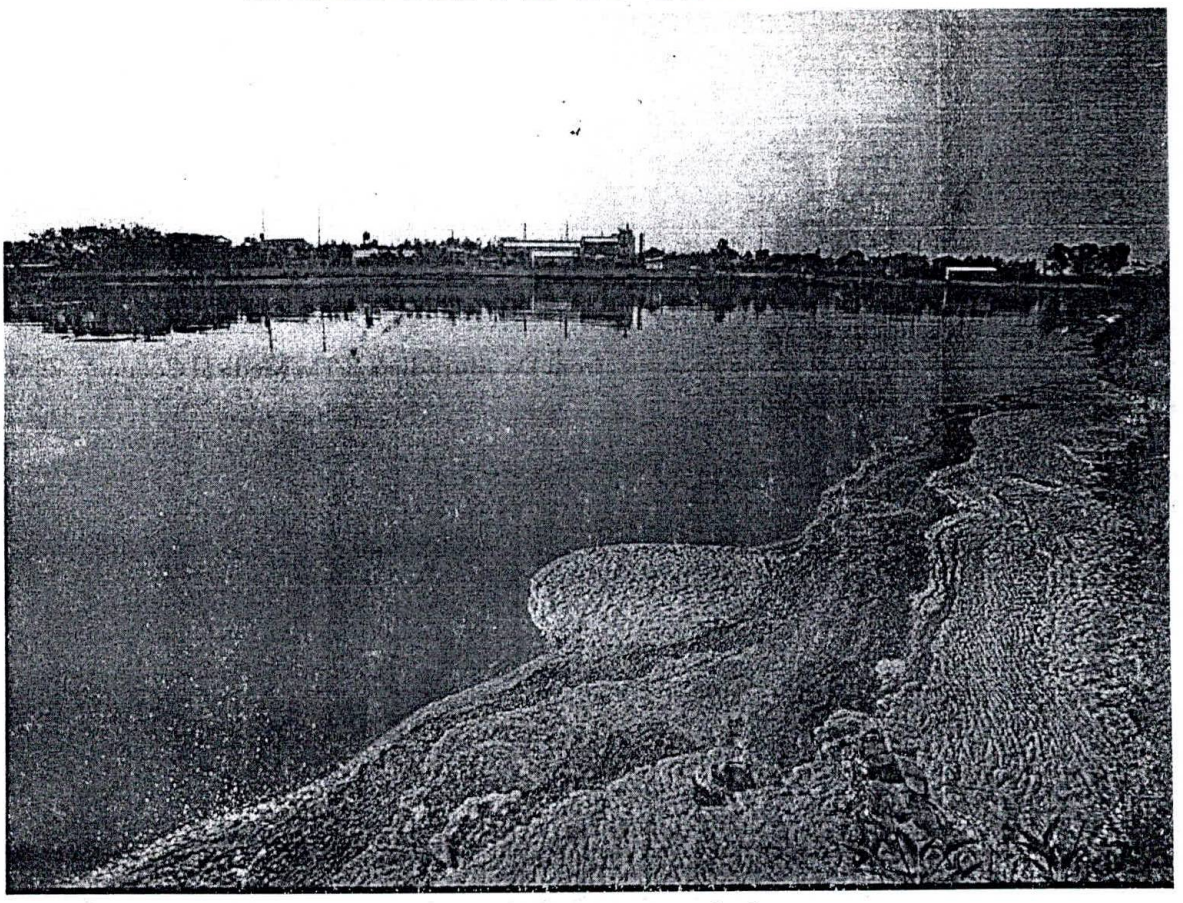
State of Community Health
at
MEDAK DISTRICT



Supported by

LTM Medical College, Mumbai
Community Health Cell, Bangalore
St. John's Medical College, Bangalore
Nimhans, Bangalore
Occupational Health and Safety Centre, Mumbai

GREENPEACE

August 2004

State of Community Health
at
MEDAK DISTRICT[1]

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The researchers data collection process is augmented by library research and web research. Thanks to Salil Mukhia, Imran Khan and Jai Krishna of Greenpeace India to contribute in this process of research.

respiratory disorders such as asthma and bronchitis, the incidence is 4 times higher in the study group in comparison to the control group.

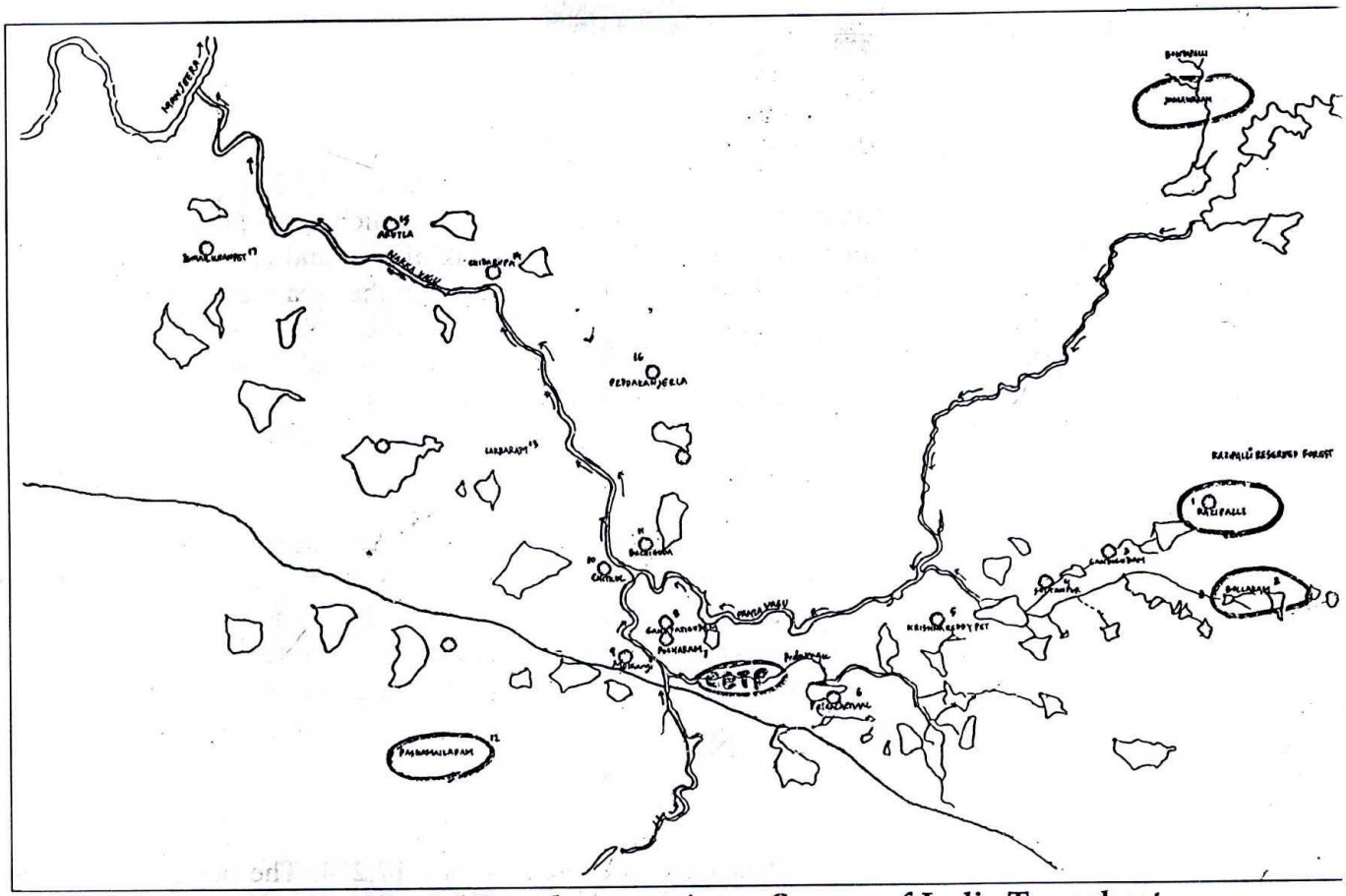
A stratified random sample of the study group (9 villages) when compared with those from the Control group (4 villages) shows a significant increased disease incidence in many body systems. These include

