

**Type - 2 Diabetes Mellitus: Indian and Global Scene –
Burden & Challenges.**

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Diabetes meets Medical Informatics

Diabetes mellitus is a common household disorder, which is a life long companion, genetically inherited, manifests at any age from childhood to senescence and if neglected causes serious complications of vital systems in the body. The magnitude of this problem at present and in future, and how best to cope with it, at the level of the individual, community, and the nation and the roles each can play towards the dissemination of awareness and the information to enable early detection, management, mitigation of complications, and planning strategies to prevent the condition are outlined. The important value of medical informatics in the management as well as prevention of diabetes has to be understood by all concerned if any program has to be successfully implemented in the containment of this ubiquitous disorder.

Prevalence of Type – 2 Diabetes Mellitus in India

| Year | Population of India (in millions) | Prevalence (in millions) | Percentage (%) |
|-------------|--|-------------------------------------|---------------------------|
| 2002 | 1000⁺ | 30 | 3.0 |
| 2025 | 1250⁺ | 57 | 4.5 |

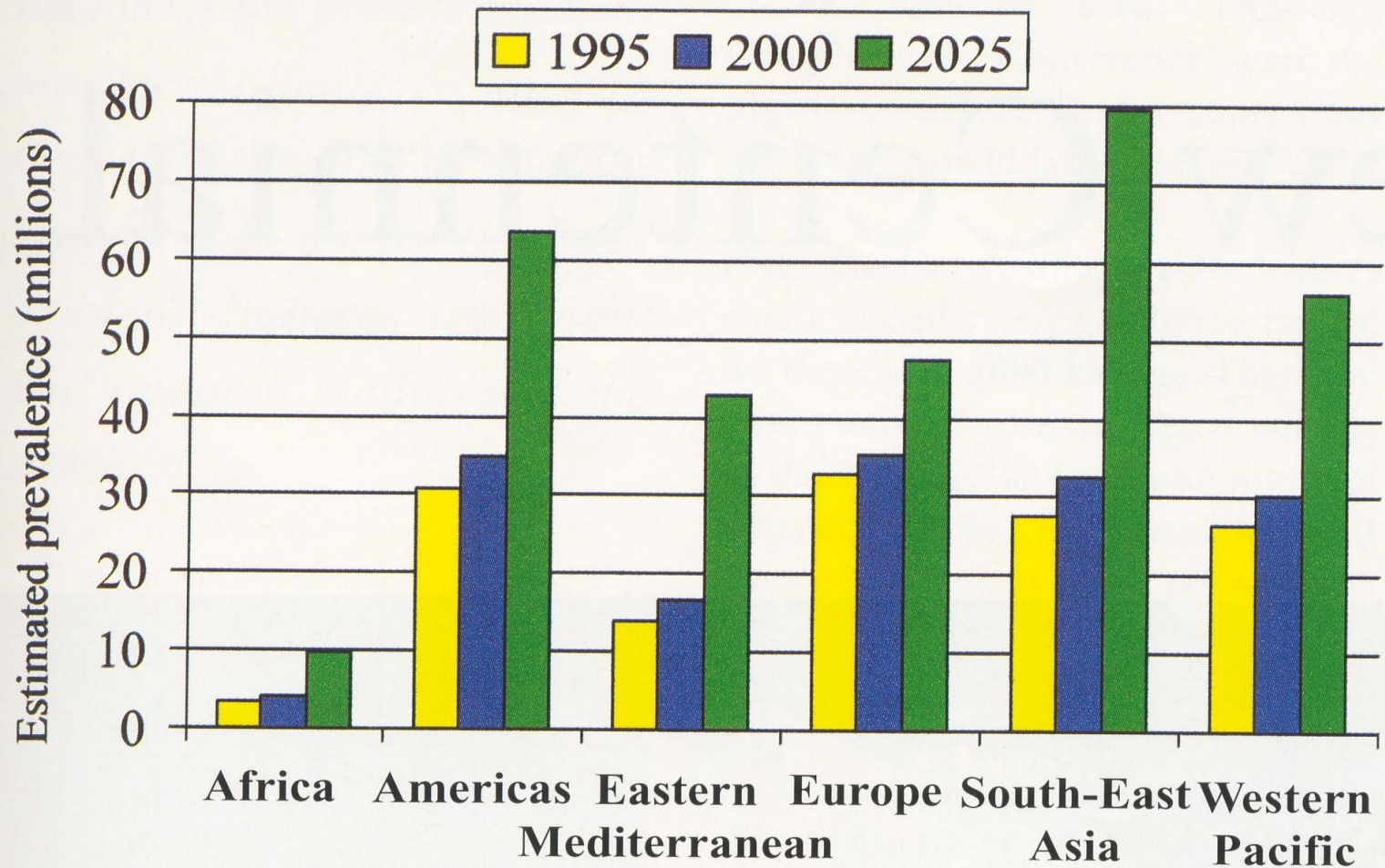
(WHO Projections – 1999)

Type 2 Diabetes (NIDDM or Non-Insulin Dependent Diabetes Mellitus)

