

**Sentinel Health Monitoring Centers in India:  
Biochemical Risk Factor Survey for Non-communicable Diseases**

**(February 2005 to January 2006)**

**COLLATED REPORT OF 6 CENTERS**

**Project Coordinated and Report Prepared at**

Division of Noncommunicable Diseases  
Indian Council of Medical Research, New Delhi

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## **Sentinel Health Monitoring Centers in India: Biochemical Risk Factor Survey for Non-communicable Diseases**

### **Background and Rationale**

There is global concern for the rising premature morbidity and mortality due to noncommunicable diseases (NCDs- cardiovascular diseases, diabetes, obesity, cancers, chronic lung diseases etc). This disturbing trend is also being increasingly seen in developing countries, including India.

Since NCDs are slowly evolving diseases, their early clinical recognition is difficult. These diseases are very closely related to changing lifestyle patterns and hence, early detection of some parameters will help in preventing the progress of disease. These factors have been labeled as 'risk factors', since their presence or absence directly influences disease occurrence. A group of risk factors may influence the occurrence of a single disease. Several studies have shown that the measurements of these risk factors is practical, repeatable, ethical, and that time trend analysis can be done to understand NCD burden. Disease specific registries will be expensive and not feasible at present. The intervention programs can be easily designed targeting these risk factors for modifications.

There are few National health programmes addressing NCDs, and no formal surveillance system for NCDs exists. There is data available from one time survey done by ICMR on coronary heart disease and diabetes. In 2003-2004 a multi-site study was done using the WHO STEP wise approach for NCD risk factor surveillance in 6 centers spread across the country (Ballabgarh, Chennai, Delhi, Dibrugarh, Nagpur and Trivandrum). The study collected information on consumption of alcohol and tobacco, fruits and vegetable intake, physical activity, weight, height, blood pressure and waist circumference. This data was collected from one person per selected household, in males and females aged between 15-64 years of age. Using the STEPS sample frame, at each participating site there were 250 participants in each age (15-24, 25-34, 45-44, 45-54, 55-64 years) and sex category. Thus, the target sample size at Ballabgarh, Chennai, Dibrugarh, Nagpur and Trivandrum was 7500 subjects in all the age, sex and population categories. At the Delhi center, the target was 5000 subjects since the center did not include rural areas in its population to be studied. Overall, at the end of the study at 6 sites 42,500 subjects were recruited. The urban areas were recruited by all 6 sites, whereas rural areas were studied at Ballabgarh, Chennai, Dibrugarh, Nagpur and Trivandrum and urban slum areas were included at Ballabgarh, Chennai, Delhi, Nagpur and Trivandrum. At Dibrugarh site, peri-urban population was recruited instead of slums.

As a follow up of this study, it was agreed that a pilot study would be undertaken on a sub-sample of the individuals studied in the STEP 1 and 2 study for their biochemical risk factors status (STEP 3).

## Methodology

### Aim:

To develop a sustainable system of NCD surveillance in India.

### Objectives:

1. To collect data on selected biochemical risk factors for NCDs.

### A. Setting:

The study was carried out in a representative population at the following 6 centers.

S No.	Center	State/ Region of India
1.	Comprehensive Rural Health Services Project (CRHSP), Ballabgarh	Haryana/ North West
2.	Madras Diabetes Research Foundation (MDRF), Chennai	TamilNadu/ South West
3.	Regional Medical Research Center (RMRC), Dibrugarh	Assam/ North East
4.	Government Medical College (GMC), Nagpur	Maharashtra/ Central
5.	Achutha Menon Centre for Health Sciences Studies (AMCHS), Sree Chitra Institute of Medical Sciences and Technology, Thiruvananthapuram	Kerala/ South East
6.	Institute of Human Behavior and Allied Sciences (IHBAS), Delhi	Delhi/ North India

Since these sites were involved in STEP 1 and 2 data collection (2003-2004), they had access to the population covered. Also, these centers are well equipped with laboratory support and necessary infrastructure to undertake biochemical assessment. Since they are representative of various regions and sectors of health care in the country, they can be used as role models to develop them as regional resources.

### B. Study Population

Biochemical estimation of fasting blood glucose, total cholesterol, HDL cholesterol and triglycerides was undertaken in the same urban, rural and slum population where the earlier study with STEP 1 and 2 was carried out in 2003-2004. The purpose was to estimate these biochemical parameters in the same individuals in whom behavioral and physical risk factor data were already collected. Since the time lag between these two studies was about 6-12 months, and their risk factor data would not have changed significantly during this period, attempts were made to collect blood samples from the

same individuals who have provided with STEP 1 and 2 information. This will facilitate linking their behavioral, physical and biochemical parameters at a later stage.

### C. Sample size

This study was planned for piloting biochemical estimation for the STEPS study and to work out the feasibility of such data collection. Thus, the study was carried out in 20% of the previous sample size studied. In the STEP 1 and 2 study, we had covered 250 individuals (one per household) in each age and sex category in the urban, rural and slum population. Thus, a total of 2500 respondents were interviewed in urban, rural and slum areas each. The proposed sample size will provide valid estimates (narrower 95% Confidence intervals) of biochemical parameters and their linking with the social and physical characteristics collected.

In the present study, 50 blood samples were collected per age and sex category in three population groups as given below:

#### Sample size per center\*

Age category (years)	URBAN		RURAL		SLUM		TOTAL	
	Male	Female	Male	Female	Male	Female	Male	Female
15-24	50	50	50	50	50	50	150	150
25-34	50	50	50	50	50	50	150	150
35-44	50	50	50	50	50	50	150	150
45-54	50	50	50	50	50	50	150	150
55-64	50	50	50	50	50	50	150	150
Total	250	250	250	250	250	250	750	750
<b>Grand Total</b>							<b>1500</b>	

\*- IHBAS center would collect blood samples in 1000 respondents from the urban (n-500) and slum (n-500) population.

### D. Selection of Subjects

In the earlier study where data on STEP 1 and 2 was collected, all respondents were assigned identification numbers (ID) unique to each one of them only. At the coordinating unit at ICMR, the ID numbers were sorted by study area first (urban, rural and slum) and then within these areas by age and sex, and then were arranged in ascending order of their ID numbers. By systematic sampling, about 100 ID numbers were chosen in each age and sex cell. These ID numbers were sent to each center and blood samples were collected in 50 patients only in the specified age and sex categories. In case of refusal to participate in the study or unavailability of the respondent, subjects

from the remaining chosen random numbers were taken till the required sample size was achieved.

## **F. Data Collection**

The study was conducted between February 2005 to January 2006 at the 6 sites using a common protocol.

Data was collected in two components:

1. Collection of personal information: Name, date of birth, age, sex, address, fathers/mothers name, occupation, level of education, any significant illness and or treatment taken for especially for diabetes, high blood pressure and / or deranged lipid profile since the last visit by the investigators, weight and blood pressure.
2. Collection of fasting blood samples for estimating blood glucose, total cholesterol, HDL cholesterol and triglycerides.

As house to house collection of blood samples was logistically inconvenient at most times, research teams gave appointments to the selected respondents for reporting at a common place (targeted camp) which was convenient to the participants. Since fasting samples were to be collected, the selected respondents were advised in writing about the instructions and the time in early morning to assemble. To maximize participation and compliance, the appointments were given on holidays also. Personal data as well as samples were collected in privacy. Height and waist circumference were not be retaken, as they were less likely to have changed significantly since the last examination done about 6-12 months earlier. These camps were organized once or more in a week. The Site investigators decided upon the frequency and places of the camp. Midway through the study, at some places house to house sampling was also done in order to maximize participation. The sequence of events at the camp followed mostly was: arrival at the place by the respondent, obtaining informed consent (explanation of the purpose of the study was done when giving appointments), collection of personal information, measuring blood pressure and weight and collection of blood samples. The blood pressure was recorded after they had rested well for about 10 minutes.

The blood samples were allowed to clot and then were placed in carriers with ice packs for transportation to the laboratories for further processing and testing. The results of the tests were communicated to the subjects by the laboratory to the field in writing. Those individuals whose biochemical tests results were not within normal limits were referred by the research teams for further evaluation to appropriate health facilities as pre-decided by the PI.

The study was done in 6 centers adapting the WHO STEP wise approach (STEP 3, Version 1.3) for NCD Risk Factor Surveillance. The biochemical risk factors studied in the fasting blood samples included the following;

- a. Blood glucose
- b. Serum total cholesterol
- c. Serum HDL cholesterol
- d. Serum triglycerides

## **G. Network Structure**

The PIs of the earlier study (STEPS1 and 2) were approached by the Coordinating unit at ICMR for their willingness to participate in the study. The Agreement for Performance to Work (APW) was signed between the PI and WHO on the terms and conditions laid down. The Division of NCD with its Senior Deputy Director General as the overall principal investigator and coordinator of the study provided technical guidance for the study and for quality assurance measures. Monitoring of the study, approval for release of funds, review of technical reports and preparation of collated final report was done by ICMR. The laboratory coordination and quality assurance was provided to all centers by Dr. Lakshmy Ramakrishnan at Cardiac Biochemistry laboratory Center, All India Institute of Medical Sciences, New Delhi.

## **H. Quality control measures**

The overall quality control was provided by the coordinating unit at ICMR along with its experts.

1. *Laboratory:* At each center, the co-opted Co-investigator from Biochemistry/Laboratory Medicine department supervised the testing of samples and the quality of its results. The central laboratory at AIIMS is part of the United Kingdom External Quality Assessment Scheme (UKNEQAS). It was responsible for providing quality control of the samples being tested at each center. This was achieved by baseline standardization and by sending of quality control samples periodically from AIIMS to each center and analysis of these results at AIIMS. The results of quality control were shared with the specific center and with coordinating unit at ICMR. In case of deviation of results from the standards, appropriate measures were suggested to rectify it. The laboratory protocol and methods is provided in the Annexure.
2. *Field work:* The PI at each center along with another Co-PI supervised the training of staff and collection of data. At about 10% “camp” at least one of the senior investigators were physically present to supervise the collection of data and samples, and verify all information and safety of the samples collected before leaving the camp.
3. *External quality control measures:* Site specific visits were undertaken by a team comprising of members of the coordinating unit at ICMR and experts. The objectives of these visits were to physically verify quality of field data being collected (including testing of blood samples), identify problem areas, solve queries of the centers staff and suggest measures for any further improvements.

## **I. Data Analysis**

The study estimated the point prevalence of the selected NCD biochemical risk factors (fasting blood glucose, total cholesterol, HDL cholesterol and triglycerides) via a cross-sectional design in the selected population. Hence, frequency and proportions of the study variables have been calculated. The data was entered in Epi-Info 6.0 version. Each center has completed its site specific data analysis and its report has been submitted to WHO (Country Office). The final data was obtained from all centers by the coordinating unit at ICMR for collated data analysis. The analysis was done using SPSS package.

**J. Ethical clearance/informed consent:**

The participating centers obtained Ethical Clearance from their respective institutions. Informed consent was taken from the participating respondents in their local language. Those respondents requiring further medical evaluation were referred to appropriate nearby centers.

## Results

The data collection was done between February 2005 to January 2006 at the following six participating centers: Ballabgarh, Chennai, Dibrugarh, Delhi, Nagpur and Trivandrum. The population areas that were covered were as; urban (Ballabgarh, Chennai, Dibrugarh, Delhi, Nagpur and Trivandrum), rural (Ballabgarh, Chennai, Dibrugarh, Nagpur and Trivandrum), slum (Ballabgarh, Chennai, Delhi and Nagpur) and peri-urban (Dibrugarh). For simplicity of collation, the results of peri-urban and slum populations have been combined and are being reported as such. The study adapted the WHO STEPwise 3 approach for collecting data on biochemical risk factors on NCDs. All centers followed a common protocol for data collection in field and for analysis of blood samples. The final completed data from all sites was obtained by the coordinating unit at the Division of NCD at ICMR, New Delhi. The results of the collated data are being presented in this report as the format provided in the WHO STEPS data analysis manual. The results have been analysed according to the presence of risk factor in the age groups of 15-24, 25-34, 35-44, 45-54, 55-64 years, in men and women, residing in the urban, rural and slum populations.