1. The presence of Diseases of skin and subcutaneous tissue in the study group is at least two times higher than the control group.
2. One in every eleven, in the study group is afflicted with Diseases of the musculoskeletal system and connective tissue.
3. All systemic classification was based on the International Classification of Diseases-10 (ICD-10). In at least 15 out of 20 of the ICD 10, the Study group showed higher rates of incidence in almost all the age groups.
4. Clinically confirmed cancer incidence and respiratory disorders are greater in the study group at a statistically significant rate. While 11cases of incidence were reported in the study group, no such case was reported in the sampling set in the control group. The occurrence of Asthma and Bronchitis is 4 times higher in the study group.
5. There is absolutely no incidence of Heart Disease in the Control Group unlike in the Study group.

This report, further, uses available and existing research to demonstrate: -

- The presence of a wide range of chemicals in the land, air and water in Medak.
- The ways in which the local community are being exposed to these toxins.
- The increased exposure has increased the potential for detrimental health impacts

The implications of these findings, amongst others, are serious. In brief, the study demonstrates that serious damage is being done to the health of the residents of Medak at current levels of Industrial activity, and this damage potentially correlates with location, a measure of exposure to Industrial activity-generated pollution. It is incumbent on State regulatory authorities responsible for the public health to investigate this matter, to further define the scope and severity of the problem, and initiate processes which will return the community to the state of health enjoyed by them prior to this reckless industrialization era and pressurize industries to follow all environmental and ethical norms and implement clean production and closed-loop systems in their production cycle. The evidence presented here contributes to a growing repository of research that reinforces the conclusion of this report that serious damage is afflicted upon the local community potentially through the pollution stemming out of reckless industrial activity and necessitates the need to ensure that Industrial estates of the nature of Patancheru, not be replicated elsewhere.



Map of Patancheru Industrial Development Area : Survey of India Toposheet

INTRODUCTION

Medak – A Brief Description

Patancheru and the adjoining study areas are located at 17° 31' N latitude and 78° 15' E longitude on the northeastern part of Andhra Pradesh, which is on the southeastern coast of India. It covers an area of 222 Sq. Kms in Medak district and is 40 km away from the capital of Andhra Pradesh, Hyderabad. Many villages in the area are situated on alluvium and weathered bedrock. Amidst the Granite terrain, the Nakkavagu stream has been identified as a paleo-channel that is composed of clay-silt-sand. It was predominantly an agricultural landmass located on the banks of river Manjira, a major tributary of River Godavari, one of the lengthiest rivers of south India, but transformed into an industrial area as part of the governments' drive on industrialization.

The region experiences a semi-arid tropical climate with persistent drought, unpredictable weather, limited and erratic rainfall. The area gets two monsoons in varying degrees, southwest monsoon from end of June till August and Northeast monsoon from September till November. May is the hottest month with the mean daily temperature of about 40 degree C. December is the coldest month with a mean daily temperature of about 29 degree C.

The Community

As per the 2001 census, Patancheru's population is 1,17,214. The population density is 234 persons/Sq.km and the sex ratio is (56,267 female, 60947 male). Population of Medak district, in which Patancheru falls, is about 22, lakhs persons of whom. A prdominat section of the resident community were traditional farmers and agricultural labourers cultivating jowar, paddy, ground-nut, chillies, tomato, cotton and wheat till the industrialization process started in 1975. Affected by aggression of industrialization, most of them moved into jobs in industries and a large number of them are taken up indirect jobs created by the industrialization. Today, agriculture continues to be the sustenance for a few. The inception of Industrialization witnessed the influx of a migratory population from other parts of the country to take up jobs in the industries.

The problem

The Patancheru Industrial Estate was set up in 1975 as part of the government initiative to bring in more industries to the state of Andhra Pradesh. Over a period of 29 years, about 320 industries that are manufacturing pesticides, chemicals, pharmaceutical and steel rolls have come up in this area. In the year 1989, 110 of these industries joined hands and set up a common effluent treatment plant (CETP) in a nearby location. These industries transport their effluent in tankers to the CETP for treatment. After treating these effluents, wastewater is discharged into peddavagu water stream, which meets the main stream Nakkavagu flowing through Patancheru area. The Nakkavagu finally meets the river manjira that is one of the main potable water sources in the area. In this context, it is interesting to note that the people of Medak and the twin cities of Secunderabad and