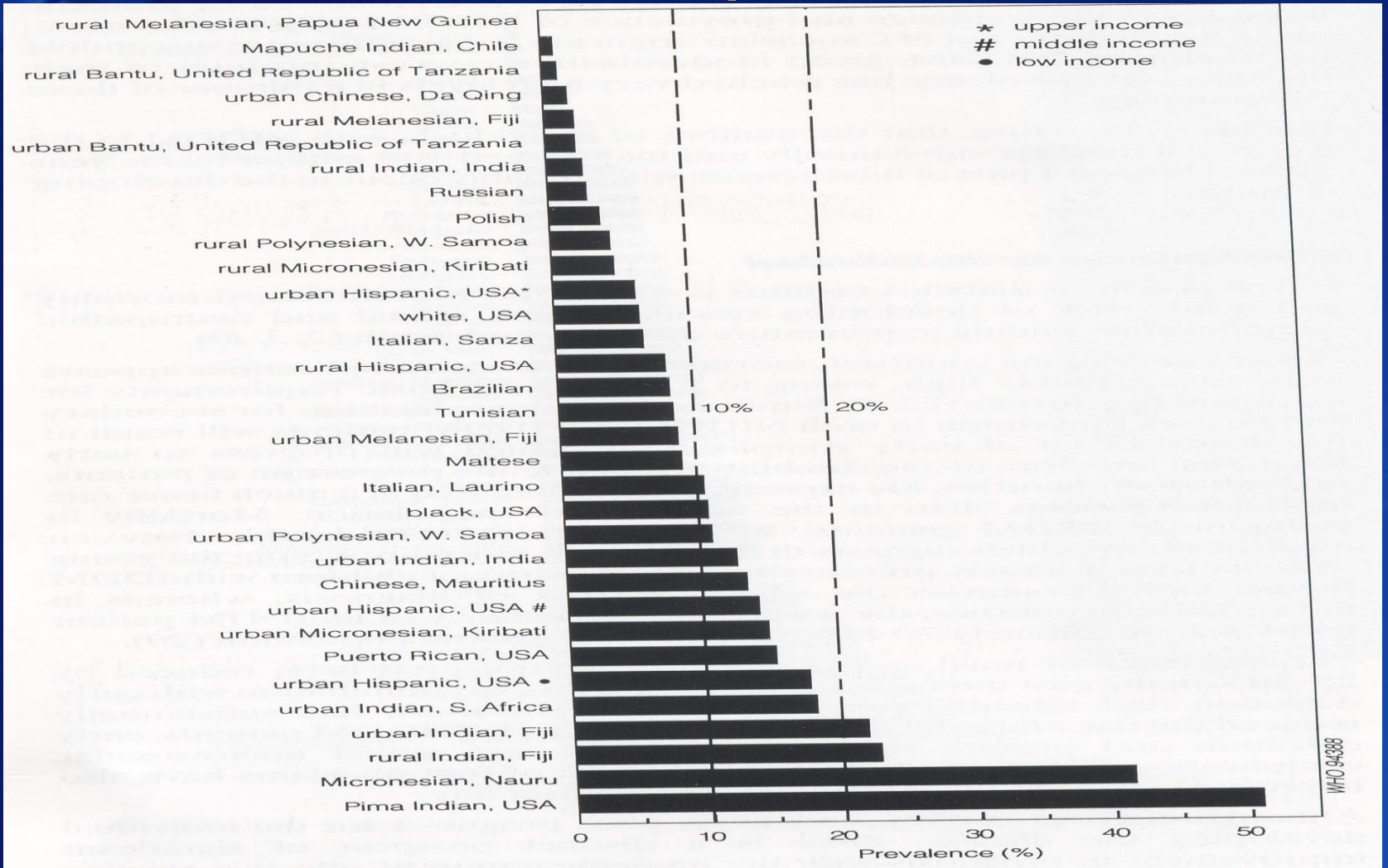
Indian and Global Scene : Burdens and Challenges

Diabetes Mellitus is the commonest Medical Problem of the 21st Century, affecting the quality of day to day life of over 150 million people of the world cutting across age, gender, racial and economic barriers.

DIABETES MELLITUS REGIONAL ESTIMATES 1995 - 2025



Prevalence of NIDDM in the age range 30 – 64 Years in Selected Populations



WHO 94388

Prevalence and Incidence of Type - 2 Diabetes and Impaired Glucose Tolerance in a Selected Indian Urban Population

PV Asha Bai*, CV Krishnaswami**, M Chellamariappan***

RESULTS:

A total of 1198 persons, 455 (38%) females and 743 (62%) males, participated in the study. While 116 (9.7%), suffering from Diabetics were exempted from remaining 1082 (90.3%) , 663 (61.3%) males and 490 (38.7%) females, were screened by OGTT.

Department of Diabetes, The VHS Medical Center, TTTI Post, Chennai –600113.

| Place of Survey | Year | Prevalence of Diabetes | |
|---|-------------|------------------------|-------------|
| | | Urban | Rural |
| ICMAR, INDIA² | 1972 | 2.3% | 1.5% |
| Multicentre² | 1979 | 3.0% | 1.3% |
| Daryagunj, New Delhi² | 1986 | 9.0% | |
| Kudremukh, India² | 1988 | 5.0% | |
| Eluru³ | 1989 | | 6.1% |
| Chennai⁴ | 1992 | 8.2% | 2.4% |
| Kerela⁵ | 1999 | 16.3% | |
| Kashmir⁶ | 2000 | 6.14% | |