The results of the biochemical tests were obtained in mgs/dl, but have been presented in this report in mmol/L through the following conversions:

1. Blood glucose mmol/L= mg/dl x 0.055
2. Total Cholesterol and HDL cholesterol mmol/l =mg/dl x 0.026
3. Triglycerides mmol/L=mg/dl x 0.0115

The results being presented in this report are for the age group 15-64 years, and according to Center, sex, and study area (urban, rural, slums).

### **A. Participation (Table1.1)**

Overall at all centers there were 8158 individuals (men and women) who were contacted as per the random number list generated from those who had participated in the STEPS 1 and 2 survey conducted in 2003-2004 at the same centers.

During the analysis of the all center data, 283 subjects were dropped for analysis from all the centers due to the following reasons;

1. Age was more than 64 years (n- 222)
2. Consent for participation refused (n-22)
3. Refusal to give blood sample (n-35)
4. Blood sample was collected in the non-fasting state (n-4)

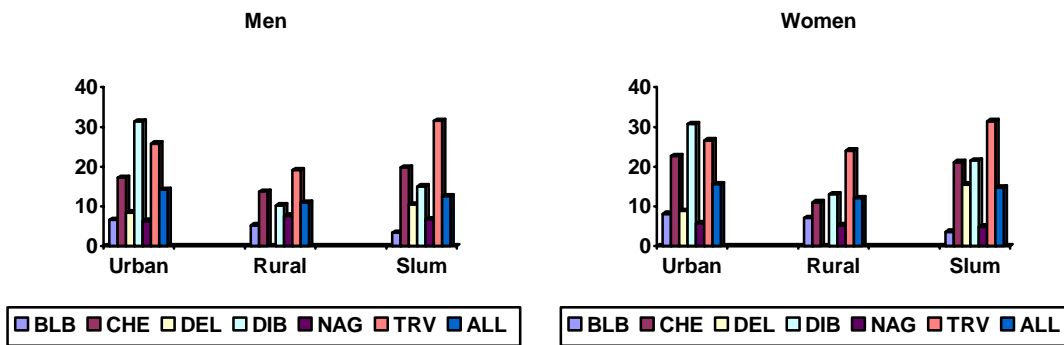
Thus, there were 7874 subjects whose data has been analysed for all the centers. Of these, there were 3820 (48.5%) men and 4054 (51.4%) women. There were 2572 (32.7%) from urban areas, 2560 (32.5%) from rural areas and 2742 (34.6%) from peri-urban/slum populations. At all sites the target coverage of at least 50 subjects in each age and sex group was achieved for all studied populations. There were 50 pregnant women (urban- 14, rural-16 and slum- 20) amongst the total recruited women at all centers.

Data from 35 subjects who had refused to give their blood samples was included for the analysis of history of significant chronic illness in the past 12 months, current medication for hypertension and diabetes mellitus. Thus, this data was available for 7909 subjects.

**B. I. History of Significant Chronic Illness in the past 12 months (Table 1.2, Fig. 1.1)**

Overall, 12.5% men and 14.1% women gave this history. Amongst men, it ranged from 5.1% (at Ballabgarh) to 22.9% (at Trivandrum), while in women it ranged from 5.3% (at Nagpur) to 26.6% (at Trivandrum). The urban population had the highest proportion than the slum, and was least in the rural areas, for both sexes.

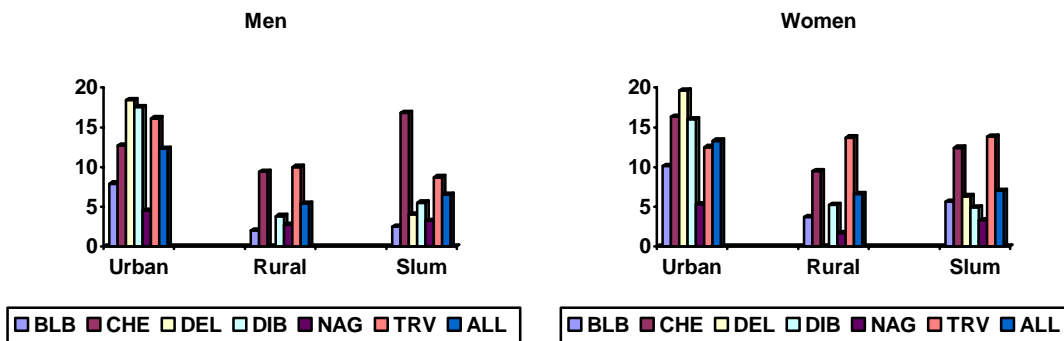
**Fig. 1.1: Proportion (%) of Men and Women with History of Significant Chronic Illness in the past 12 months according to Center and Population**



**B.II. Current Medication for Hypertension (Table 1.3, Fig. 1.2)**

There were 8.4% (672 out of 7910) subjects who were currently on some form of medication for hypertension. Amongst men, 4.1% (at Ballabgarh) to 12.9% (at Trivandrum), while 3.4% (at Nagpur) to 13.5% (at Trivandrum) women reported them to be on medication. The proportions were highest in the urban areas, then the slums and least in the rural areas.

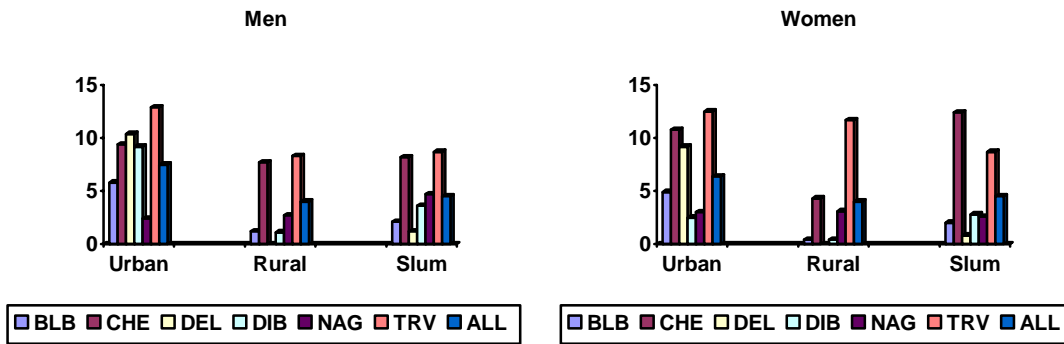
**Fig. 1.2: Proportion (%) of Men and Women on Current Medication for Hypertension according to Center and Population**



**B.II. Current Medication for Diabetes Mellitus (Table 1.4, Fig 1.3)**

Overall, 5% (402 out of 7910) subjects reported to be taking some medication for diabetes. Amongst men, 3.0% (at Ballabgarh) to 8.8% (at Trivandrum), while 1.8% (at Dibrugarh) to 10.9% (at Trivandrum) women reported them to be on medication. The proportions were highest in the urban areas, then the slums and least in the rural areas.

**Fig. 1.3: Proportion (%) of Men and Women on Current Medication for Diabetes Mellitus according to Center and Population**



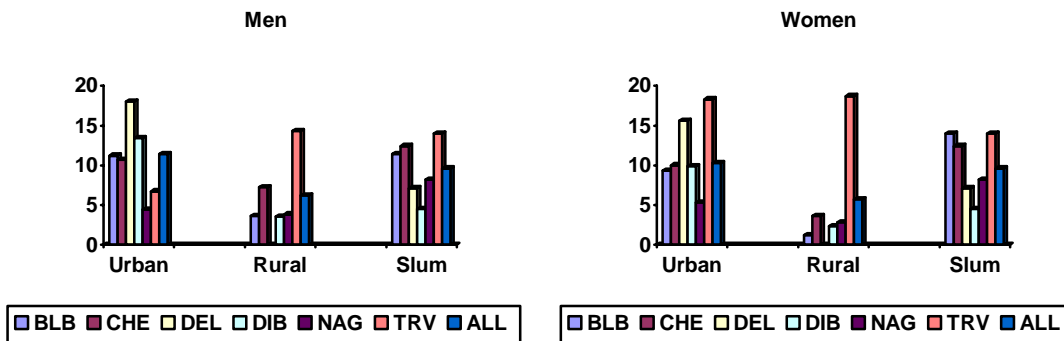
**C. Fasting Blood Glucose (Tables 1.5, 1.6, Fig. 1.4)**

For 3820 (48.1%) samples analysed for all men, the overall mean fasting blood glucose was 5.42mmol/L (range 4.79 to 6.16mmol/L). The mean values in urban areas were 5.65mmol/L, rural 5.15mmol/L and peri-urban/slum 5.47mmol/L. The levels were comparable between the age categories in all three populations.

The overall mean levels for 4054 (51%) women were 5.43mmol/L (range 4.8 to 6.0mmol/L). The mean fasting blood glucose levels in urban areas was 5.53mmol/L, rural 5.23mmol/L and peri-urban/slum 5.53mmol/L. The mean values between each age category of men and women in their respective populations were comparable and showed no significant gap.

The data was analysed to look at risk levels of fasting blood glucose at  $\geq 7$ mmol/L and  $< 7$ mmol/L. Equal proportion of men (8.7%) and women (8.6%) were having levels  $\geq 7$ mmol/L. For all age categories and both sexes, urban areas had a higher proportion of subjects with FBG  $\geq 7$ mmol/L, followed by peri-urban/slums and least in rural areas, indicating to the effect of urbanization.

**Fig 1.4: Proportion (%) of Men and Women with Fasting Blood Glucose levels  $\geq 7$ mmol/L according to Center and Population**



#### D. Lipid Profile

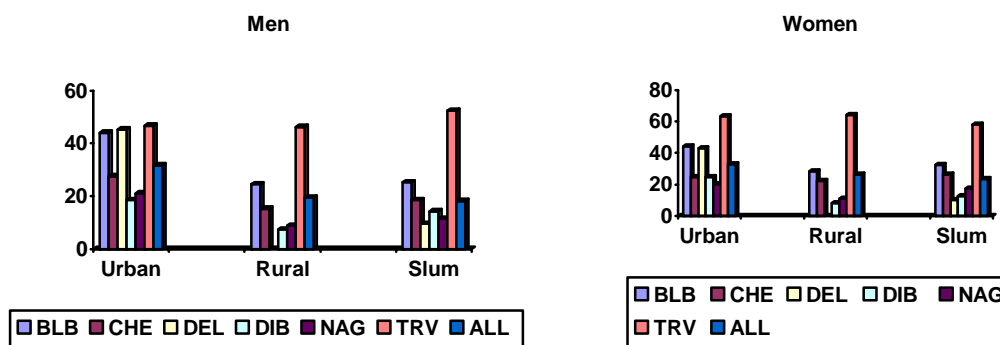
The fasting blood samples were analysed for total cholesterol (Tc), High Density lipoprotein cholesterol (HDL-c) and Triglycerides (TG).

##### Total cholesterol (Tc) (Tables 1.7, 1.8, Fig. 1.5)

It was analysed in 3820 men and 40544 women aged between 15-64 years in the urban, rural and slum populations. An increasing trend with age was observed in the mean Tc values in all populations. The all center mean amongst men was 4.63 mmol/L (urban), 4.20mmol/L (rural) and 4.17mmol/L (slums), whereas it was 4.70mmol/L (urban), 4.65mmol/L (rural) and 4.60mmol/L (slums) in women.