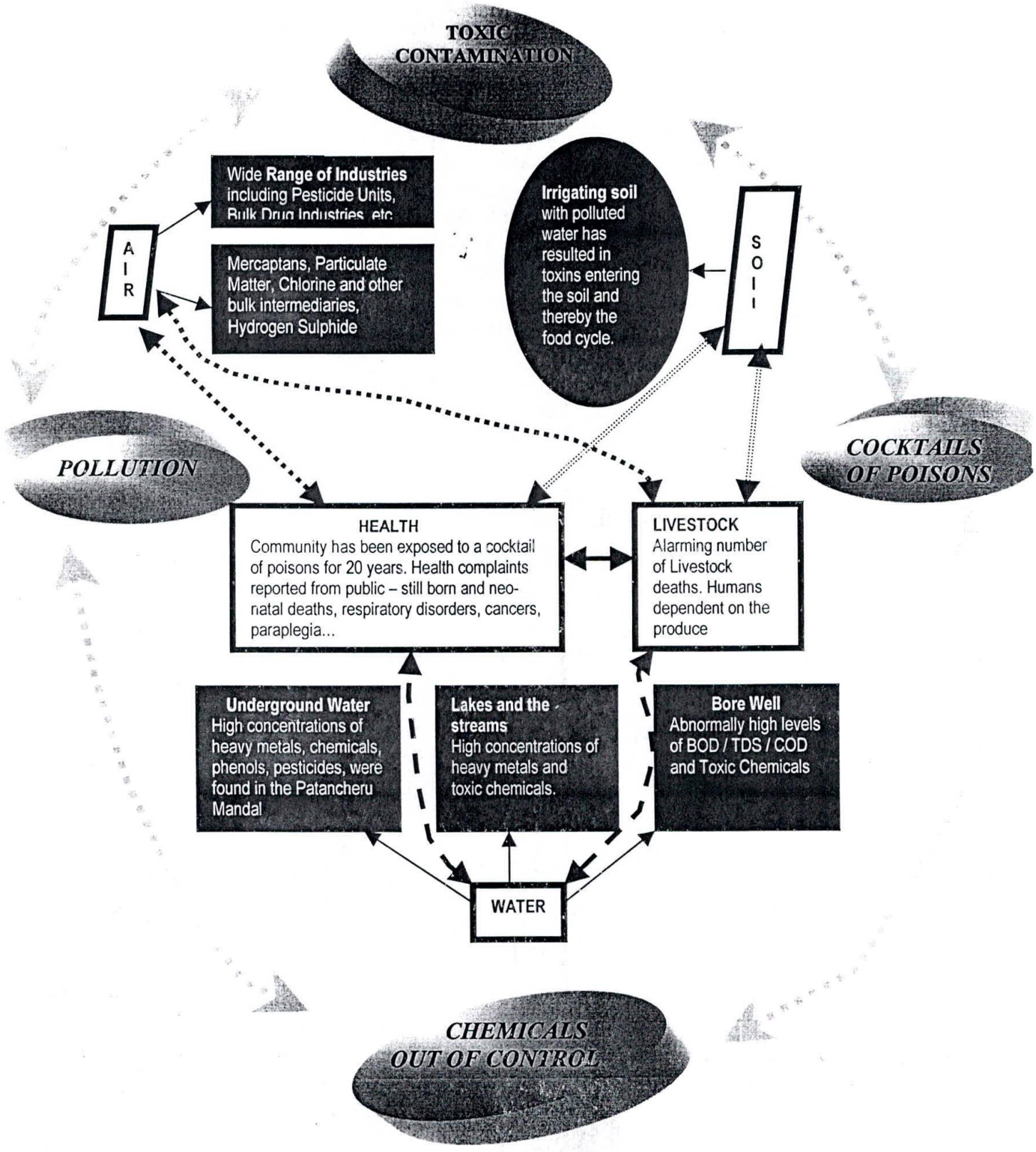
Hyderabad are dependent on the Manjira for their requirements. The Manjira further flows to join the river Godavari, which is one of the longest rivers of South India.

As per conservative estimates, the industries of the Patancheru and Bolaram area generate cumulative 8 x 106 l/day effluents which are being directly discharged on to surrounding land, irrigation fields, and surface water bodies that finally enter into the Nakkavagu stream a tributary of the Manjira river. Studies on abundance and distribution pattern of toxic trace elements indicated the quantitative aspect of pollution in the Nakkavagu Basin. Migration patterns indicate that the pollutants discharged by the industries are entering the surface and groundwater system (aquifers) and are also migrating towards the Manjira further deteriorating the entire hydrological structure of the area. A National Geophysical Research Institute (NGRI) study sponsored by the Central Pollution Control Board covering an area of about 160 sq km where more than 400 big and small pharmaceutical and chemical industries operate has found high levels of heavy metals such as Arsenic, Strontium, Barium, Selenium, Boron, Manganese and Nickel and residual pesticides of Aldrin and Endosulphan in the groundwater as well as surface water in the area.

Complaints pertinent to health have become common-place at Medak, which include respiratory disorders, cancers, congenital problems like mentally/ physically challenged children, chronic depression and reproductive problems.

Concerned with the growing indiscriminate discharge of effluents into the open areas and the consequent large scale pollution, Hyderabad-based Indian Council for Enviro Legal Action filed a Writ Petition in 1990 in the Supreme Court. The apex court moved the petition to the High Court of Andhra Pradesh in 2001 and directed it to monitor implementation of order passed by the Supreme Court of India on stricter measures with regard to Common Effluent Treatment Plants (CETP). A High Court appointed expert committee in March 2004 submitted that 18 of the 23 lakes in the area are polluted at various degrees and suggested a detailed health study on the people in that area to assess the impact of the pollution.

Nakka vagu - identified as a paleo-channel (composed of clay–silt–sandfacies); the **Exposure Pathway** *of the alluvial aquifer varies from 750 to 1315 m 2 /day. The adjoining granite has a transmissivity that varies from 30 –430 m 2 /day. MORE VULNERABLE TO POLLUTION*


TOXIC CONTAMINATION
Wide Range of Industries including Pesticide Units, Bulk Drug Industries etc
AIR
Mercaptans, Particulate Matter, Chlorine and other bulk intermediaries, Hydrogen Sulphide
Irrigating soil with polluted water has resulted in toxins entering the soil and thereby the food cycle.
SOIL
POLLUTION
COCKTAILS OF POISONS
HEALTH
Community has been exposed to a cocktail of poisons for 20 years. Health complaints reported from public – still born and neo-natal deaths, respiratory disorders, cancers, paraplegia...
LIVESTOCK
Alarming number of Livestock deaths. Humans dependent on the produce
Underground Water
High concentrations of heavy metals, chemicals, phenols, pesticides, were found in the Patancheru Mandal
Lakes and the streams
High concentrations of heavy metals and toxic chemicals.
Bore Well
Abnormally high levels of BOD / TDS / COD and Toxic Chemicals
WATER
CHEMICALS OUT OF CONTROL

Methodology

The survey in Medak district was on nine study villages and four reference villages totaling a sample size of 10874 persons.

The survey has its need arising out of he following - suspected rampant pollution of the water bodies in the area-lakes in the and also the prevalent air pollution in the vicinity.

Also together is the fact that there has been a long struggle of the people in he area both by legal and public demonstrations.

The primary aim is the identification of the need for a detailed health analysis in the area to bring about any understanding of the poisons present in the water and air and the way people are affected by their presence.

The Proposed Research Question for the study was "What are the health problems faced by the resident community of the nine villages in Medak district which comprised the study group, due to increased pollution of the air and water by industries?"

The answer was researched involving four strategies:

1) A Review of literature from around the area
2) A questionnaire based survey of people in villages of the mandal
3) Ethnographic interviews of people and
4) Focus group discussions

Preceding the study:

The first step was to obtain community consent to do the assessment and ensure participation and cooperation from the local panchayats and community leaders. Next came a comprehensive literature survey of all available material on health status of the community. One map was used to capture all the data from secondary sources on it. After plotting the cases of ill health and death due to diseases with environmental causes on this detailed map, decisions were made on identification of the target and reference group. A visit of the partners in research, the Occupational Health & Safety Centre-Mumbai was arranged to examine the conditions at Medak and help us with developing the medical aspects of the study.

Consulting individuals and like minded groups, sarpanches of villages,

Villages were chosen after deep research of their social standards, location, occupation, their acceptance for the survey, and various other parameters.

The advisory board consisted of ... and their inputs were implemented on drafts, training procedures, on sample size selections and other scientific and statistical analysis.