C S Yagnik, NFI Bulletin, July 1995

Rao PV at al, Diabetes Res Clin Pract 1998 Jun 20; 7(1): 29-31

Ramachandran a eet al, Diabetologia 1992 Feb; 40(2): 232-7

Raman Kutty V et al, Ethn Health 1999 Nov; 4(4): 231-9

Zargar AH et al, Diabetes Res Clin Pract 2000 Feb; 47(2): 135-46

The I.I.T Study - Population

| Numbers | Male(%) | Female(%) |
|---|------------------------|------------------------|
| 1198 Volunteers | 743 (62%) | 455 (32%) |
| known DM 116(9.7%) | 80 (69%) | 36 (31%) |
| Eligible subjects For OGTT(75g) 1082 (90.3%) | 663 (61.3%) | 419 (38.7%) |

The I.I.T Study - Population

| Sex(N) | Normal(%) | IGT(%) | DM(%) |
|------------------------|------------------|------------------|----------------|
| Male N663 | 450(67.9) | 155(23.4) | 58(8.7) |
| Female N419 | 275(65.6) | 120(28.6) | 24(5.7) |
| Total 1082 | 725 | 275 | 82 |

The I.I.T Study - Results of OGTT – II (Follow - up) - 1993

Out of 1000 persons without diabetes, 444(63.8%) with normal GTT and 252(36.2%) with IGT, participated in repeat screening in 1993.

1 normal person(0.7%)
14 with IGT (5.5%)



Diabetes Mellitus in 1 year

The I.I.T Study - 1992 - 1993

Conclusions:

1. 64.3% of those with IGT Reverted to normal
2. 30.2% remained status Quo.
3. 5.5% of IGT → Diabetes Mellitus
4. The annul incidence Type - 2 Diabetes Mellitus for both sexes was 2.2%

THE LANCET

EDITORIAL

Do epidemiologists cause epidemics?

VOL 341: April 17 1993

BMJ

The Scandal of Poor Medical Research

We need less research, better research, and research done for the right reasons .

London Saturday, January 1994

Original article

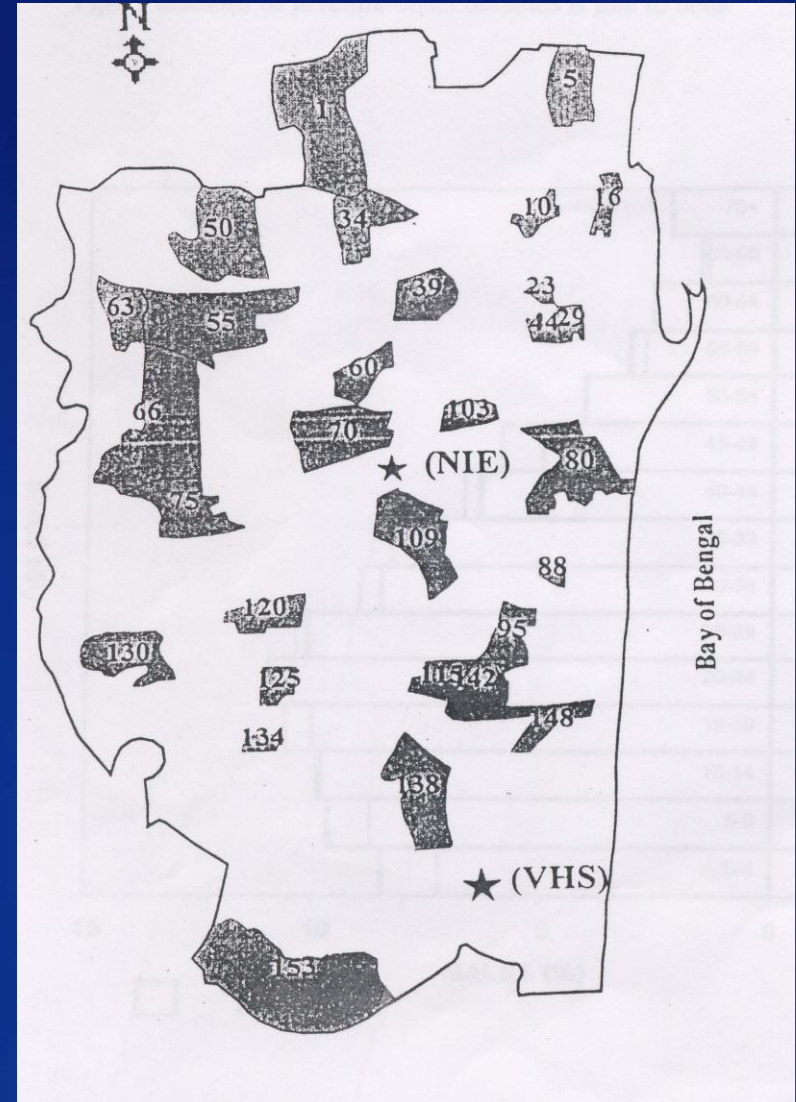
Prevalence of Known Diabetics in Chennai City

PV Asha Bai*, BN Murthy⁺, M Chellamariappan**, MD Gupte⁺⁺,
CV Krishnaswami***

Abstract :

Aim: To determine prevalence of known diabetes in those more than 20 years of age in Chennai city.