On further analysis it was observed that 23% (879 out of 3820) men and 27% (1109 out of 4054) women had Tc levels  $\geq 5.2$ mmol/L. In all populations the proportion of subjects with Tc levels  $\geq 5.2$ mmol/L increased with increasing age. In slums, women were in higher proportions than men from the lowest age category onwards. The highest proportion of men with Tc levels  $\geq 5.2$ mol/L were present in the urban population at each center, and that Trivandrum showed the highest frequency in all populations.

**Fig. 1.5: Proportion (%) of Men and Women with Fasting Blood Total Cholesterol levels  $\geq 5.2$ mmol/L according to Center and Population**



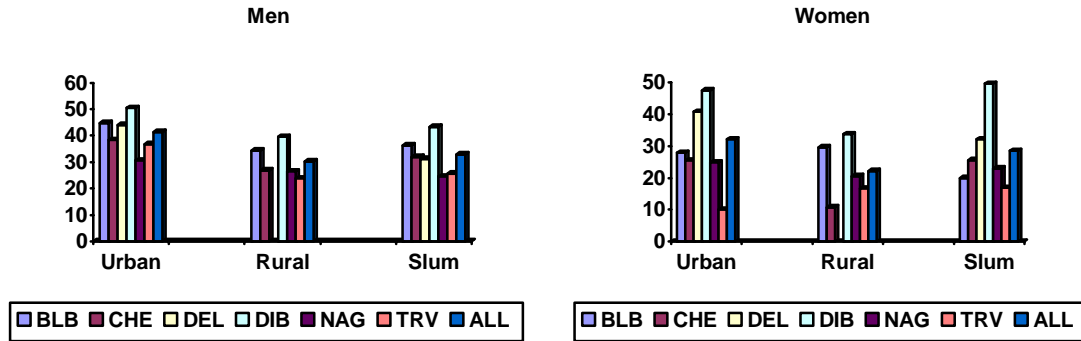
##### Triglycerides (TG) (Tables 1.9, 1.10, Fig. 1.6)

The mean fasting TG levels increased with advancing age in all populations and amongst men and women. The overall mean TG levels in men were 1.62mmol/L and women 1.44mmol/L in all populations. Men had higher levels than women at all centers. The highest levels were seen in Dibrugarh (men 1.76mmol/L, women 1.72mmol/L) and were least in Trivandrum (men 1.38mmol/L, women 1.18mmol/L). Women had higher mean levels of TG than men in the respective age categories and populations. A gradient of increasing mean values was observed from rural to slums to urban population in both sexes.

Taking a cut off level of 1.7mmol/L, there were 34.9% men and 27.7% women in the entire study with levels  $\geq 1.7$ mmol/L. Men were in more proportions than women at all centers, the highest being in Dibrugarh (44.3% men and 43.4% women). The urban

populations had more persons with TG levels  $\geq 1.7\text{mmol/L}$  than the slum and rural respectively.

**Fig. 1.6: Proportion (%) of Men and Women with Fasting Blood Triglyceride levels  $\geq 1.7\text{mmol/L}$  according to Center and Population**

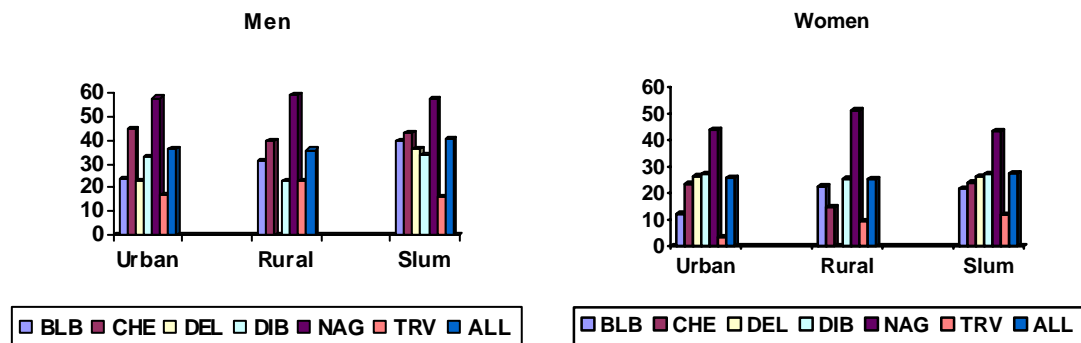


**HDL cholesterol (HDL-c) (Tables 1.1, 1.12, Fig. 1.7)**

The proportion of men with HDL-c  $\leq 0.9\text{mmol/L}$  was 37.5% (1433 out of 3819) and 26% (1061 out of 4047) women in all populations. In urban area, nearly equal proportion of men and women were in this risk category in the age category of 15-24 years, and thereafter men were present in higher frequency. The men and women in Nagpur site showed the highest proportion of subjects with an HDL level of  $\leq 0.09\text{mmol/L}$  in all its populations. Overall, men were in higher proportions than women with a low HDL level in all populations.

The overall mean HDL levels in all ages and populations among men were  $1.03\text{mmol/L}$  and for women it was  $1.11\text{mmol/L}$ . It was lowest in Nagpur amongst men and women. Urban areas showed highest levels at all centers followed by slums and least amongst the rural populations.

**Fig. 1.7: Proportion (%) of Men and Women with Fasting Blood HDL Cholesterol levels  $\leq 0.9\text{mmol/L}$  according to Center and Population**

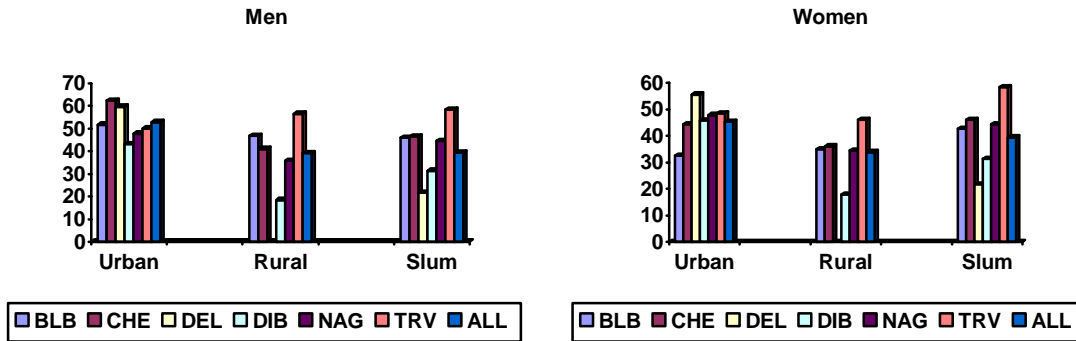


**Total cholesterol: HDL ratio (Tables 1.13, 1.14, Fig. 1.8)**

The overall mean Tc: HDL ratio was 4.48 in men and 4.33 in women at all centers and populations. The range in men was 3.94 to 4.89mmol/L, and 3.98 to 4.65mmol/L in women at Dibrugarh and Trivandrum respectively. The mean values were highest in the urban population followed by slums and were least in the rural areas at all centers.

There were 43.7% men and 39.7% women at all centers and populations with a Tc: HDL ratio  $\geq 4.5$ . Trivandrum showed the highest proportion of men and women with the abnormal ratio (57.2% and 48.8% respectively), while the least was at Dibrugarh (men 30.6% and women 31.4% respectively).

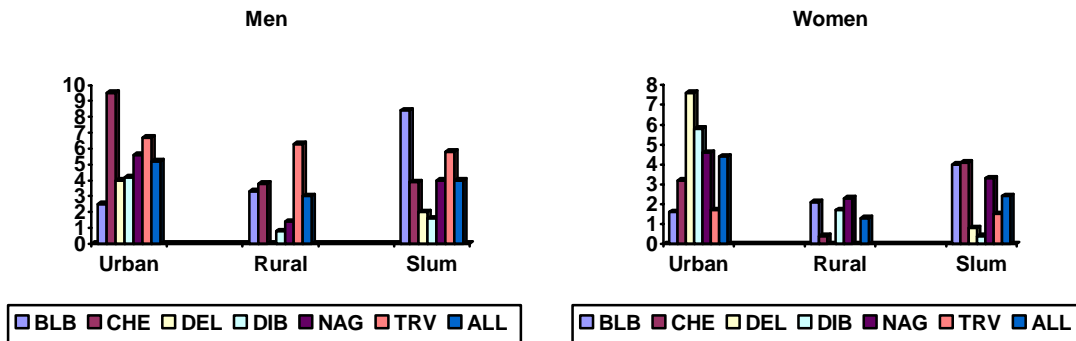
**Fig. 1.8: Proportion (%) of Men and Women with Total: HDL Cholesterol ratio  $\geq 4.5$  according to Center and Population**



**Dyslipidemia (Table 1.15, Fig. 1.9)**

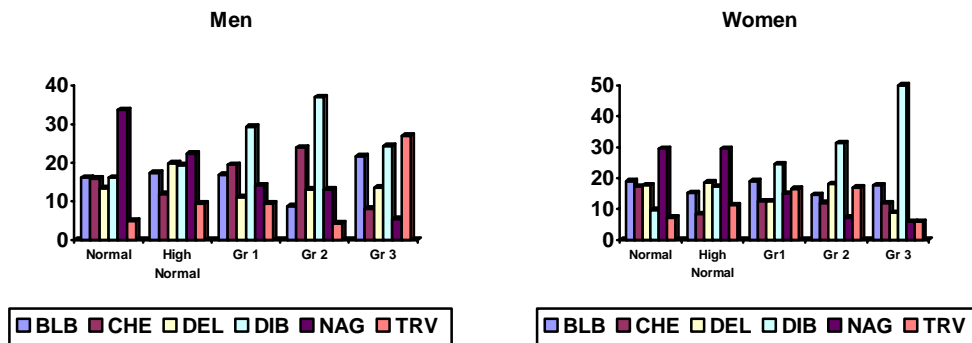
It included individuals with an elevated Tc and TG levels and low HDL levels. Overall there were 4.1% men and 2.7% women with dyslipidemia in all populations. The highest proportions amongst men were seen in Trivandrum (6.2%) and women in Delhi (4.2%). The proportion of men and women with dyslipidemia in various populations were; urban (5.2%, 4.4%), slums (4%, 2.4%) and rural (3%, 1.3%) respectively.