The details of the study villages are:

Village	Sample size
Bonthapally	1322
Chitkul	1574
Digwal	1404
Guddapotaram	509
Khazipally	670
Kistareddypet	628
Pashamilaram	672
Pocharam	987
Sultanpur	1159
	Total = 8925

The details of the control villages are:

Village	Sample size
Musapet	707
Ramojipally	349
Uthloor	508
Veerojipally	385
	Total = 1949

Training of interviewers:

The training of interviewers, a team of 10 people was done in November 2003.They were introduced to the problems of people living in the industrial area with introductions to Greenpeace and its activities in the environmental front. During the second day of this session, fundamental overviews of epidemiology, with the example of a survey done on the impacts of industries on public health by Greenpeace at Eloor, Kerala was discussed.

Finally the questionnaire was also discussed and model exercises were held to keep the interviewers familiar with the questions and procedures.

Sampling exercise:

It is random sampling method followed and the randomisation was executed in picking lots at a public gathering in the village panchayat as to which house is to be sampled. It was chosen so that we get a comfortable sampling ratio of 1:3. It was followed by interaction with villagers as to why the study was conducted.

Pilot survey:
This was done in all villages on the first day of sampling. Its aim was to understand the field difficulties involved and to serve as an experience to the interviewer. It also was useful in learning the cooperativeness of the people, whether they were comfortable in disclosing personal information and to understand manners and customs of the people which was required to make this survey a pleasant exercise.
It as a whole served as a review of the whole process.

The questionnaire:
The questionnaire was exhaustive one prepared with the recommendations of our advisory board.
Each sample would be identified with an identification number which is actually a combination of a area code, interviewer code, and the house number combined to form a six character code no.

The date, time, address and contact no.s were all recorded.
The questions were wall designed to be open-ended questions. In each of the house the procedure of 'key informant' was followed.
This is the oldest surviving female of the house who would be telling the interviewer the information required about the other members and also the last two deceased members.
After recording basic information like the age, education, two different health problems were documented. They were diseases that the member of the house perceived of being affected and those, which were diagnosed by doctors to be present. Personal information like presence of habits of chewing tobacco/smoking/ drinking/snuff was also documented.
Finally related information like pesticides used in home, their frequency of use, practice of burning of house hold wastes at home, presence of protected water supply, if no, appearance and details of water available, their sources were all collected.
Appropriate codes for the various diseases, for rating of overall health were used to make the documentation and analysis easier at the later stage.
Throughout the investigation involving the respondents all basic ethical norms were strictly followed. Prior informed voluntary written consent was obtained from each participant.
The information gathered was entered on a day-to-day basis onto a computer and collated in a database. The database was later searched for various diseases and disease sets as recommended by the International Classification of Diseases, ICD-10.

Follow up medical verification:

The team of doctors from the OHSC and Sion hospital in Mumbai, were involved in the follow up and verification of the diagnosed illnesses of the people documented. Though the persons were identified after referring to the complaints of diagnosed illness they were further classified into cases where there is no personal habit, which may be responsible for the illness. The team of doctors visited these persons and tests were done verifying their illnesses in respiratory system, reproductive system disorders, examined medical records of cancer symptoms, allergies of skin, and birth defects. These investigations served as a confirmation to the study and added reliability to its findings.

Ethnographic survey

Ethnographic information were collected from individuals classified according to age and occupation using open questionnaires.

Limitations:

One of the limitations of the study is that it might not examine in detail the range of health problems faced by the workers working in the polluting industries who mostly reside outside villages that fall under the purview of the field investigations.

Another limitation is that the health study too place during the harvest season and so a segment of the population could not be interviewed as they were out in the fields. A certain section of the sampled population was relatively new to the area and so that too was a seen as a limitation.

Also were the problems of migrating and drifting sections of population, which makes the study in a way incomplete with respect to the idea of a completely random sample.

Similar were the cases where personal information like monthly income was not revealed.

Analysis:

The analysis was classified into three. First the data was classified under six age groups from 0 to 61 and above. Then there are classifications on sex, and percentage of illnesses. This data thus grouped into three was then analysed for individual diseases based on the ICD-10 scale. There was an analysis done on mortality rates based on the data accumulated in the study.

Once these divisions were made the data was tested for consistency and significance using the χ^2 tests and odds ratio tests. These give a direct ratio between ill health of the people to industrial pollution.

Then based on the results of these tests the graphs were plotted and analysis was done.

The health related responses of the respondents traversing a wide spectrum were recorded, stored and sorted using a customized software management system. This involved segregating raw data in an order prescribed in the disease index (refer to disease index annexure).
The sorted data was then further categorized under the International Classification of Diseases (ICD 10). (Refer to annexure on International Classification of Diseases)

Analysed data was then projected in a graphical format for easy understanding, which was done with simple office software coupled with Manual Computation techniques.
The validation of this analysed and processed data was further substantiated by performing the Chi square test to determine their statistical significance. (Refer table 2452...insert table of few dieases n their statistics)

Findings:

All body systems without exception are adversely affected in the Study areas as opposed to the control locations. It is amply evident that this is the result of a cocktail of poisons in the water and air of the study villages, which has had considerable effects on the health and well being of the local population.

Brief Summary of the Health Study conducted at Medak District.

The Analysis of the data collected at Medak District has shown that there is an overwhelming difference in incidence of many systemic maladies across the Exposed group when compared to the Less Exposed group as detailed below:

Cancer Incidence is greater in the Exposed group at a statistically significant rate. While *11cases* of incidence were reported in this group, no such case was reported in the sampling set in the Less Exposed group.
There is absolutely *no incidence* of ***Heart Disease*** in the less exposed group unlike in the exposed group.
The occurrence of *Asthma and Bronchitis* **is** *4 times* **higher in the exposed group.**

One in every eleven is afflicted with ***Diseases of the muscoskeletal system and connective tissue*** .
The presence of ***Diseases of skin and subcutaneous tissue*** in the exposed group is atleast two times higher than the less exposed group.

The number of people in the Study group suffering from ***headaches is 25 times*** more than those suffering from headaches in the Control group.

Medical Verifications were performed using the lung function tests (Spirometry) on a random sample of the reference and target populations. These confirmed our findings.
73.6% of the people tested were found to have affected lungs when compared to the control group where only 32.5% were affected. The chi square test proves that this difference is highly statistically significant as well.

In atleast ***15 out of 20*** of the ICD 10 (International Classification of Diseases), the Study group showed higher rates of incidence in almost all the age groups.

Conclusion:

The study population is in grave danger of chemical crisis which might seem only invisible now; the aquifers, the lakes and the streams around the area is being target of the callous attitude of the industries. Now they have reached to the human population. The pollution control board with crores of Rs of investment to function in two decades have failed to intervene and come up with strategy which protects the community and the ecosystem, from toxic contamination. They have posed a question to their very existence using public money with total lack of transparency.