Prevalence of Known Diabetes in Chennai



Prevalence of Known Diabetes in Chennai

Methodology :

Urban population was selected for the survey assuming that prevalence of known diabetics as 5.0% in those aged > 20 years, the cluster sample size calculated to estimate it with 95% CI and +/- 10% precision, was 25,800 individuals of all ages. Special workers surveyed this population obtained from 200 households in each of 30 randomly selected corporation divisions of the city, by house-to-house enquiry. General information and life status of every member of the household were recorded on prescribed forms. This survey was conducted during January - July, 1998.

Prevalence of Known Diabetes in Chennai

Results :

Among 26,066 individuals of all ages 779 had known diabetes and 99.4% of them had Type - 2 diabetes. The prevalence of known diabetes was 2.9% for all ages and both sexes combined. Crude and age-standardized prevalence was 4.9% (95% CI 4.6 - 5.2) for those aged > 20 years. The standardized prevalence was 10.5% (95% CI 9.8 - 11.2) in those aged \geq 40 years. The prevalence was significantly high ($p < 0.05$) in females.

Prevalence of Known Diabetes in Chennai

Conclusion :

The prevalence of known diabetes was low in total population but increased in those aged > 20 and further increased in those aged ≥ 40 years. The causes for high prevalence in > 40 years age group needs to be explored in this population.

(J Assoc Physician India 2001; 49 : 974 - 981).

JAPI, Vol.49, October 2001

Prevalence of Known Diabetes in Chennai

JAPI, Vol.49, October 2001

| Sl-no | Div-No | Name of Division |
|--------------|---------------|-----------------------------------|
| 1 | 1 | Kodungaiyur (West) |
| 2 | 5 | Jeeva nagar (North) |
| 3 | 10 | Kumarasamy Nagar (South) |
| 4 | 16 | Grace Garden |
| 5 | 23 | Kondithope |
| 6 | 29 | Seven Wells (South) |
| 7 | 34 | Perambur (North) |
| 8 | 39 | Wadia Nagar |
| 9 | 44 | Perumal Koil Garden |
| 10 | 50 | Agram (North) |
| 11 | 55 | Viduthalai Gurusamy Nagar (South) |
| 12 | 60 | Maramalai Adigal Nagar (South) |
| 13 | 63 | Villiwakkam (North) |
| 14 | 66 | Anna Nagar |
| 15 | 70 | Kilpauk (North) |

Prevalence of Known Diabetes in Chennai

JAPI, Vol.49, October 2001

| Sl-no | Div-No | Name of Division |
|--------------|---------------|-----------------------------------|
| 16 | 75 | Aminijikarai (West) |
| 17 | 80 | Nehru nagar |
| 18 | 88 | Umarapular nagar |
| 19 | 95 | Azath nagar (South) |
| 20 | 103 | Dr.Ambedkar Nagar |
| 21 | 109 | Thousand Lights |
| 22 | 115 | Alwarpet(North) |
| 23 | 120 | Navalar neducheziyan Nagar (East) |
| 24 | 125 | Kamarajar Nagar(South) |
| 25 | 130 | Kodambakkam |
| 26 | 134 | Kumaran Nagar |
| 27 | 138 | G.T.Naidu Nagar (East) |
| 28 | 142 | Beemannahpet |
| 29 | 148 | Avvai Nagar (North) |
| 30 | 153 | Velachery |