**Fig. 1.9: Proportion (%) of Men and Women with Dyslipidemia according to Center and Population**





**Fig. 1.12: Proportion (%) of Men and Women with Their Blood Pressure (mmHg): Slum Areas**



**Summary of Risk Factor Profile (Tables 1.22, 1.23, 1.24, 1.25)**

- The overall mean fasting blood glucose levels in men were 5.65mmol/ (urban), 5.15mmol/L (rural), and 5.47mmol/L (slum), while in women they were 5.53mmol/L (urban), 5.23mmol/L (rural) and 5.53mmol/L (slum) respectively. The mean levels were higher in the urban areas than the slums and were least in the rural areas, in both sexes. Subjects from Nagpur center had the lowest mean levels of fasting blood glucose in comparison to the remaining centers. The proportion of men with blood glucose levels  $\geq 7$ mmol/L were 11.4% (urban), 6.2% (rural) and 8.5% (slums), while amongst women there were 10.3% (urban), 5.7% (rural) and 9.6% (slums) respectively. The rural areas were almost 50 percent less than the urban areas amongst men and women Trivandrum center shows the high proportions in all areas and both sexes, while lower proportions were observed at Nagpur.
- In men, the mean total cholesterol in urban areas ranged from 4.12mmol/L (Nagpur) to 5.35mmol/L (Trivandrum), rural 3.56mmol/L (Dibrugarh) to 5.05mmol/L (Trivandrum) and slums 3.88mmol/L (Nagpur) to 5.33mmol/L (Trivandrum), while in women from urban areas it ranged from 4.30mmol/L (Nagpur) to 5.29mmol/L (Trivandrum), rural 3.72mmol/L (Dibrugarh) to 5.57mmol/L (Trivandrum) and slums 4.05mmol/L (Delhi) to 5.49mmol/L (Trivandrum). Overall, the urban areas showed higher mean total cholesterol levels than the slums and least was seen in the rural areas.
- The overall mean HDL cholesterol levels were about 1mmol/L in men in urban, rural and slum areas, while it was about 1.1mmol/L in women in these areas. The urban areas showed lower levels as compared to slums and were highest in the rural areas. Trivandrum subjects showed highest HDL mean levels in comparison to other centers. The highest proportion of subjects with HDL levels  $\leq 0.9$ mmol/L was seen at Nagpur, and urban areas showed highest frequency of persons with low HDL levels as compared to slums and rural.
- In men, the mean triglycerides levels ranged from 1.50mmol/L (rural areas) to 1.75mmol/L (urban areas), while in women it ranged from 1.35mmol/L (rural areas) to 1.50mmol/L (urban areas). The urban areas showed highest levels at all

centers. The proportion of men and women with TG levels  $\geq 7.0$ mmol/L were highest in urban areas than slums and were least in rural areas. Overall, in men TG levels  $\geq 7.0$ mmol/L were present in 23-50% subjects while in women it was seen in 10-50%.

- Trivandrum center showed the highest mean levels of total cholesterol, HDL cholesterol and triglycerides in both sexes and all areas. Dyslipidemia was seen in highest proportions in the urban areas than the slums and rural. However, slum populations at Ballabgarh and Chennai had much higher proportions with dyslipidemia than their urban subjects.

### **Laboratory Quality Assurance**

The Coordinating lab for the entire study was at the Center for Cardio-Neurosciences (CN Center), All India Institute of Medical Sciences (AIIMS), New Delhi under Dr. R Lakshmy. Its role was to ensure that the participating labs were standardized to the same level, and that the variation between the labs was minimal. It was agreed that for uniformity, all centers would use Randox ® commercial kits for estimation of blood glucose, cholesterol, and triglycerides. These kits were centrally procured by the coordinating lab at AIIMS and delivered by the company at the respective centers. All centers had assured use of fully automated blood analysers to be used in the study, except Delhi center where the semi-automated analyzer was available. In between the study, the automated analyzer at Nagpur center was discontinued due to malfunctioning, and manual methods of analysis undertaken. The quantity of kits calculated per center was sufficient to take care of about 2000 blood samples. The coordinating lab received requests for additional kits in between the study, and was delivered at the respective institutions. In February 2005, the biochemical investigator and lab technician from each center were invited to participate in one day hands on training workshop held at AIIMS. The coordinating lab was monitored and coordinated by the study Coordinating unit at ICMR.

The results of the biochemical tests were obtained in mgs/dl, but have been presented in this report in mmol/L through the following conversions:

4. Blood glucose mmol/L= mg/dl x 0.055
5. Total Cholesterol and HDL cholesterol mmol/l =mg/dl x 0.026
6. Triglycerides mmol/L=mg/dl x 0.0115

A system for continuous monitoring of the participating labs (Ballabgarh, Chennai, Delhi, Dibrugarh Nagpur, and Trivandrum) for quality assurance was adopted. It included three levels of quality checks;

1. Internal quality control (commercially available and sent by coordinating lab)
2. External quality control (prepared and sent by coordinating lab) and
3. Analysis of 10% of samples.

The Internal quality control material (Lipid level 1, 2 and 3 and Human Assayed serum for glucose) was sent to all the centers along with the reagent kits. Plotting of daily quality control on a graph to identify systematic or random error of analysis was explained to all the labs during workshop. The Levy-Jennings plots of the participating labs were periodically reviewed by the coordinating lab.

For external quality assurance, two quality control samples were couriered monthly by coordinating lab. External quality control material was distributed 18 times during the duration of the study. Table 1.26 gives details of when the external quality control materials were sent and the dates on which the results were to be communicated to coordinating lab. Table 1.27 gives the target values of different distributions for cholesterol, triglycerides, HDL and glucose. The coordinating lab had sent samples with values in the normal and high ranges so that any random or systematic error of estimation could be picked up. The total cholesterol values in the various distributions ranged from 152-271 mg%, triglycerides from 81-360 mg%, HDL from 38-77 mg% and glucose from 0-270 mg%. For assessing the performance of labs through the external quality control programme, mean of the individual lab values was calculated and a consensus value was arrived at by removing outliers that would distort the distribution and affect the mean. For this, results outside 2 Standard Deviation (SD) values were rejected and the mean values recalculated. However, since the SD was so high and the number of participating labs is less than 10, meaningful calculation could not be done. So the results of participating labs were reported individually and compared against the coordinating lab's values as well as the mean of all labs. Table 1.28 gives the cholesterol values of the different centers for the different distributions. Table 1.29, 1.30 and 1.31 gives triglycerides, HDL and glucose values respectively of different distributions. Ballabgarh center finished the study by June and therefore participated only up to 8 distributions.

As the third quality assurance measure, 10% of the samples were collected in duplicates by the centers and one set of samples were sent to coordinating lab for analysis. Table 1.32 gives details of samples received for 10% analysis from the centers. 813 samples have been received from the centers for 10% analysis. The break up of samples received from individual centers is given in the Table. 1.32. 55 samples could be analyzed for cholesterol, triglycerides, HDL and Glucose. 58 samples (7.1 %) could not be analyzed as the quantity of samples sent was insufficient. For few samples only serum samples or plasma samples were sent. According to the protocol lipids are to be analyzed in serum and glucose in plasma. In many instance sample vials were not closed tightly leading to leakage. At least 200 µl samples are required to do the analysis.

## **Experience gained**

1. The study was undertaken as a pilot study for undertaking biochemical estimation of NCD risk factors in the community. The experience and lessons learned would be useful in guiding larger community studies. This would be first large scale community based study on biochemical risk factors for NCDs in our country using WHO STEPS approach.
2. The workshop held on 9<sup>th</sup> February 2005 at All India Institute of Medical Sciences (AIIMS), New Delhi was attended by the biochemist co-investigator and laboratory technician identified for the study at each center. This exercise was very useful in developing the operational aspects of undertaking the biochemical study. It brought all the investigators and experts at a common platform and provided an opportunity for close interaction and finalization of laboratory protocols. The final protocol for the study was agreed by all Principal investigators. All centers were supplied Randox kits for analysis of blood samples.
3. A structured weekly monitoring system through email was built in to monitor the coverage of population and track movement of samples from centers to the central coordinating laboratory at AIIMS, New Delhi. The participating sites communicated any specific problem or query through this. The site visits by a team of experts and coordinating unit were useful in identifying problems at the specific sites and providing on the spot solutions.
4. Tracking the individual subjects who were randomly selected from the STEP 1 and 2 survey done in 2003-2004 was difficult in many instances. It was mainly due to migration due to marriage or employment, death or change of residence. The field teams had difficulty in obtaining consent for participation, especially in the urban areas. Logistic difficulties due to subject requirement to be reporting in fasting state at a common place, overcrowding by onlookers, organizing a common place for data collection, ensuring privacy in household blood collection, transportation of samples to the institute for analysis, communicating the results back to the respondents were experienced almost at all centers. There was spoilage of samples during their transportation by courier between the centers and AIIMS lab.
5. The study highlighted the need for better coordination between the field investigators and the laboratory team in handling samples from the time of their collection to reporting. At times institutional support to facilitate the conduct of the study was found to be lacking.
6. Difficulties in following quality control were largely due to improper quantity of blood sample collected and aliquoted for various tests, shifting from fully automated blood analyzers to semi-automatic and manual methods, using some other kits in for sometime when the recommended kits finished and additional orders were not placed in time, unintentional deviations from the prescribed lab protocol and methods, delay in monitoring lab results against standards.

## TABLES OF COLLATED RESULTS ACCORDING TO POPULATION AREA AND CENTER

**Table 1.1: Participation of Men and Women**

Areas Centers	Total participants recruited	Urban						Rural						Slum						All areas					
		Men			Women			Men			Women			Men			Women			Men			Women		
		N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%
BLB	1467	246	241	97.97	255	247	96.86	257	248	96.50	250	244	97.60	249	237	95.18	255	250	98.04	752	726	96.54	760	741	97.50
CHE	1457	255	244	95.69	257	251	97.67	251	235	93.63	258	253	98.06	252	232	92.06	252	242	96.03	758	711	93.80	767	746	97.26
DEL	1002	250	250	100	250	250	100	NA	NA	NA	NA	NA	NA	250	250	100	252	252	100	500	499	99.8	502	502	100
DIB	1502	251	238	94.82	255	243	95.29	274	258	94.16	274	264	96.35	256	252	98.44	248	247	99.60	781	748	95.77	777	754	97.04
NAG	1653	262	262	100	278	265	95.32	291	291	100	287	287	100	253	253	100	305	305	100	806	795	98.64	870	857	98.51
TRV	793	39	30	76.92	72	61	84.72	246	223	90.65	270	257	95.19	102	86	84.3	155	136	87.74	387	339	87.18	497	454	91.35
All Centers	7876	1303	1255	96.24	1367	1317	96.34	1319	1255	95.38	1339	1305	97.46	1362	1310	96.18	1467	1432	97.61	3984	3820	95.88	4173	4054	97.15

N- No. of individuals contacted; n - No. of individuals recruited for the study

**Table 1.2: History of Significant Chronic Illness in the past 12 months**

Areas	Urban						Rural						Slum						All Areas					
Centers	Men			Women			Men			Women			Men			Women			Men			Women		
	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%
BLB	241	16	6.6	247	20	8.1	248	13	5.2	244	17	7.0	237	8	3.4	250	9	3.6	726	37	5.1	741	46	6.2
CHE	244	42	17.2	251	57	22.7	235	32	13.6	253	28	11.1	232	46	19.8	242	51	21.1	711	120	16.9	746	136	18.2
DEL	250	21	8.4	250	22	8.8	NA	NA	NA	NA	NA	NA	250	26	10.4	251	39	15.5	501	47	9.4	501	61	12.2
DIB	240	75	31.3	244	75	30.7	265	27	10.2	269	35	13.0	253	38	15.0	247	53	21.5	758	140	18.5	760	163	21.4
NAG	253	16	6.3	265	15	5.7	291	22	7.6	287	15	5.2	253	17	6.7	305	15	4.9	797	55	6.9	857	45	5.3
TRV	31	8	25.8	64	17	26.6	230	44	19.1	258	62	24.0	92	29	31.5	137	43	31.4	353	81	22.9	459	122	26.6
All Centers	1259	178	14.1	1321	206	15.6	1269	138	10.9	1311	157	12.0	1317	164	12.5	1432	210	14.7	3846	480	12.5	4064	573	14.1