Though it is essential to control damage already inflicted, and to protect the community and the ecosystems from the poison fallout. But given what is already known - that damage done to aquifers is mostly irreversible, that it can take years before groundwater pollution reveals itself, that chemicals react synergistically and often in unanticipated ways - it is equally clear that a patchwork response will not be effective. Given how much this pollution inflicts on public health, the environment, and the economy once it gets into the water, it is critical that emphasis shift from filtering out toxins to not using them in the first place. Andrew Skinner, who heads the international Association of Hydrogeologists puts it this way: "Prevention is the only credible strategy"

There have been large scale environmental crime going on in the region, we suggest the regulators and the polluters take up immediate interventions.
The project demands that:

1. Declare a state of Chemical crisis in the region
2. Zero Discharge in Land, Lakes, Nakkavagu, Pamalavagu, Pedavagu stream
3. Compensate and Medically rehabilitate the affected coomunity. It has to be long term medical rehabilitation
4. Stop illegal dumping and injection of effluents directly into ground

5. Implement immediate and concrete steps towards clean production at Patancheru, pashamailram and khazippaly and bollaram IDA now.
6. Clean up all contaminated sites immediately
7. The companies and government must Make all information Public regarding pollution, health risks, emergency preparedness and related dangers to local communities. Companies must ensure that all workers have access to medical records
8. The Companies must accept complete responsibility and liability for their past actions
9. Complete enforcement of the environmental laws must happen in letter and spirit.
10. Time bound commitment to phase out from deadly chemicals and toxins

The evidence found Patancheru, Jinnaram and Kohir Mandal clearly shows that the synergistic effects of cocktail of chemicals (a few score heavy metals a few hundred organic chemicals) are far more alarming than expected.

Waiting for further solid evidence of chemical effects on health will mean risking irreversible damage to the health further, especially of children.
The reality today is that we are exposed to tens of thousands of chemicals which simply didn't exist on planet until a few decades ago. We have no tools for analyzing the toxicity of the complex mixture to which we are exposed (Howard, 1997; Lang, 1995). Most toxicology is performed on chemicals one at a time. We have difficulty comparing chemicals even in combinations of pairs (Axelrad et al., 2002 and 2003). When we consider combinations of hundreds or thousands of chemicals, it is clear that we have not yet developed any methods that will allow for their rigorous toxicological analysis. There is no indication of any imminent major breakthrough to this testing problem. That leaves us with only a generalized approach to safety through hazard reduction, i.e. reduction in exposure, using a precautionary approach. There are simply no other rational options available.

Appendix 1. Copy of Questionnaire

PATANCHERU FIELD INVESTIGATION QUESTIONNAIRE

GREENPEACE

1. _____ Identification Number (Area Code+ Interviewer code+ Ward Number+ House Number)
2. _____ DATE
3. _____ TIME
4. _____ Number of Family Members
5. _____ Address-Phone Number:_____
6. _____ What is the total monthly income of the family?

NAME OF FAMILY MEMBER	AGE	SEX	Ky Infmt Y / N	OCCUPATION	EDUCATION # of yrs	Over all Health	DOCTOR-DIAGNOSED HEALTH PROBLEM 1	2	3	4	Perceived Health 1	2
M1)												
M2)												
M3)												
M4)												
M5)												
M6)												
M7)												
M8)												

Deceased Member:	*age*	*sex*	*Year of Death*	*Occupation*	*Education*	*Over-all Health*	*Cause of death?*	*Any chronic dis*
D1)								
D2)								

7. N / Y_____ Do you spray pesticides in the home? If yes what is the number of rounds of spraying in a year?
8. N / Y _____ Do you burn your house-hold wastes at the home? If yes how many times do you burn it in a year?
9. N / Y_____ Protected water supply?
   If 'N' source a) Well b) Borewell c) Tank d) Stream / River
   A) _____ Colour of water : Normal / Change of colour
   B) _____ Odour : Less / Smelly
   C) _____ Turbidity : Normal / Above
10. N / Y_____ Do you cultivate your own vegetables?
    If 'N' source a) Village Shops b) Nearby Market c) City
11. _____ Ventilation : Adequate / Inadequate

DISEASE INDEX FOR INTERVIEWER

*A: Asthma, **AL: Allergies, AD: Allergic Dermatitis, ATD: Attention Defects**, ADR: Allergic to Drugs, ART: Arthritis, ANM: Anemia, AC-R: Accident Road, **AC-F: Accident Factory.***	***B: Bronchitis, BD: Blood Disease, BRD: Birth Defects, BS: Breathlessness sudden**, LBP: Blood Pressure, HBP: High Blood Pressure, **BR: Breathlessness regular, BP: Back Pain.***
C: Cancer, CB: Cancer of the Breast, CT: Cancer of the testicles, CPR: Cancer of the Prostrate, CL: Cancer of the Lungs, CBL: Cancer of the Bladder, CUDT: Cancer of the Upper Digestive Tract, CLDT: Cancer of the lower Digestive Tract, CST: Soft Tissue, CAS: Angiosarcoma**, CA: Cardiac Arrest, CP: Chest Pain, CNT: Contraceptive Pills/ implants /injections, **CC: Cervical Cancer, CNF: Confusion, CS: Severe Cough, CCS: Severe Cough & Cold	***D: Diabetes, DP: Depression, DZ: Dizziness**, DH: Diarrhea, DNP: Dental Problem*
*E: Endometriosis, EP: **Early onset of Puberty**, ED: Erectile Dysfunction, EL: Epilepsy, **EFL: Early Foetal Loss**, EP: Eye Pain, EO: Eye Operation, G: Gall Bladder Stone*	***HL: Hearing Loss, HR: Headaches Recurring, H: Headaches,** HD: Heart Disease, HP:Hepatitis*
*I: Infection, IE: Infection of the Ear, IT: Infection of the throat, IL: Infection of the Lungs, **IC: Infection-Common Cold**, IO: Other infection, **INF: Infertility, IRT: Irritation, IA: Induced Abortions**, IMN: Immunisation, ID: Indigestion.*	***J:** Jaundice, **K: Kidney Failure**, KS: Kidney Stone*
F: Fibroid in the Uterus, FR: Fever recurring, FCR: Cold & Fever recurring	***L: Leukemia, LD: Liver Disease, LGY: Lethargy, LSC: Low Sperm count: LGS: Lymph Gland Swelling, LP: Leg Pain***
M: Migraine, MP: Menstrual Problems, ML: Memory Loss, MN: Menhorragea, MA; Missed Abortions, MD: Mental Disease	***N: Nasal Septum Perforation**, NS: Nausea*
O: Obesity, OP: Osteoporosis	***P: Paralysis**, PS: Paralysis-Stroke, **PCOS: Poly-cystic Ovarian Syndrome**, PLS: Piles, **PM: Psychiatric Morbidity, PU: Prolapse Uterus***
R: **Rheumatism, RP: Reproductive illness**, RTI: Reproductive Tract Infection	***SD: Skin Disease, SW: Shuffling when walking**, STD: Sexually Transmitted Diseases, SU: Suicide Urge, **STU: Stomach Ulcers, SNS: Sinusitis, SI: Stress Incontinence**, SP: Surgical Procedures? **SPN: Stomach Pain***
T: Thyroid problem**, TB: Tuberculosis, **TH: True Hermaphrodite	***U:** Urinary Tract Dysfunction, **UMM: Uncontrolled Muscle Movements, UT: Undescended Testis***
VDE: Vomiting with direct exposure**, VL: Vision Loss, **V: Varicose Vein Dysfunction	***W: Weakness, WZ: Wheezing***