Prevalence of Known Diabetes in Chennai

AGE - SPECIFIC PREVELANCE OF KNOWN DIABETES ACCORDING TO SEX

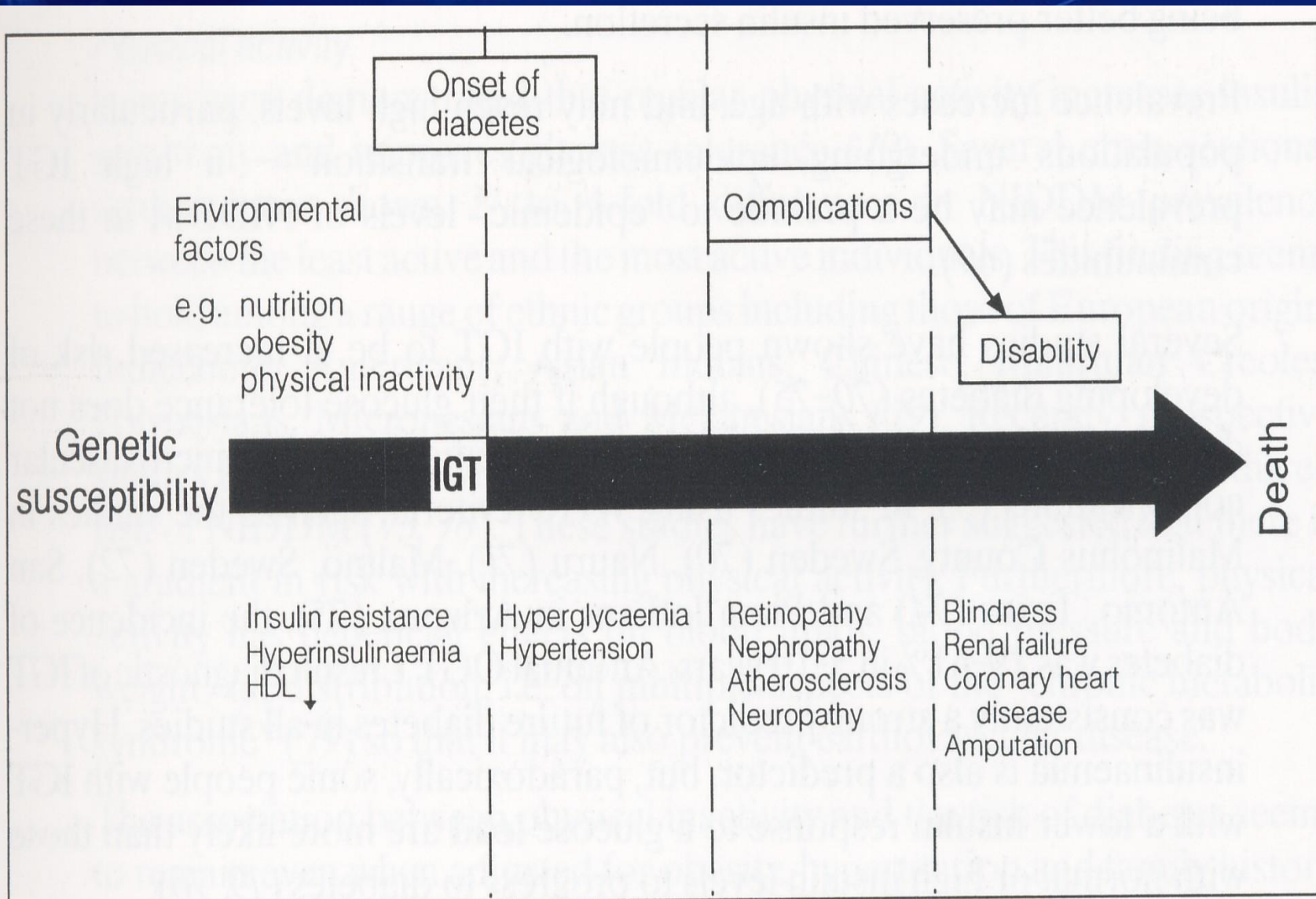
| AGE (YRS) | MALES | | | FEMALES | | | TOTAL | | |
|--------------|--------------|------------|------------|--------------|------------|------------|--------------|------------|------------|
| | PEOPLE | DIABETES | PREVELANCE | PEOPLE | DIABETES | PREVELANCE | PEOPLE | DIABETES | PREVELANCE |
| 0-9 | 2066 | 0 | 0 | 2000 | 0 | 0 | 4066 | 0 | 0 |
| 10-14 | 1267 | 0 | 0 | 1224 | 1 | 0.08 | 2491 | 1 | 0.04 |
| 15-19 | 1374 | 0 | 0 | 1356 | 0 | 0 | 2730 | 0 | 0 |
| 20-24 | 1353 | 0 | 0 | 1441 | 5 | 0.3 | 2794 | 5 | 0.2 |
| 25-29 | 1350 | 5 | 0.4 | 1461 | 4 | 0.3 | 2811 | 9 | 0.3 |
| 30-34 | 1168 | 7 | 0.6 | 1046 | 11 | 1.1 | 2214 | 18 | 0.8 |
| 35-39 | 1094 | 23 | 2.1 | 1068 | 24 | 2.2 | 2162 | 47 | 2.2 |
| 40-44 | 908 | 42 | 4.6 | 758 | 42 | 5.5 | 1666 | 84 | 5.0 |
| 45-49 | 818 | 56 | 6.8 | 675 | 51 | 7.6 | 1493 | 107 | 7.2 |
| 50-54 | 604 | 72 | 11.9 | 499 | 65 | 13.0 | 1103 | 137 | 12.4 |
| 55-59 | 425 | 61 | 14.4 | 354 | 52 | 14.7 | 779 | 113 | 14.1 |
| 60-64 | 389 | 46 | 11.8 | 340 | 59 | 17.4 | 729 | 105 | 14.4 |
| 65-69 | 223 | 34 | 15.2 | 191 | 39 | 20.4 | 414 | 73 | 17.8 |
| 70+ | 327 | 38 | 11.6 | 287 | 42 | 14.6 | 614 | 80 | 13.0 |
| TOTAL | 13366 | 384 | 2.9 | 12700 | 395 | 3.1 | 26066 | 779 | 3.0 |