**Table 1.3: History of Current Medication for Hypertension**

Areas Centers	Urban						Rural						Slum						All Areas					
	Men			Women			Men			Women			Men			Women			Men			Women		
	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%
BLB	241	19	7.9	247	25	10.1	248	5	2.0	244	9	3.7	237	6	2.5	250	14	5.6	726	30	4.1	741	48	6.5
CHE	244	31	12.7	251	41	16.3	235	22	9.4	253	24	9.5	232	39	16.8	242	30	12.4	711	92	12.9	746	95	12.7
DEL	250	46	18.4	250	49	19.6	NA	NA	NA	NA	NA	NA	250	10	4.0	252	16	6.3	501	56	11.2	502	65	12.9
DIB	240	42	17.5	243	39	16.0	265	10	3.8	269	14	5.2	253	14	5.5	247	12	4.9	758	66	8.7	759	65	8.6
NAG	253	12	4.7	265	14	5.3	291	8	2.7	287	5	1.7	253	8	3.2	305	10	3.3	797	28	3.5	857	29	3.4
TRV	31	5	16.1	64	8	12.5	230	23	10.0	256	35	13.7	92	8	8.7	138	19	13.8	353	36	10.2	458	62	13.5
All Centers	1259	155	12.3	1320	176	13.3	1269	68	5.4	1309	87	6.6	1317	85	6.5	1434	101	7.0	3846	308	8.0	4063	364	9.0

**Table 1.4: History of Current Medication for Diabetes Mellitus**

Areas Centers	Urban						Rural						Slum						All Areas					
	Men			Women			Men			Women			Men			Women			Men			Women		
	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%
BLB	241	14	5.8	247	12	4.9	247	3	1.2	244	1	.4	237	5	2.1	250	5	2.0	725	22	3.0	741	18	2.4
CHE	243	23	9.4	251	27	10.8	235	18	7.7	253	11	4.3	232	19	8.2	242	30	12.4	710	60	8.4	746	68	9.1
DEL	250	26	10.4	250	23	9.2	NA	NA	NA	NA	NA	NA	250	3	1.2	252	2	.8	500	29	5.8	502	25	5.0
DIB	238	22	9.2	242	6	2.5	258	3	1.1	264	1	.4	252	9	3.6	246	7	2.8	748	34	4.5	752	14	1.8
NAG	252	6	2.4	265	8	3.0	291	8	2.7	287	9	3.1	253	12	4.7	305	8	2.6	796	26	3.3	857	25	2.9
TRV	30	4	12.9	60	8	12.5	223	19	8.3	257	30	11.7	86	8	8.7	136	12	8.7	339	31	8.8	453	50	10.9
All Centers	1254	95	7.5	1315	84	6.4	1254	51	4.0	1304	52	4.0	1310	56	4.3	1431	64	4.5	3818	202	5.3	4051	200	4.9

**Table 1.5: Mean Fasting Blood Glucose Levels (mmol/L)**

Areas Centers	Urban						Rural						Slum						All Areas					
	Men			Women			Men			Women			Men			Women			Men			Women		
	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E
BLB	241	6.15	.16	247	5.86	.12	247	5.34	.09	244	5.15	.07	237	5.96	.11	250	5.91	.10	725	5.81	.07	741	5.64	.06
CHE	243	5.50	.14	251	5.61	.16	235	5.18	.14	253	5.04	.09	232	5.25	.11	242	5.78	.17	710	5.31	.07	746	5.47	.08
DEL	250	6.10	.17	250	5.82	.13	NA	NA	NA	NA	NA	NA	250	5.49	.13	252	5.44	.13	500	5.79	.10	502	5.63	.09
DIB	238	5.75	.15	242	5.42	.12	258	5.00	.08	264	4.98	.07	252	5.37	.09	246	5.23	.09	748	5.36	.06	752	5.20	.05
NAG	252	4.81	.14	265	4.84	.15	291	4.78	.07	287	4.74	.06	253	5.00	.13	305	4.96	.13	796	4.86	.07	857	4.85	.07
TRV	30	5.47	.45	60	6.05	.40	223	5.58	.16	257	6.30	.18	86	6.28	.37	136	6.36	.27	339	5.75	.15	453	6.29	.14
All Centers	1254	5.65	.07	1315	5.53	.06	1254	5.15	.05	1304	5.23	.05	1310	5.47	.05	1431	5.53	.06	3818	5.42	.03	4051	5.43	.03

**Table 1.6: Proportion with Fasting Blood Glucose Levels  $\geq$  7mmol/L**

Areas Centers	Urban						Rural						Slum						All Areas					
	Men			Women			Men			Women			Men			Women			Men			Women		
	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%
BLB	241	27	11.2	247	23	9.3	247	9	3.6	244	3	1.2	237	27	11.4	250	35	14.0	725	63	8.7	741	61	8.2
CHE	243	26	10.7	251	25	10.0	235	17	7.2	253	9	3.6	232	19	8.2	242	30	12.4	710	62	8.7	746	64	8.6
DEL	250	45	18.0	250	39	15.6	NA	NA	NA	NA	NA	NA	250	17	6.8	252	18	7.1	500	62	12.4	502	57	1.4
DIB	238	32	13.4	242	24	9.9	258	9	3.5	264	6	2.3	252	18	7.1	246	11	4.5	748	59	7.9	752	41	5.5
NAG	252	11	4.4	265	14	5.3	291	11	3.8	287	8	2.8	253	16	6.3	305	25	8.2	796	38	4.8	857	47	5.5
TRV	30	2	6.7	60	11	18.3	223	32	14.3	257	48	18.7	86	14	16.3	136	19	14.0	339	48	14.2	453	78	17.2
All Centers	1254	143	11.4	1315	136	10.3	1254	78	6.2	1304	74	5.7	1310	111	8.5	1431	138	9.6	3818	332	8.7	4051	348	8.6

**Table 1.7: Mean Fasting Total Cholesterol Levels (mmol/L)**

Areas Centers	Urban						Rural						Slum						All Areas					
	Men			Women			Men			Women			Men			Women			Men			Women		
	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E
BLB	241	5.01	.08	247	5.10	.07	248	4.63	.07	243	4.62	.08	237	4.40	.07	250	4.74	.08	726	4.68	.04	740	4.82	.04
CHE	243	4.64	.07	251	4.61	.06	235	4.24	.06	253	4.57	.06	232	4.35	.07	242	4.69	.07	710	4.41	.04	746	4.62	.04
DEL	250	4.98	.07	250	5.00	.07	NA	NA	NA	NA	NA	NA	250	3.91	.07	252	4.05	.07	500	4.44	.05	502	4.53	.05
DIB	238	4.34	.07	242	4.58	.07	258	3.56	.06	264	3.72	.07	252	3.97	.07	246	4.09	.07	748	3.95	.04	752	4.12	.04
NAG	252	4.12	.08	263	4.30	.08	291	3.71	.06	287	3.86	.06	252	3.88	.07	304	4.21	.06	795	3.89	.04	854	4.12	.04
TRV	30	5.35	.22	60	5.29	.11	223	5.05	.07	257	5.57	.06	86	5.33	.13	136	5.49	.10	339	5.15	.06	453	5.51	.05
All Centers	1254	4.63	.03	1313	4.74	.03	1255	4.20	.03	1303	4.45	.04	1309	4.17	.03	1430	4.46	.03	3818	4.33	.02	4047	4.54	.02

**Table 1.8: Proportion with Total Cholesterol Levels  $\geq$  5.2mmol/L**

Areas Centers	Urban						Rural						Slum						All Areas					
	Men			Women			Men			Women			Men			Women			Men			Women		
	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%
BLB	241	106	44.0	247	109	44.1	248	61	24.6	243	69	28.4	237	60	25.3	250	81	32.4	726	227	31.3	740	259	35.0
CHE	243	67	27.6	251	62	24.7	235	36	15.3	253	57	22.5	232	43	18.5	242	64	26.4	710	146	20.6	746	183	24.5
DEL	250	113	45.2	250	108	43.2	NA	NA	NA	NA	NA	NA	250	24	9.6	252	26	10.3	500	137	27.3	502	134	26.7
DIB	238	44	18.5	242	60	24.8	258	19	7.4	264	21	8.0	252	36	14.3	246	31	12.6	748	99	13.2	752	112	14.9
NAG	252	53	21.0	263	54	20.5	291	26	8.9	287	32	11.1	252	29	11.5	304	53	17.4	795	108	13.6	854	139	16.3
TRV	30	14	46.7	60	38	63.3	223	103	46.2	257	165	64.2	86	45	52.3	136	79	58.1	339	162	47.8	453	282	62.3
All Centers	1254	397	31.7	1313	431	32.8	1255	245	19.5	1303	344	26.4	1309	237	18.1	1430	334	23.4	3818	879	23.0	4047	1109	27.4

**Table 1.9: Mean Fasting Triglyceride Levels (mmol/L)**

Areas Centers	Urban						Rural						Slum						All Areas					
	Men			Women			Men			Women			Men			Women			Men			Women		
	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E
BLB	241	1.84	.06	247	1.48	.04	248	1.66	.06	243	1.50	.05	237	1.63	.06	250	1.40	.05	726	1.71	.04	740	1.46	.03
CHE	243	1.85	.11	251	1.42	.05	235	1.45	.07	253	1.13	.04	232	1.69	.10	242	1.42	.06	710	1.67	.06	746	1.32	.03
DEL	250	1.75	.05	250	1.59	.05	NA	NA	NA	NA	NA	NA	250	1.58	.06	252	1.53	.05	500	1.67	.04	502	1.56	.03
DIB	238	1.90	.06	242	1.81	.05	258	1.64	.04	264	1.58	.04	252	1.75	.05	246	1.78	.05	748	1.76	.03	752	1.72	.03
NAG	252	1.45	.05	265	1.36	.05	291	1.42	.04	287	1.33	.04	252	1.45	.06	304	1.42	.05	795	1.44	.03	856	1.37	.03
TRV	30	1.56	.15	60	1.05	.08	223	1.32	.05	257	1.20	.04	86	1.45	.09	136	1.18	.05	339	1.38	.04	453	1.18	.03
All Centers	1254	1.75	.03	1315	1.50	.02	1255	1.50	.02	1304	1.35	.02	1309	1.61	.03	1430	1.48	.02	3818	1.62	.02	4049	1.44	.01

**Table 1.10: Proportion with Triglyceride Levels  $\geq 1.7$ mmol/L**

Areas Centers	Urban						Rural						Slum						All Areas					
	Men			Women			Men			Women			Men			Women			Men			Women		
	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%
BLB	241	108	44.8	247	69	27.9	248	85	34.3	243	72	29.6	237	86	36.3	250	50	20.0	726	279	38.4	740	191	25.8
CHE	243	93	38.3	251	64	25.5	235	63	26.8	253	27	10.7	232	74	31.9	242	62	25.6	710	230	32.4	746	153	20.5
DEL	250	110	44.0	250	102	40.8	NA	NA	NA	NA	NA	NA	250	78	31.2	252	81	32.1	500	188	37.7	502	183	36.5
DIB	238	120	50.4	242	115	47.5	258	102	39.5	264	89	33.7	252	109	43.3	246	122	49.6	748	331	44.3	752	326	43.4
NAG	252	77	30.6	265	66	24.9	291	77	26.5	287	59	20.6	252	62	24.6	304	70	23.0	795	216	27.2	856	195	22.8
TRV	30	11	36.7	60	6	10.0	223	53	23.8	257	43	16.7	86	22	25.6	136	23	16.9	339	86	25.4	453	72	15.9
All Centers	1254	519	41.4	1315	422	32.1	1255	380	30.3	1304	290	22.2	1309	431	32.9	1430	408	28.5	3818	1330	34.8	4049	1120	27.7