Questions to be asked to the Key informant about himself and other people in the family:

1. How would you rate your overall Health?
   A: Excellent, seldom if ever, sick. B: Good, occasionally sick, no major health problems but not ideal health, C: Fair, sick more than most people; limited in a few activities,
   D: Poor, gets sick often, illness limits many activities. E: Very poor or bad, always sick, Chronic Illness limits all activities.
2. Have you been diagnosed for any disease/health problem by a doctor? Any other perceived diseases and symptoms?
3. What are your current or past habits?
   S (n)/(y): Smoking n=number of cigarettes/bidis per day/ y= number of years of smoking,
   D (n)/(p): Drinking n= number of days per week/p= number of pegs in one session
   CT (n)/(y): Chewing Tobacco, n=no of times a day/ y= no of years of chewing;
   SN (n)/(y): Snuff; n=no of times a day/ y= no of years of use
   TP (n)/(y): Tobacco Paste: n=no of times a day/ y= no of years of use

Appendix 2
Study of effect on Lung Function in villages exposed to industrial pollution

It is known fact that air pollution from industries affect lung function (respiratory systems).Lung function tests are a good tool to study this effect. Lung function tests measure the volume of air forcefully exhaled by a person in the mouthpiece of a lung function test meter after inhaling air initially. Forced expiratory volume in the first second (FEV1) means the volume of air exhaled forcefully in the first second after exhalation starts. This parameter is known to get affected mainly due to air pollution. Some dusts cause fibrosis in lungs (e.g. asbestos, silica). These dusts have more effect on the total capacity of lungs than effect on FEV1.

We studied effect on FEV1 in exposed villages and in non-exposed villages. A portable ventilometer (SPIRO DOC) was used. Dr. S. R. Kamat's equations and tables were used for the predicted values of FEV1. Sex and age, two important variables are considered in the equations themselves. Separate stratification on the basis of age and sex is not needed to see the effect on FEV1, if height is within the normal range.

We have labelled persons having FEV1 below the 60% of predicted values as being severely affected. Persons having FEV1 in the range of 60 to 80%of the predicted values were labelled as affected but not severely. All the persons having FEV1 above 80% of the predicted values were labelled as being non-affected.

Smoking also affects FEV1. To neutralize effect of smoking for sake of comparison of exposed villages to unexposed villages, smokers were subtracted from affected as well as unaffected. We see the effect in Table 4. We see that actually percentage of affected persons increases in the exposed villages among the non-smokers. There are smokers who are yet not affected in both types of villages. These figures we see in Table 3.

Environmental asthma is known to be present in polluted areas. For suspected asthmatic persons, the lung function test was repeated after administering broncho-dilator asthelin pump.
Increase in FEV1 equal or more than 15% was used as a criteria for asthama, as given by Carl Zenz. Family history was probed. One person reported that mother is known to have suffered in her youth. This was labelled as familial asthma. Even in this case it is possible that even mother started suffering after industrialization. To be conservative we labelled it as familial asthma.

Sample:
For testing for lung function 44 persons from exposed villages and 35 persons from unexposed villages were randomly selected among persons who complained of some respiratory problem. In field studies due to problems of communication, in grasping instructions and also genuine respiratory problem some persons cannot perform the

test fully satisfactorily. The ratio of exposed to unexposed in the range of 1.15 to 1 was decided to be acceptable. Even though in many persons it was clear that they could not perform the test also due to respiratory problem but with a mixture of problem of communication; such tests (6 from exposed and 1 from unexposed) were not considered for analysis. Where doctor has clearly commented problem of incapacity due to respiratory problem it was accepted for analysis as severely affected. One instance of report of pleural effusion and non-performance was also not taken for analysis (one of the six above).
The following tables list the findings. Results of test of significance (chi-square) are given at the end.

Tables of lung function test in Patancheru area:

Table 1. Lung function affected in exposed and unexposed villages:

Villages		FEV1 Severely Affected	FEV1 Affected, but not severely	**Total lung function (FEV1) affected**	Total non-affected	**Total tested for lung function**
Exposed	Males	08	11	19	09	28
	Females	03	06	09	01	10
	Total	11	17	**28 (73.6%)**	**10**	**38**
Unexposed	Males	04	06	10	16	26
	Females	02	00	02	06	08
	Total	06	06	**12 (35.2%)**	**22**	**34**
Total				**40**	**32**	**72**

Odds ratio=2.08>2

ASTHMA:
Increase in FEV1 equal or more than 15% after broncho-dilator.
Table 2.

	Familial asthma	**Environmental asthma**	**No asthma**	**Total**
Exposed	01(smoker)	**07(18.4%); (3 smokers)**	31	38
Unexposed	00	**01(2.9%); (Non-smoker)**	33	34
Total		**08**	64	72

Smokers:

Table 3.

All smokers are males.

	Affected smokers		**Affected Smokers**	Unaffected Smokers		**Unaffected Smokers**
	Heavy	Non-Heavy	**Total**	Heavy	Non-Heavy	**Total**
Exposed Villages	06	03	**09**	02	04	**06**
Un-Exposed Villages	03	02	**05**	05	02	**07**
Total 27			**14**			**13**

Number of affected and non-affected smokers is almost the same.

Effect among non- smokers.

Table 4.

Villages		FEV1 Severely Affected	FEV1 Affected, but not severely	**Total Lung function (FEV1) affected**	Total non-affected	**Total tested for Lung function**
Exposed	Males	02	08	**10**	03	13
	Females	03	06	**09**	01	10
	Total	11	17	**19 (82.6%)**	**04**	**23**
Unexposed	Males	01	04	**05**	09	14
	Females	02	00	**02**	06	08
	Total	05	06	**07 (31.8%)**	15	22
Total				**26**	**19**	**45**

Odds ratio= 2.5>2

Significance:

Chisquare test shows that number of affected persons is significantly higher in exposed villages ($P<0.01$) (Table1).

The difference is significant also among non smokers at $P<0.01$ (Table 4)

Appendix 3:
FOLLOW UP MEDICAL INVESTIGATION OF CARCINOMA QUESTIONNAIRE:

1. _____ identification Number (Area Code+ Interviewer code+ Ward Number+ House Number+ follow up number- (two digits)
2. _____date
3. _____AGE
4. Male/Female _____SEX
5. Type of Cancer_____
6. Organ affected_____
7. TNM Stage
8. In which year was it detected?_____
9. How was it detected?
10. Local doctor
11. Senior doctor in a major hospital
12. Pathology confirmation
13. Was surgery performed?
14. Was chemotherapy administered?
15. Was radiotherapy administered?
16. Is there pain at present?
17. Is there bleeding from the site?