Prevalence of Known Diabetes in Chennai

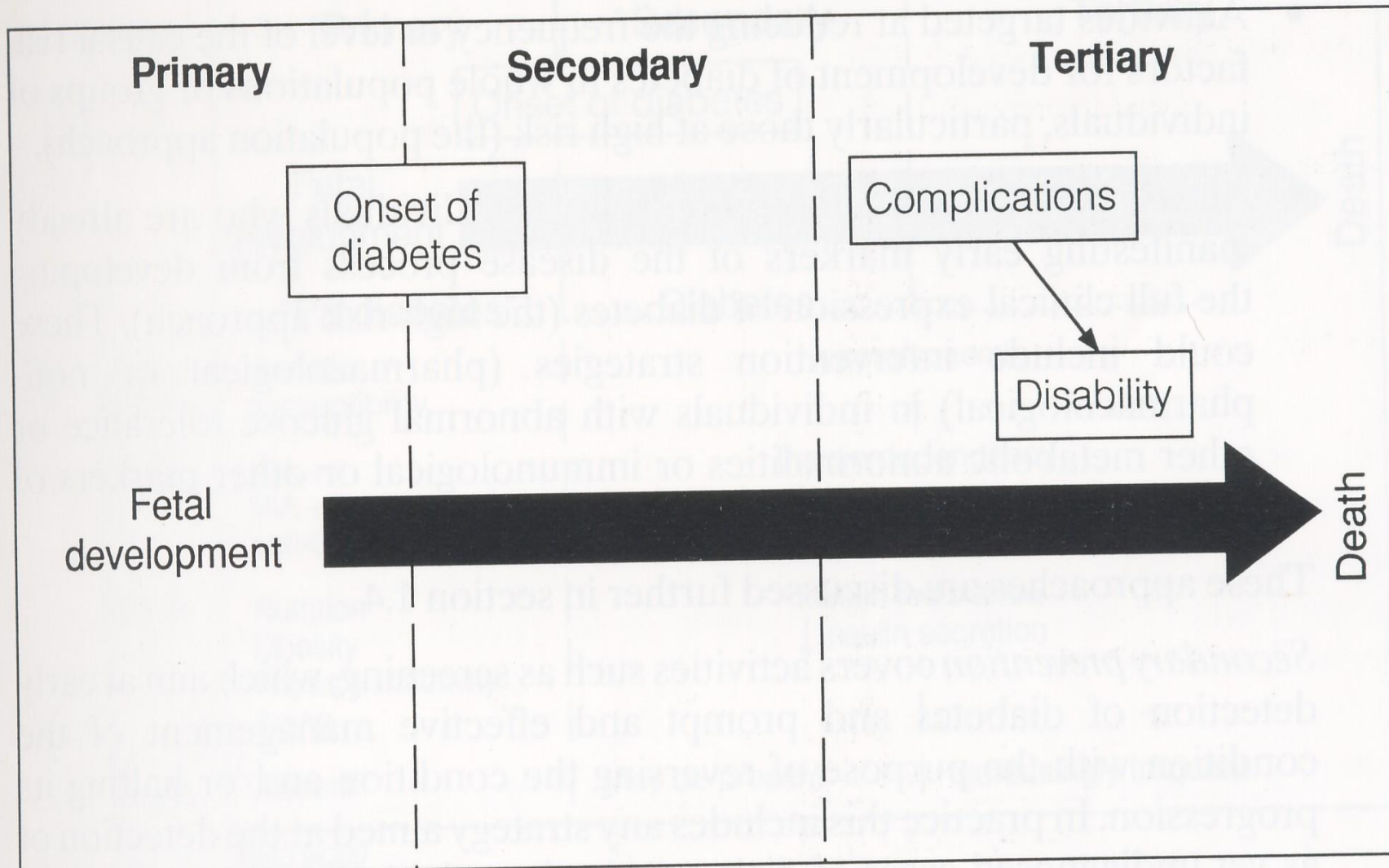
So, our data indicates that Type - 2 Diabetes clinically affects people largely between the ages of 40 -70 years - at the prime time in their lives - and producing complications after 15 to 25 years which necessitate complex and expensive treatment when they are at a low ebb both physically and economically.

JAPI, Vol.49, October 2001

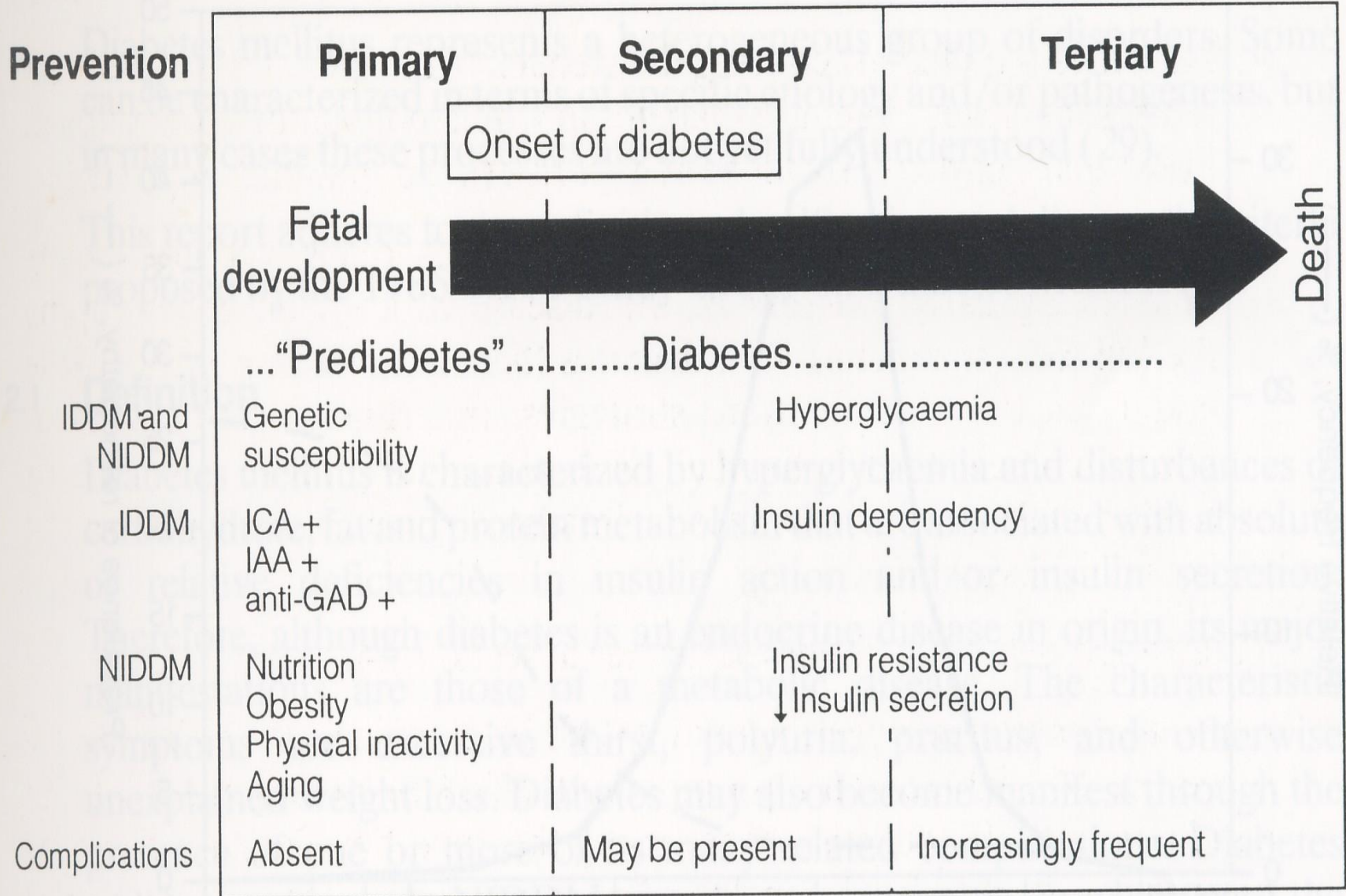
The Natural History of Non-Insulin-Dependent Diabetes Mellitus