**Table 1.11: Mean Fasting HDL Cholesterol Levels (mmol/L)**

Areas Centers	Urban						Rural						Slum						All Areas					
	Men			Women			Men			Women			Men			Women			Men			Women		
	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E
BLB	241	1.11	.02	247	1.31	.02	246	1.08	.02	240	1.16	.02	237	.99	.02	250	1.15	.02	724	1.06	.01	737	1.20	.01
CHE	243	.96	.01	251	1.07	.01	235	1.01	.02	253	1.11	.01	232	.99	.02	242	1.08	.02	710	.99	.01	746	1.09	.01
DEL	250	1.05	.01	250	1.07	.01	NA	NA	NA	NA	NA	NA	250	1.06	.02	252	1.11	.02	500	1.06	.01	502	1.09	.01
DIB	238	1.05	.02	242	1.07	.02	258	1.19	.03	264	1.19	.02	252	1.15	.03	246	1.21	.03	748	1.13	.02	752	1.16	.01
NAG	252	.91	.02	265	.97	.02	291	.88	.01	287	.93	.01	252	.90	.02	304	.95	.01	795	.90	.01	856	.95	.01
TRV	30	1.13	.04	60	1.22	.03	223	1.08	.02	257	1.26	.02	86	1.12	.03	136	1.18	.02	339	1.09	.01	453	1.23	.01
All Centers	1254	1.02	.01	1315	1.10	.01	1253	1.04	.01	1301	1.13	.01	1309	1.03	.01	1430	1.10	.01	3816	1.03	.00	4046	1.11	.00

**Table 1.12: Proportion with HDL Cholesterol Levels  $\leq 0.9$ mmol/L**

Areas Centers	Urban						Rural						Slum						All Areas					
	Men			Women			Men			Women			Men			Women			Men			Women		
	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%
BLB	241	57	23.7	247	30	12.1	246	76	30.9	240	54	22.5	237	95	40.1	250	54	21.6	724	228	31.5	737	138	18.7
CHE	243	109	44.9	251	59	23.5	235	93	39.6	253	37	14.6	232	100	43.1	242	58	24.0	710	302	42.5	746	154	20.6
DEL	250	58	23.2	250	66	26.4	NA	NA	NA	NA	NA	NA	250	91	36.4	252	66	26.2	500	149	29.7	502	132	26.3
DIB	238	78	32.8	242	66	27.3	258	59	22.9	264	67	25.4	252	86	34.1	246	67	27.2	748	223	29.8	752	200	26.6
NAG	252	146	57.9	265	116	43.8	291	171	58.8	287	147	51.2	252	144	57.1	304	132	43.4	795	461	58.0	856	395	46.1
TRV	30	5	16.7	60	2	3.3	223	51	22.9	257	24	9.3	86	14	16.3	136	16	11.8	339	70	20.6	453	42	9.3
All Centers	1254	453	36.1	1315	339	25.8	1253	450	35.9	1301	329	25.3	1309	530	40.5	1430	393	27.5	3816	1433	37.5	4046	1061	26.2

**Table 1.13: Mean Total Cholesterol: HDL ratio**

Areas Centers	Urban						Rural						Slum						All Areas					
	Men			Women			Men			Women			Men			Women			Men			Women		
	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E
BLB	241	4.73	.09	247	4.14	.08	246	4.59	.10	240	4.20	.09	237	4.66	.10	250	4.40	.10	724	4.66	.06	737	4.25	.05
CHE	243	5.12	.13	251	4.43	.08	235	4.39	.08	253	4.20	.06	232	4.61	.09	242	4.52	.08	710	4.71	.06	746	4.38	.04
DEL	250	4.85	.08	250	4.84	.08	NA	NA	NA	NA	NA	NA	250	3.86	.09	252	3.82	.08	500	4.35	.06	502	4.33	.06
DIB	238	4.46	.11	242	4.54	.10	258	3.32	.09	264	3.36	.08	252	4.08	.13	246	4.08	.15	748	3.94	.07	752	3.98	.07
NAG	252	4.77	.11	263	4.64	.10	291	4.34	.07	287	4.31	.08	252	4.55	.10	304	4.60	.08	795	4.54	.05	854	4.51	.05
TRV	30	4.94	.27	60	4.44	.13	223	4.87	.09	257	4.61	.08	86	4.93	.16	136	4.83	.11	339	4.89	.08	453	4.65	.06
All Centers	1254	4.79	.05	1313	4.52	.04	1253	4.28	.04	1301	4.13	.04	1309	4.38	.04	1430	4.35	.04	3816	4.48	.03	4044	4.33	.02

**Table 1.14: Proportion with Cholesterol: HDL ratio  $\geq$  4.5**

Areas Centers	Urban						Rural						Slum						All Areas					
	Men			Women			Men			Women			Men			Women			Men			Women		
	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%
BLB	241	124	51.5	247	80	32.4	246	117	47.6	240	83	34.6	237	110	46.4	250	105	42.0	724	351	48.5	737	268	36.4
CHE	243	151	62.1	251	109	43.4	235	95	40.4	253	90	35.6	232	107	46.1	242	111	45.9	710	353	49.7	746	310	41.6
DEL	250	149	59.6	250	139	55.6	NA	NA	NA	NA	NA	NA	250	54	21.6	252	68	27.0	501	203	40.5	502	207	41.2
DIB	238	102	42.9	242	113	46.7	258	47	18.2	264	47	17.8	252	80	31.7	246	76	30.9	748	229	30.6	752	236	31.4
NAG	252	120	47.6	263	126	47.9	291	104	35.7	287	99	34.5	252	112	44.4	304	137	45.1	795	336	42.3	854	362	42.4
TRV	30	17	56.7	60	27	45.0	223	127	57.0	257	115	44.7	86	50	58.1	136	79	58.1	339	194	57.2	453	221	48.8
All Centers	1254	663	52.9	1313	594	45.2	1253	490	39.1	1301	434	33.4	1309	513	39.2	1430	576	40.3	3817	1666	43.6	4044	1604	39.7

**Table 1.15: Proportion with Dyslipidemia\***

Area Center	Urban						Rural						Slum						All Areas					
	Men			Women			Men			Women			Men			Women			Men			Women		
	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%	N	n	%
BLB	241	6	2.5	247	4	1.6	248	8	3.3	244	5	2.1	237	20	8.4	250	10	4.0	726	34	4.7	741	19	2.6
CHE	244	23	9.5	251	8	3.2	235	9	3.8	253	1	.4	232	9	3.9	242	10	4.1	711	41	5.8	746	19	2.5
DEL	250	10	4.0	250	19	7.6	NA	NA	NA	NA	NA	NA	250	5	2.0	252	2	.8	500	15	3.0	502	21	4.2
DIB	238	10	4.2	243	14	5.8	258	2	.8	264			253	4	1.6	247	1	.4	749	16	2.1	754	15	2.0
NAG	252	14	5.6	265	12	4.6	291	4	1.4	287	5	1.7	253	10	4.0	305	10	3.3	796	28	3.5	857	27	3.2
TRV	30	2	6.7	61	1	1.7	223	14	6.3	257	6	2.3	87	5	5.8	136	2	1.5	340	21	6.2	454	9	2.0
All Centers	1255	65	5.2	1317	58	4.4	1255	37	3.0	1305	17	1.3	1312	53	4.0	1432	35	2.4	3822	155	4.1	4054	110	2.7

- Raised Total cholesterol, Triglycerides and Low HDL cholesterol (mmol/L)

**Table 1.16: Mean Resting Systolic Blood pressure (mmHg) (including those on medication)**

Areas Centers	Urban						Rural						Slum						All Areas					
	Men			Women			Men			Women			Men			Women			Men			Women		
	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E
BLB	241	126.88	1.16	247	122.82	1.20	248	124.06	1.07	244	119.68	1.08	237	124.48	1.29	250	124.60	1.27	726	125.13	.68	741	122.39	.69
CHE	242	124.69	1.16	250	121.62	1.32	235	123.14	1.27	253	118.04	1.28	232	123.88	1.15	242	119.76	1.23	709	123.91	.69	745	119.80	.74
DEL	247	130.18	.97	249	127.84	1.19	NA	NA	NA	NA	NA	NA	248	116.57	1.26	252	120.38	1.19	495	123.38	.85	501	124.09	.86
DIB	239	142.20	1.34	244	137.86	1.53	263	133.18	1.53	266	133.97	1.55	253	131.71	1.31	245	133.73	1.64	755	135.54	.83	755	135.15	.91
NAG	252	123.62	.79	265	121.15	.84	291	120.37	.58	287	115.74	.65	253	124.90	.84	305	121.67	.85	796	122.84	.43	857	119.52	.46
TRV	30	136.13	4.37	60	126.93	2.85	225	133.66	1.30	257	128.82	1.27	86	136.76	2.66	134	130.53	1.90	341	134.66	1.15	451	129.08	.99
All Centers	1251	129.60	.52	1315	126.18	.56	1262	126.66	.54	1307	123.20	.57	1309	125.16	.54	1428	124.53	.55	3822	127.11	.31	4050	124.64	.32

**Table 1.17: Mean Resting Diastolic Blood pressure (mmHg) (including those on medication)**

Areas Centers	Urban						Rural						Slum						All Areas					
	Men			Women			Men			Women			Men			Women			Men			Women		
	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E	N	Mean	S.E
BLB	241	77.59	.75	247	76.68	.70	248	77.04	.75	244	73.81	.68	237	77.36	.81	250	77.83	.73	726	77.33	.44	741	76.12	.41
CHE	242	78.80	.80	250	75.05	.74	235	75.67	.75	253	72.70	.72	232	76.61	.79	242	75.74	.75	709	77.05	.45	745	74.47	.43
DEL	247	80.81	.66	249	79.76	.84	NA	NA	NA	NA	NA	NA	248	73.51	.79	252	74.33	.81	495	77.16	.54	501	77.04	.60
DIB	239	83.03	.69	244	80.98	.74	263	77.05	.78	266	77.95	.80	253	77.12	.71	245	79.19	.80	755	78.96	.43	755	79.33	.45
NAG	252	79.12	.50	265	78.15	.50	291	75.91	.39	287	73.28	.40	253	79.54	.49	305	78.29	.48	796	78.09	.27	857	76.56	.28
TRV	30	82.40	2.78	60	76.70	1.59	225	80.44	.85	257	80.35	.72	86	83.08	1.78	134	79.73	1.04	341	81.28	.76	451	79.67	.56
All Centers	1251	79.92	.31	1315	78.05	.31	1262	77.14	.32	1307	75.59	.31	1309	77.24	.33	1428	77.38	.31	3822	78.08	.19	4050	77.02	.18

**Table 1.18: Blood pressure Risk Categories (including those taking medicines): URBAN**

Areas Centers	Men													Women													
	Optimal			Normal		High normal		Gr 1 HTN		Gr 2 HTN		Gr 3 HTN		Optimal			Normal		High normal		Gr 1 HTN		Gr 2 HTN		Gr 3 HTN		
	N	n	%	n	%	n	%	n	%	n	%	n	%	N	n	%	n	%	n	%	n	%	n	%	n	%	
BLB	241	84	34.8	61	25.3	40	16.5	36	14.9	17	7.0	3	1.2	247	118	47.7	40	16.1	44	17.8	30	12.1	12	4.8	3	1.2	
CHE	242	102	42.1	54	22.3	36	14.8	35	14.8	13	5.3	4	1.6	250	132	52.8	50	20	21	8.4	32	12.8	10	4.0	6	2.4	
DEL	247	41	16.5	68	27.5	83	33.6	42	17	11	4.4	4	1.6	249	65	26.1	53	21.2	56	22.4	58	23.2	15	6.0	3	1.2	
DIB	239	20	8.3	45	18.8	59	24.6	68	28.4	31	12.9	16	6.6	244	54	22.1	53	21.7	33	13.5	57	23.3	30	12.2	17	6.9	
NAG	252	80	31.7	94	37.3	54	21.4	21	8.3	3	1.1	1	0.3	265	100	37.7	95	35.8	53	20	13	4.9	2	0.7	2	0.7	
TRV	30	5	16.6	6	20	8	26.6	8	26.6	2	66.6	1	33.3	60	19	31.6	12	20	13	21.6	14	21.7	2	3.3	1	1.6	
All Centers	1251	332	26.5	328	26.2	280	22.3	210	16.7	77	6.1	29	2.3	1315	488	37.1	303	23.0	220	16.7	204	15.5	71	5.3	32	2.4	
STEPS classification for Hypertension systolic/diastolic mmHg : Optimal:<120/<80; Normal:120 NA129/80 NA84; High NAnormal: 130 NA139/85 NA89 ; Grade 1=140 NA159/90 NA99 ; Grade 2=160 NA179/100 NA109;Grade 3 = ≥180/≥110																											