Appendix 4:
FOLLOW UP INVESTIGATION OF RESPIRATORY DISABILITY USING PULMONARY FUNCTION TESTING QUESTIONNAIRE

1. _____Identification Number (Area Code+ Interviewer code+ Ward Number+ House Number+ follow up number- (two digits)
2. _____Date
3. _____Age
4. Male/Female_____Sex
5. Y/N_____Do you smoke? Y/N Did you smoke earlier?
6. _____S (n)/(y): Smoking n = number of cigarettes/bidis per day/y = number of years of smoking
7. Y/N Do you get up due to cough?
8. Y/N Is the problem for more than 2 months?
9. Y/N Is the problem for more than 2 years?
10. Is there a particular season when the problem is faced?
11. Y/N Is the cough with expectoration?
12. Y/N Are you suffering due to asthma?
13. Y/N Are you diagnosed to be asthmatic?
14. Y/N Is there a family history of asthma?

15. Y/N Have you associated this problem with any cause?
16. What is the cause you have identified?
17. What is the medication you take for asthma?
18. What is the frequency of medication?

BREATHLESSNESS:
Do You become breathless while:

19. Climbing staire
20. Walking at usual speed
21. Walking for even 100 steps/performing activities of daily living
22. Even at rest
23. GRADE OF BREATHLESSNESS:_____

READINGS OF LUNG FUNCTION TEST

Sr. No.	FEV1	FVC	PEFR	MEFR	Selected
1.					
2.					
3.					
4.					

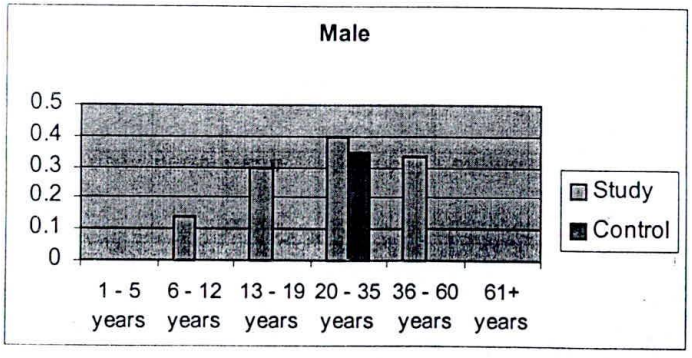
AFTER BRONCHODILATOR:

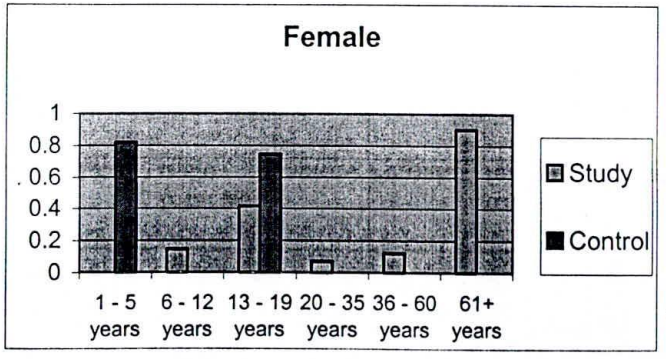
Sr. No.	FEV1	FVC	PEFR	MEFR	Selected
1.					
2.					
3.					
4.					

24. FEV1 _____% of predicted; 25. FVC _____ % of predicted
26. COMMENTS

Appendix 5: List of Charts transcribed into Graphs: Mental disease

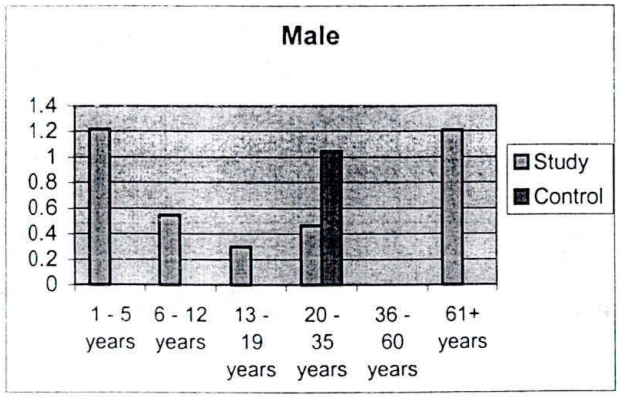
Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	0	493	0	0	487	0	0	116	0	1	122	0.819672
6 - 12 years	1	732	0.1366	1	688	0.145349	0	157	0	0	149	0
13 - 19 years	2	668	0.2994	3	721	0.416089	0	130	0	1	134	0.746269
20 - 35 years	6	1503	0.3992	1	1446	0.069156	1	287	0.348432	0	334	0
36 - 60 years	3	896	0.3348	1	821	0.121803	0	220	0	0	201	0
61+ years	0	248	0	2	222	0.900901	0	56	0	0	43	0

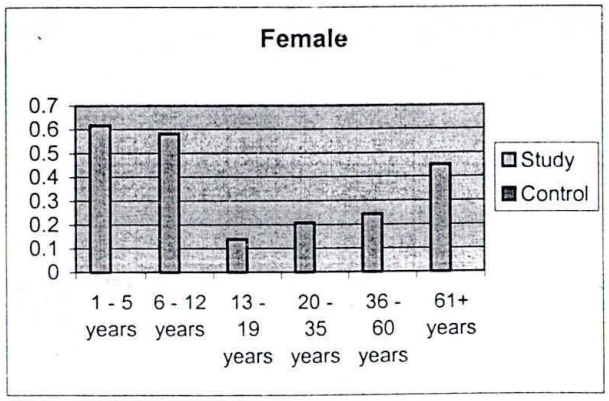




Epilepsy

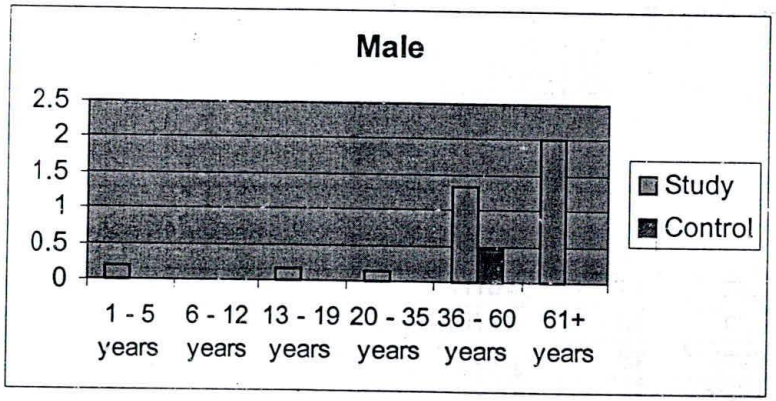
Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	6	493	1.217039	3	487	0.616016	0	116	0	0	122	0
6 - 12 years	4	732	0.546448	4	688	0.581395	0	157	0	0	149	0
13 - 19 years	2	668	0.299401	1	721	0.138696	0	130	0	0	134	0
20 - 35 years	7	1503	0.465735	3	1446	0.207469	3	287	1.0453	0	334	0
36 - 60 years	0	896	0	2	821	0.243605	0	220	0	0	201	0
61+ years	3	248	1.209677	1	222	0.45045	0	56	0	0	43	0

