.

There is also a need to **improve case record maintenance**, develop registries and perform outcomes research to define standards and identify patients at risk. There is a need for widespread education campaigns to improve awareness and knowledge among patients and their families, and the general population. Such programmes should focus on the importance of early diagnosis, lifestyle changes and regular monitoring to reduce the burden of complications. Promoting the use of urine and blood test strips would help encourage self-monitoring, and so reduce the need to visit pathology laboratories; this would cut transport costs and lead to improved diabetic control for those who otherwise could not afford it. This integrated approach would help provide better care early in the course of the disease and reduce the rate of complications and associated costs for all patients, regardless of education and/or income.

The current thrust of health care services in India is towards the treatment and prevention of communicable disease. This needs to be reviewed and an added impetus towards preventing and treating non-communicable diseases is the need of the hour. To be cost effective, diabetes health care should be linked with health care to control risk factors like hypertension, dyslipidemia, tobacco and alcohol abuse etc. For this purpose, the health care professional
should receive additional training and this can yield rich dividends at a low cost.

With such a health care delivery system, one would achieve, improved patient adherence to medical regimens, enhanced patient confidence, improved utilization of effective treatments with proper glycemic control, reduction of ischemic heart disease, decreased progression to blindness, decreased progression to renal failure and less number of lower extremity amputations. This would also cause a shift in overall health utilization from high cost complication related hospitalizations to low cost preventive services.

AT THE CLINIC LEVEL

Both the economic burden and loss quality of life experienced by a diabetic individual could be attributed to its morbidity associated with microvascular and macrovascular complications. In view of the high prevalence of complications and associated risk factors for macro vascular disease in newly detected diabetics in India, there is a need for screening all diabetics for complications at the time of diagnosis and annually thereafter. This includes retinal screening for detecting retinopathy, microalbuminuria for diabetic nephropathy, examination of pedal pulses and peripheral doppler for peripheral vascular disease, 12 lead electrocardiography for coronary artery disease and if indicated Treadmill and Echocardiography as well as a complete foot examination including monofilament testing and biothesiometry for diabetic neuropathy. The study highlights that diabetic patients need special care and a multidisciplinary approach for treatment. As diabetic treatment continuous for life so regular checkups are required to avoid or restrict co-morbidities attached to diabetes.

The early approaches for prevention of complications should target glycemic control, hypertension control and control of dyslipidemia. Such a
multi factorial approach is necessary to prevent complications, particularly macrovascular disease.

**Life style measures to prevent complications** should include dietary modification, which includes substituting
- Saturated fat, and trans- fatty acids with non-hydrogenated mono-and poly-unsaturated fats.
- High glycemic load items with low glycemic items, increasing fiber intake and reducing salt intake.
- Regular exercise and cessation of smoking would also help in preventing macrovascular complications.

The **intermediate approach** should target prevention of progression of complications after the complications set in. This includes pan-retinal photocoagulation for reducing the risk of visual loss in subjects with retinopathy, tight blood pressure control and protein restriction in subjects with nephropathy and use of antiplatelet therapy for macrovascular disease.

**Late approach** includes interventional procedures to prevent progression to end stage of the complications, like vitreo-retinal surgery (proliferative retinopathy), dialysis and kidney transplantation (renal failure) angioplasty and bypass surgery (macrovascular disease). However, it can be appreciated that most of these are not curative but palliative therapies and it is better to try to prevent patients going into these late stages of complications.

**DURING PREGNANCY**

Women with Gestational Diabetes Mellitus (GDM) are an ideal group for the primary prevention of diabetes as they are at increased risk of future diabetes, predominantly Type 2 diabetes, as are their children. The timely action taken now in **screening all pregnant women for glucose intolerance**, achieving euglycemia in them and ensuring adequate nutrition
may prevent in all possibility, India becoming the diabetes capital of the world.

To conclude, prevention and effective treatment of diabetes is not costly; however, in both human and economic terms, not treating the condition is extremely costly.