**Table 1.19: Blood pressure Risk Categories (including those taking medicines): RURAL**

Areas Centers	Men													Women													
	Optimal			Normal		High normal		Gr 1 HTN		Gr 2 HTN		Gr 3 HTN		Optimal			Normal		High normal		Gr 1 HTN		Gr 2 HTN		Gr 3 HTN		
	N	n	%	n	%	n	%	n	%	n	%	n	%	N	n	%	n	%	n	%	n	%	n	%	n	%	
BLB	248	100	40.3	69	27.8	37	14.9	29	11.6	7	2.8	6	2.4	244	130	53.2	58	23.7	24	9.8	25	10.2	5	2.0	2	0.8	
CHE	235	105	44.6	52	22.1	42	17.8	24	10.2	9	3.8	3	1.2	253	155	61.2	47	18.5	15	5.9	23	9.0	9	3.5	4	1.5	
DEL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
DIB	263	91	34.6	51	19.3	46	17.4	37	14.0	23	8.7	17	6.4	266	81	30.4	52	19.5	38	14.2	54	20.3	25	9.3	18	6.7	
NAG	291	146	50.1	94	32.3	35	12.0	15	5.1	1	0.3	0	0	287	189	65.8	73	2.4	16	5.5	5	1.7	3	1.0	1	0.3	
TRV	225	44	19.5	55	24.4	48	21.3	51	22.6	19	8.4	8	3.5	257	88	34.2	51	19.8	44	17.1	45	17.5	19	7.3	9	3.5	
All Centers	1262	486	38.5	321	25.4	208	16.4	156	12.3	59	4.6	34	2.6	1307	643	49.1	281	21.4	137	10.4	152	11.6	61	4.6	34	2.6	
STEPS classification for Hypertension systolic/diastolic mmHg : Optimal:<120/<80; Normal:120 NA129/80 NA84; High NAnormal: 130 NA139/85 NA89 ; Grade 1=140 NA159/90 NA99 ; Grade 2=160 NA179/100 NA109;Grade 3 = ≥180/≥110																											

**Table 1.20: Blood pressure Risk Categories (including those taking medicines): SLUM**

Areas Centers	Men												Women													
	Optimal			Normal		High normal		Gr 1 HTN		Gr 2 HTN		Gr 3 HTN		Optimal			Normal		High normal		Gr 1 HTN		Gr 2 HTN		Gr 3 HTN	
	N	n	%	n	%	n	%	n	%	n	%	n	%	N	n	%	n	%	n	%	n	%	n	%	n	%
BLB	237	105	44.3	53	22.3	35	14.7	32	13.5	4	1.6	8	3.3	237	110	46.4	53	22.3	31	13.0	38	16.0	12	5.0	6	2.5
CHE	232	105	45.2	52	22.4	24	10.3	37	15.9	11	4.7	3	1.2	232	138	59.4	48	20.6	17	7.3	25	10.7	10	4.3	4	1.7
DEL	248	134	54.0	44	17.7	40	16.1	21	8.4	6	2.4	5	2.0	250	121	48.4	49	19.6	38	15.2	25	10.0	15	6.0	3	0.1
DIB	253	78	30.8	53	20.9	39	15.4	56	22.1	17	6.7	9	3.5	252	92	36.5	27	10.7	35	13.8	49	19.4	26	10.3	17	6.7
NAG	253	62	24.5	111	43.8	45	17.7	27	10.6	6	2.3	2	0.7	253	125	49.0	82	32.4	60	23.7	30	11.8	6	2.3	2	0.7
TRV	86	21	24.4	16	18.6	19	22.0	18	20.9	2	2.3	10	11.6	86	44	51.1	20	23.2	23	26.7	33	38.3	14	16.2	2	2.3
All Centers	1309	505	38.5	329	25.1	202	15.4	191	14.5	46	3.5	37	2.8	1310	630	48.0	279	21.2	204	15.5	200	15.2	83	6.3	34	2.5

STEPS classification for Hypertension systolic/diastolic mmHg : Optimal:<120/<80; Normal:120 NA129/80 NA84; High NA normal: 130 NA139/85 NA89 ; Grade 1=140 NA159/90 NA99 ; Grade 2=160 NA179/100 NA109;Grade 3 = ≥180/≥110

**Table 1.21: Blood pressure Risk Categories (including those taking medicines): ALL AREAS**

Area Centers	Men												Women													
	Optimal			Normal		High normal		Gr 1 HTN		Gr 2 HTN		Gr 3 HTN		Optimal			Normal		High normal		Gr 1 HTN		Gr 2 HTN		Gr 3 HTN	
	N	n	%	n	%	n	%	n	%	n	%	n	%	N	n	%	n	%	n	%	n	%	n	%	n	%
BLB	726	289	39.8	183	25.2	112	15.4	97	13.3	28	3.8	17	2.3	726	358	49.3	151	20.7	99	13.6	93	12.8	29	3.9	11	1.5
CHE	709	312	44.0	158	22.2	102	14.3	96	13.5	33	4.6	10	1.4	711	425	59.7	145	20.3	53	7.4	80	11.2	29	4.0	14	1.9
DEL	495	175	35.3	112	22.6	124	25.0	63	12.7	17	3.4	9	1.8	500	186	37.2	102	20.4	94	18.8	83	16.6	30	6.0	6	1.2
DIB	755	189	25.0	149	19.7	144	19.0	161	21.3	71	9.4	42	5.5	756	227	30.0	132	17.4	106	14.0	160	21.1	81	10.7	52	6.8
NAG	796	288	36.1	299	37.5	134	16.8	63	7.9	10	1.2	3	0.3	797	414	51.9	250	31.3	129	16.1	48	6.0	11	1.3	5	0.6
TRV	341	70	20.5	77	22.5	75	21.9	77	22.5	23	6.7	19	5.5	341	151	44.2	83	24.3	80	23.4	92	26.9	35	10.2	12	3.5
All Centers	3822	1323	34.6	978	25.5	691	18.0	557	14.5	182	4.7	100	2.6	3831	1761	45.9	863	22.5	561	14.6	556	14.5	215	5.6	100	2.6

STEPS classification for Hypertension systolic/diastolic mmHg : Optimal:<120/<80; Normal:120 NA129/80 NA84; High NA normal: 130 NA139/85 NA89 ; Grade 1=140 NA159/90 NA99 ; Grade 2=160 NA179/100 NA109;Grade 3 = ≥180/≥110

**Table 1.22: Summary of Mean Blood Glucose, Total Cholesterol, HDL Cholesterol and Blood Pressure: MEN**

Centers	Blood Glucose mmol/L			Total cholesterol mmol/L			HDL cholesterol mmol/L			Triglycerides mmol/L			Blood pressure Systolic/Diastolic mmHg		
	Urban	Rural	Slum	Urban	Rural	Slum	Urban	Rural	Slum	Urban	Rural	Slum	Urban	Rural	Slum
BLB	6.15	5.34	5.96	5.01	4.63	4.40	1.11	1.08	0.99	1.84	1.66	1.63	126.8 77.5	124.0 77.0	124.4 77.3
CHE	5.50	5.18	5.25	4.64	4.24	4.35	0.96	1.01	0.99	1.85	1.45	1.69	124.6 78.8	123.1 75.6	123.8 76.6
DEL	6.10	NA	5.49	4.98	NA	3.91	1.05	NA	1.06	1.75	NA	1.58	130.1 80.8	NA NA	116.5 73.5
DIB	5.75	5.00	5.37	4.34	3.56	3.97	1.05	1.19	1.15	1.90	1.64	1.75	142.2 83.0	133.1 77.0	131.7 77.1
NAG	4.81	4.78	5.00	4.12	3.71	3.88	0.91	0.88	0.90	1.45	1.42	1.45	123.6 79.1	120.3 75.9	124.9 79.5
TRV	5.47	5.58	6.28	5.35	5.05	5.33	1.13	1.08	1.12	1.56	1.32	1.45	136.1 82.4	133.6 80.4	136.7 83.0
All Centers	5.65	5.15	5.47	4.63	4.20	4.17	1.02	1.04	1.03	1.75	1.50	1.61	129.6 79.9	126.6 77.1	125.1 77.2

**Table 1.23: Summary of Mean Blood Glucose, Total Cholesterol, HDL Cholesterol and Blood Pressure: WOMEN**

Centers	Blood Glucose mmol/L			Total cholesterol mmol/L			HDL cholesterol mmol/L			Triglycerides mmol/L			Blood pressure Systolic/Diastolic mmHg		
	Urban	Rural	Slum	Urban	Rural	Slum	Urban	Rural	Slum	Urban	Rural	Slum	Urban	Rural	Slum
BLB	5.86	5.15	5.91	5.10	4.62	4.74	1.31	1.16	1.15	1.48	1.50	1.40	122.8 76.6	119.6 73.8	124.6 77.8
CHE	5.61	5.04	5.78	4.61	4.57	4.69	1.07	1.11	1.08	1.42	1.13	1.42	121.6 75.0	118.0 72.7	119.7 75.7
DEL	5.82	NA	5.44	5.00	NA	4.05	1.07	NA	1.11	1.59	NA	1.53	127.8 79.7	NA NA	120.3 74.3
DIB	5.42	4.98	5.23	4.58	3.72	4.09	1.07	1.19	1.21	1.81	1.58	1.78	137.6 80.9	133.9 77.9	133.7 79.1
NAG	4.84	4.74	4.96	4.30	3.86	4.21	0.97	0.93	0.95	1.36	1.33	1.42	121.1 78.1	115.7 73.2	121.6 78.2
TRV	6.05	6.30	6.36	5.29	5.57	5.49	1.22	1.26	1.18	1.05	1.20	1.18	126.9 76.7	128.8 80.3	130.3 79.7
All Centers	5.53	5.23	5.53	4.74	4.45	4.46	1.10	1.13	1.10	1.50	1.35	1.48	126.1 78.0	123.3 75.5	124.5 77.3

**Table 1.24: Summary of Risk Category for Blood Glucose, Total Cholesterol, HDL Cholesterol and Dyslipidemia: MEN**

Centers	Blood Glucose % ≥7mmol/L			Total cholesterol % ≥ 5.2mmol/L			HDL cholesterol % ≤0.9 mmol/L			Triglycerides % ≥1.7mmol/L			Dyslipidemia %		
	Urban	Rural	Slum	Urban	Rural	Slum	Urban	Rural	Slum	Urban	Rural	Slum	Urban	Rural	Slum
BLB	11.2	3.6	11.4	44	24.6	25.3	23.7	30.9	40.1	44.8	34.3	36.3	2.5	3.3	8.4
CHE	10.7	7.2	8.2	27.6	22.5	18.5	44.9	39.6	43.1	38.3	26.8	31.9	9.5	3.8	3.9
DEL	18	NA	6.8	45.2	NA	9.6	23.2	NA	36.4	44	NA	31.2	4	NA	2.0
DIB	13.4	3.5	7.1	18.5	7.4	14.3	32.8	22.9	34.1	50.4	39.5	43.3	4.2	0.8	1.6
NAG	4.4	3.8	6.3	21	8.9	11.5	57.9	58.8	57.1	30.6	26.5	24.6	5.6	1.4	4.0
TRV	6.7	14.3	16.3	46.7	46.2	52.3	16.7	22.9	16.3	36.7	23.8	25.6	6.7	6.3	5.8
All Centers	11.4	6.2	8.5	31.7	19.5	18.1	36.1	35.9	40.5	41.4	30.3	32.9	5.2	3.0	4