The windows of opportunity in the prevention of Diabetes Mellitus & its consequences



The Natural History of Diabetes Mellitus



Types of Diabetes Mellitus Seen in Young People (< 40 years of age)

| | | |
|----|--|--------|
| 1. | Type - I Diabetes Mellitus (IDDM / JIDDM (< 15 Years) | 80% |
| 2. | Mody (With its Various - Genetic Subtypes) | 3 - 5% |
| 3. | FCPD (Peculiar to Para equatorial regions (15 – 30 Yrs) Now classified by WHO as sec Diabetes Mellitus) | 2% |
| 4. | E.O.D/NIDDY → 25 <40 Yrs (Early Onset Type - 2 Diabetes Mellitus) | 10% |
| 5. | LADA (IDDM Onset > 25 Years) | 1- 2% |
| 6. | Genetic Syndromes Assoc with Diabetes Mellitus sec to Pit Tumor etc. | 0.5% |
| 7. | Type - 2 Diabetes Mellitus in Childhood | 0.5% |

Types of Diabetes Mellitus Seen in Young People (< 40 years of age)

- **Diabetes in Young People.**
 - **MODY (5 Genetic Sub Types described).**
 - **EOD (Type – 2).**
 - **Type - 2 Diabetes Mellitus in Children.**
 - **+/- LADA (Type – 1).**
 - **FCPD (Fibro Calculus Pancreatic Diabetes – Now classified by the WHO as a secondary form of Diabetes)**

Types of Diabetes Mellitus Seen in Young People (< 40 years of age)

- **Type - 2 Diabetes Mellitus in very young children is being increasingly reported from Japan, Singapore, & Hong Kong:**
- **In Japan Type - 2 Diabetes Mellitus in 6-12 Years age Groups.**
in 1976 0.2/100,000/Yrs
1999 2.0/100,000/Yrs
- **In 12 – 15 Years age Group:**
- **1976: L 7.3/100,000/Yrs**
1995: 13.5/100,000/Yrs
- **This increase is correlated with affluence and increased reported intake of animal protein & Fat (Fall, CHD, Barker DJP(1997) Indian Pediatr)**

The bottom line of Type-2 Diabetes Mellitus is that we are born with the gene-complex and manifest it somewhere down the life span.

Type-2 Diabetes Mellitus of childhood (< 15 Years)

MODY (< 25 Years)

EOD / NIDDDY (25 - 40 Years)

NIDDM (> 40 Years)

Why not LOD / NIDDE ?

Types of Diabetes Mellitus Seen in Young People (< 40 years of age)

The fact is Type - 2 Diabetes Mellitus is our companion from birth and is called a 'Disorder'. When it manifests Biochemically or clinically and a 'Disease' when it gives raise to complications. Hence any attempt at the research on its prevention is surely best attempted at an early stage.

How early?

Three Reasons to focus our Attention on 'Diabetes in young people'(below 40 yrs)

'The child is the father of the man'

- Samuel Johnson

- I. To identify the real number of those in this age-group diabetes as those running the risk of having it.**

Three Reasons to focus our Attention on 'Diabetes in young people'(below 40 yrs)

2. Early detection:

Education

Try & Modify factors to arrest the progression; Attempt at reversal or regression of IGT stage.

Thus prevent / reduce Type - 2 Diabetes Mellitus Numbers which are reported increasing/ (in the >40 yrs) in our population / world.

Three Reasons to focus our Attention on 'Diabetes in young people'(below 40 yrs)

3. 'Back to the future'

J.C.Cherve
(IDF –Helsinki)

Molecular genetic research into diabetes in young people could prove to be most useful in discovering the preventive strategies for NIDDM-and this has to be done EARLY IN LIFE - How Early?