**Table 1.25 Summary of Risk Category for Blood Glucose, Total Cholesterol, HDL Cholesterol and Dyslipidemia: WOMEN**

Centers	Blood Glucose ≥7mmol/L			Total cholesterol ≥ 5.2mmol/L			HDL cholesterol ≤0.9 mmol/L			Triglycerides ≥1.7mmol/L			Dyslipidemia %		
	Urban	Rural	Slum	Urban	Rural	Slum	Urban	Rural	Slum	Urban	Rural	Slum	Urban	Rural	Slum
BLB	9.3	1.2	14	44.1	28.4	32.4	12.1	22.5	21.6	27.9	29.6	20	1.6	2.1	4.0
CHE	10	3.6	12.4	24.7	22.5	26.4	23.5	14.6	24	25.5	10.7	25.6	3.2	0,4	4.1
DEL	15.6	NA	6.8	43.2	NA	10.3	26.4	NA	26.2	40.8	NA	32.1	7.6	NA	0.8
DIB	9.9	2.3	4.5	24.8	8	12.6	27.3	25.4	27.2	47.5	33.7	49.6	5.8	NA	0.4
NAG	5.3	2.8	8.2	20.5	11.1	17.4	43.8	51.2	43.4	24.9	20.6	23	4.6	1.7	3.3
TRV	18.3	18.7	14	63.3	64.2	58.1	3.3	9.3	11.8	10	16.7	16.9	1.7	2.3	1.5
All Centers	10.3	5.7	9.6	32.8	26.4	23.4	25.8	25.3	27.5	32.1	22.2	28.5	4.4	1.3	2.4

**Table 1.26: Distribution of External Laboratory Quality Control Samples**

Distribution No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Date of dispatch	17th March 2005	7th April 2005	19th April 2005	9th May 2005	7th June 2005	7th June 2005	5 <sup>th</sup> July 2005	5 <sup>th</sup> July 2005	2 <sup>nd</sup> Aug. 2005	2 <sup>nd</sup> Aug. 2005	30 <sup>th</sup> Aug 2005	30 <sup>th</sup> Aug. 2005	30 <sup>th</sup> Aug. 2005	26 <sup>th</sup> Oct. 2005	26 <sup>th</sup> Oct 2005	6 <sup>th</sup> Nov 2005	6 <sup>th</sup> Nov 2005	3 <sup>rd</sup> Jan. 2006
Return date	4th April 2005	19th April 2005	9th May 2005	19th May 2005	20th June 2005	30th June 2005	18 <sup>th</sup> July 2005	30 <sup>th</sup> July 2005	16 <sup>th</sup> Aug 2005	31 <sup>st</sup> Aug 2005	15 <sup>th</sup> Sept. 2005	30 <sup>th</sup> Sept. 2005	17 <sup>th</sup> Oct. 2005	31 <sup>st</sup> Oct. 2005	14 <sup>th</sup> Nov. 2005	30 <sup>th</sup> Nov 2005	15 <sup>th</sup> Dec. 2005	15 <sup>th</sup> Jan 2006

**Table 1.27: Target values of the different distributions with each External Quality Control sample**

EQC No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Parameter																		
Cholesterol mg% (mmol/L)	157 (4)	250.5 (6.5)	160.5 (4.1)	271 (7)	230 (5.9)	269 (6.9)	268 (6.9)	162 (4.2)	163 (4.2)	268 (6.9)	156 (4)	200 (5.2)	271 (7)	164 (4.2)	253 (6.5)	188.5 (4.9)	185 (4.8)	170 (4.4)
Triglycerides mg% (mmol/L)	116 (1.3)	218 (2.5)	104 (1.1)	221 (2.5)	196 (2.2)	255 (2.9)	360 (4.1)	95 (1.0)	95 (1.0)	360 (4.1)	81 (2.1)	111 (2.8)	218 (2.5)	84 (2.1)	305 (7.9)	143.5 (3.7)	110 (1.2)	125 (1.4)
HDL mg% (mmol/L)	47.5 (1.2)	49 (1.2)	49 (1.2)	70 (1.8)	50 (1.2)	51 (1.3)	70 (1.8)	38 (0.9)	38 (0.9)	70 (1.8)	88 (2.2)	58 (1.5)	40 (1.0)	38 (0.9)	77 (2.0)	48.5 (1.2)	47 (1.2)	44 (1.1)
Glucose mg% (mmol/L)	117 (6.4)	270 (14.8)	92 (5.0)	270 (14.8)	112 (6.1)	110 (6.0)	191 (10.5)	82 (4.5)	81 (4.5)	191 (10.5)	NIL (NIL)	NIL (NIL)	NIL (NIL)	81 (4.5)	191 (10.5)	113 (6.1)	99 (5.4)	93.5 (5.1)

**Conversion factors:**

Blood glucose mmol/L= mg/dl x 0.055

Total Cholesterol and HDL cholesterol mmol/l =mg/dl x 0.026

Triglycerides mmol/L=mg/dl x 0.0115

**Table 1.28: Center wise Distribution of Total Cholesterol (mgs/dl)**

External quality control No	AIIMS lab	Coordinating	Ballabgarh	Chennai	Delhi	Dibrugarh	Nagpur	Trivandrum	Mean (All labs)
EQC 1		169.75	158	146	160	127	141	DNS*	155
EQC 2		250.5	211	260	230	194	214	288	242
EQC 3		160.5	156	151	145	120	147	134	147
EQC 4		271	285	268	255	216	224	DNS	260.7
EQC 5		230	253	211	237	192	183	182	216
EQC 6		269	284	135	192	251	239	230	232
EQC 7		276	282	243	DNS	252	204	236	248
EQC 8		186	165	155	DNS	DNS	132	DNS	159.7
EQC 9		163	-	141	170	167	160	151	165.8
EQC 10		268	-	255	268	247	244	235	257.4
EQC 11		174	-	153	125	153	218	155	157.5
EQC 12		197	-	207	190	DNS	263	195	200.1
EQC 13		258.5	-	272	DNS	DNS	370	DNS	274.15
EQC 14		173	-	159	136	165	116	156	160.12
EQC 15		268.5	-	256	253	245	144	235	252.2
EQC 16		183.5	-	DNS	164	172	148	165	182.2
EQC 17		186	-	165	154	165	139	168	185.0
EQC 18		182	-	158	157	DNS	DNS	DNS	163.2

\*DNS- Did not send sample

**Table 1.29: Center wise Distribution of Triglycerides (mgs/dl)**

External quality control No	AIIMS Coordinating lab	Ballabgarh	Chennai	Delhi	Dibrugarh	Nagpur	Trivandrum	Mean (All labs)
EQC 1	109	111	100	113	82	97	DNS	106.0
EQC 2	218	182	230	237	DNS	223	240	221.67
EQC 3	104	104.9	104	110	81	96	85	100.65
EQC 4	221	211.9	234	260	226	187	DNS	222.78
EQC 5	196	200.8	190	240	179	184	153	193.56
EQC 6	220	364.5	DNS	220	243	204	140	196
EQC 7	362	369	363	DNS	289	396	365	371
EQC 8	112.5	172.6	99	DNS	DNS	123	DNS	126.77
EQC 9	95	-	106	105	216	76	96	98.48
EQC 10	364	-	383	430	420	261	374	362.2
EQC 11	96	-	72	75	103	121	72	78.8
EQC 12	110	-	110	90	DNS	177	94	100.3
EQC 13	222	-	211	DNS	DNS	302	DNS	201.85
EQC 14	97	-	98	75	110	94	78	90.12
EQC 15	305	-	383	293	369	250	320	316.0
EQC 16	140	-	DNS	139	140	123	158	140.3
EQC 17	108	-	118	101	113	123	125	114.68
EQC 18	124	-	128	110	DNS	DNS	DNS	123.2

\*DNS- Did not send sample

**Table 1.30: Center wise Distribution of HDLCholesterol (mgs/dl)**

External quality control No	AIIMS Coordinating lab	Ballabgarh	Chennai	Delhi	Dibrugarh	Nagpur	Trivandrum	Mean (All labs)
EQC 1	43	47	43	-	29	64	DNS	49.25
EQC 2	49	56	44	-	167	48.6	47	48.9
EQC 3	49	55.7	45	-	104	43	34	45.3
EQC 4	70	35.6	53	-	107	96	DNS	61.5
EQC 5	50	32.5	61	55	67	33.6	45	46.4
EQC 6	45	37.3	30	62	58	40	50	50
EQC 7	65	55.3	86	DNS	81	45.5	69	64.2
EQC 8	35	59.3	54	DNS	DNS	28.6	DNS	44.2
EQC 9	44	-	56	24	45	46.6	42	43.5
EQC 10	63	-	80	48	95	58.8	65	68.46
EQC 11	88	-	95	18	65.5	62	82	79.2
EQC 12	58	-	61	24	DNS	38.4	52	48.7
EQC 13	40	-	30	DNS	DNS	38.8	DNS	33.97
EQC 14	38.5	-	49	29	47	27.3	46	41.01
EQC 15	91	-	78	40	226	35.7	69	7.2
EQC 16	50.5	-	DNS	19	35	31.8	33	46.8
EQC 17	48.5	-	46	31	39	34.2	40	46.3
EQC 18	45	-	44	39	DNS	DNS	DNS	39.8

\*DNS- Did not send sample

**Table 1.31: Center wise Distribution of Fasting Blood Glucose (mgs/dl)**

External quality control No	AIIMS Coordinating lab	Ballabgarh	Chennai	Delhi	Dibrugarh	Nagpur	Trivandrum	Mean (All labs)
EQC 1	112	75.8	99	48	78	71	DNS	81.6
EQC 2	130	100.9	123	66	108	129	DNS	104.7
EQC 3	92	108.6	76	26	30	62	ND	84
EQC 4	271	285	268	255	216	224	DNS	260.7
EQC 5	100	92.76	112	80	121	122	102	105
EQC 6	93	92.7	112	118	105	117	108	104
EQC 7	208	99	170	168	163	132	168	155
EQC 8	92.5	87	76	DNS	DNS	71	DNS	82
EQC 9	84.5	-	76	80	84	61	70	83.13
EQC 10	183.5	-	182	165	152	134	175	182.9
EQC 11	6.5	-	6	8	95	19	9	7.8
EQC 12	10.75	-	9	10	DNS	23	4	10.15
EQC 13	15	-	5	DNS	DNS	22	DNS	13.77
EQC 14	76	-	72	66	74	73	70	74.7
EQC 15	176.5	-	170	163	168	114	156	174.83
EQC 16	113.5	-	DNS	119	103	99	105	115.8
EQC 17	95	-	95	95	93	98	96	99.4
EQC 18	89	-	97	108	DNS	DNS	DNS	98

\*DNS- Did not send sample

**Table 1.32: Details of samples received from centers for 10% analysis**

Center	Blood sample analysis status		
	Nos. received	Nos. with quantity insufficient	Nos. Analysed
Ballabgarh	113	2	131
Chennai	173	7	166
Delhi	135	4	131
Dibrugarh	195	24	171
Nagpur	177	21	156
Trivandrum	70	9	61
Total	883	67 (7.5%)	816 (92.4%)

\*QNS- Quantity not sufficient