Early Diabetes in Early life

Rafael A.Camerinin-Davalos , Harold S.Cole

Can the art of predictive medicine anticipate the development of diabetes? If it is so, how early in life is the disease trend manifest? How early is early enough to attempt to delay the progression of, or perhaps even prevent the abnormalities? New approach and techniques are currently being developed which have important implications to the understanding of the sequence of events leading to the disease itself.

Early Diabetes in Early life

- From the manifestations of the disease, we are now looking at the molecular changes responsible for it. It has become apparent that the search should start at the very beginning of life, if possible, at conception. Will that suffice?

Academic Press Inc., New York San Francisco London 1975

Type - 2 Diabetes Mellitus

Challenges:

1. **Should we have mass diabetes detection camps?**
2. **Strategies to contain and convert (revert) IGT's ?**
3. **Should long term Drug interventions be considered as prophylaxis or preventive measures? (Ethics , morality, wisdom?)**
4. **Are life-style modification measures useful, pragmatic, and Sustainable?**
5. **Diet and Nutrition:**
 - What role? How and whom to educate (Educating the literate)?**
 - How to combine ancient wisdom with modern technologies and bridge the Generation next gap?**
6. **How to combine the science and art of exercise?**
 - of yoga, and allied self-control disciplines.**
7. **How to cope with Exotic therapies and Ad blitz?**
 - Acupuncture!**
 - Acupressure!**
 - Magnetotherapy!**
 - Ceramic current therapy!**
 - Herbal concoctions and capsules!**

Diet, Exercise reduce diabetes risk : Study

The US government's National Institutes of Health (NIH) on Wednesday announced the results of a diverse group of 3,234 overweight Americans with impaired glucose tolerance, a condition that often precedes diabetes.

Participants who were directed to eat a low-fat diet and to engage in moderate exercise, such as brisk walking or riding a bike for 30 minutes a day five days a week, reduced by 58 percent their risk of getting type 2 diabetes, which accounts for up to 95 percent of all cases of the incurable diabetes.

Glucophage, approved in 1995 to treat type 2 diabetes, is a pill that lowers blood sugar. The company said it was considering asking the government to approve the drug for preventing diabetes as well as treating it.

Diet, Exercise reduce diabetes risk : Study

The study found Glucophage was effective primarily in the most obese patients and those in the youngest age group studied, ages 25 to 44. A low-fat diet and exercise however produced strong results across the board.

“While the lifestyle intervention was effective across all age groups, all minority groups and both genders, that was not the case with metformin,” Dr Allen Spiegel , director of the NIH’s National Institute of Diabetes and Digestive and Kidney Diseases, which backed the study, said in an interview.

The study was designed to last four years, but Mr. Spiegel said the striking nature of the results led researchers to end a year early to get the word out about diet and exercise.

Type-2 diabetes – Short Term Approaches

- 1. Heightening awareness in a positive way.**
- 2. Life style modifications : Practical models under varied 'patient' situations.**
- 3. Treatment & surveillance for Stage II and III (clinical diabetes & complications respectively) with effective therapeutic interventions.**
- 4. Identification and avoidance of Iatrogenic (drug-induced) Complications.**
- 5. Strategies for containment of serious complications like retinopathy (eyes) , Nephropathy (kidneys), Renal failure, Diabetic Foot etc., so as to avoid expensive treatment modalities like eye surgery, dialysis & Kidney Transplant, amputation of limbs etc.**

Type-2 diabetes – Long Term Approaches

1. Look after young and adolescent persons particularly women, with balanced nutrition and nutrients
2. **Pregnancy Care Programme:** It is now well established that under weight babies at delivery, have higher risk of developing diabetes, hypertension and coronary artery disease later in life. Research is required amongst Indian subjects on the positive impact of nutrients like Folic Acid, Magnesium, Vit B6 and Vit E and metabolism of pregnant women and to get optimal birth weight for the babies.
3. Inclusion of appropriate physical exercise in the school curriculum from primary school onwards, is of utmost importance.
4. Establishment of Community Fitness Centers – should be popularized, affordable (if necessary subsidized and maintained consistently well).

Continued...

Type-2 diabetes – Long Term Approaches

5. Installation of Touch screen Diabetes Information Help-line Centers in schools, colleges, workplaces, hospitals etc. These centers could act as Multipurpose Information & Help-line Kiosks for all important health problems like Diabetes, Heart ailments, Hypertension, TB Bronchitis & Asthma etc. These 'Kiosks' could be planned as Revenue earning sponsored projects.
6. A Centre/State co-ordination Committee may be formed to monitor the implementation and progress of the National Tele Health Plan.
7. Government centered projects to produce drugs and aids for diabetes management on subsidised cost for treatment of Juvenile Insulin Dependant Diabetes Mellitus cost.
8. Maintenance of National Epidemiology register for both Type 1 and Type 2 diabetes using Electronic On Line Medical Record System with updating of data and information analysis every 5 years.

Prevention of Type – 2 diabetes

Prof. Sir. George Alberti (IDF President and immediate Past President of the Royal College Of Physicians, London) states that “We shall not be successful until governments and their agencies take the problem seriously. It is largely Socio-Political rather than medical.