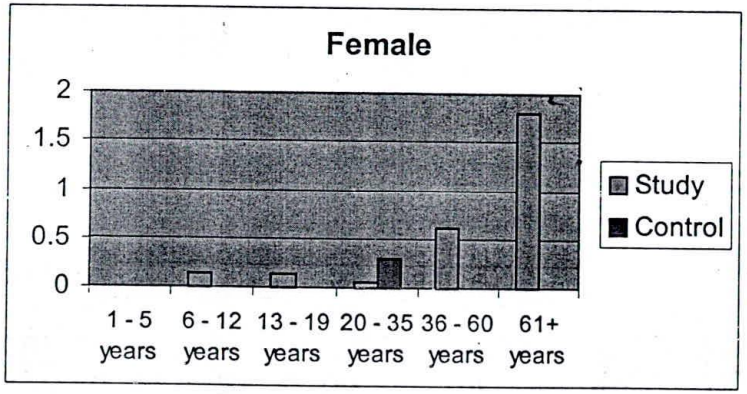




Paralysis:

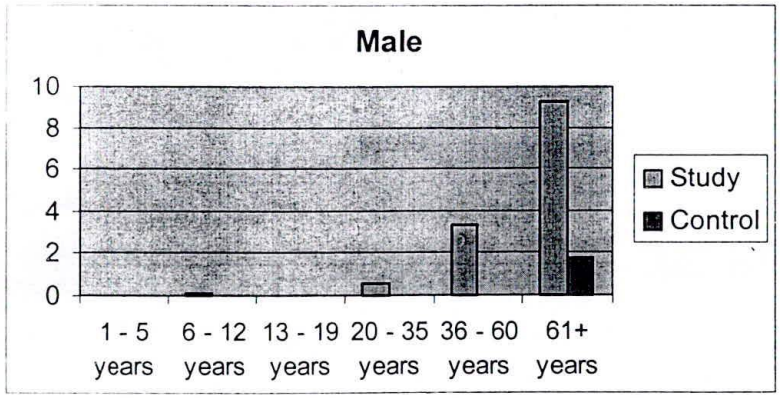
Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	1	493	0.20284	0	487	0	0	116	0	0	122	0
6 - 12 years	0	732	0	1	688	0.145349	0	157	0	0	149	0
13 - 19 years	1	668	0.149701	1	721	0.138696	0	130	0	0	134	0
20 - 35 years	2	1503	0.133067	1	1446	0.069156	0	287	0	1	334	0.299401
36 - 60 years	12	896	1.339286	5	821	0.609013	1	220	0.454545	0	201	0
61+ years	5	248	2.016129	4	222	1.801802	0	56	0	0	43	0

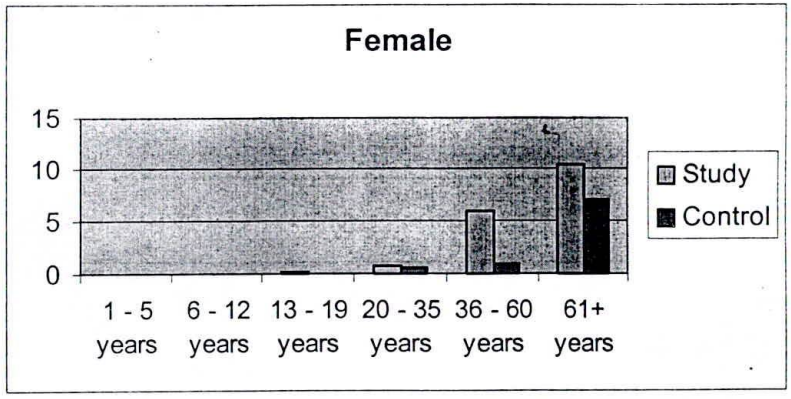




Vision loss:

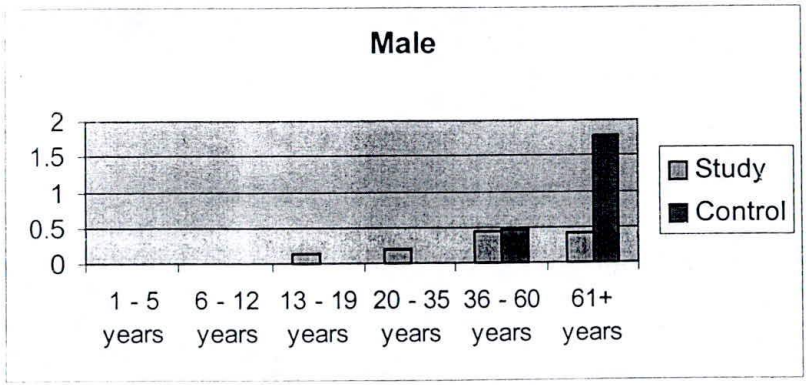
Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	0	493	0	0	487	0	0	116	0	0	122	0
6 - 12 years	1	732	0.136612	0	688	0	0	157	0	0	149	0
13 - 19 years	0	668	0	2	721	0.277393	0	130	0	0	134	0
20 - 35 years	8	1503	0.532269	10	1446	0.691563	0	287	0	2	334	0.598802
36 - 60 years	30	896	3.348214	49	821	5.968331	0	220	0	2	201	0.995025
61+ years	23	248	9.274194	23	222	10.36036	1	56	1.785714	3	43	6.976744

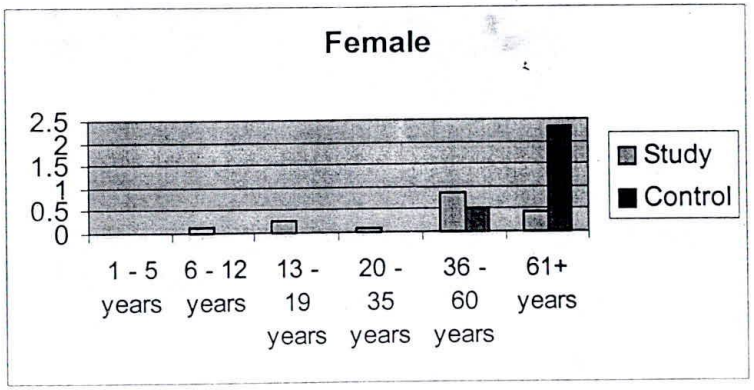




Hearing loss:

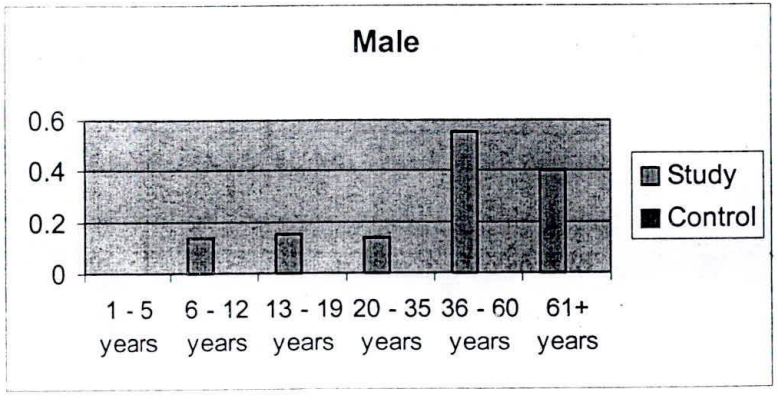
Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	0	493	0	0	487	0	0	116	0	0	122	0
6 - 12 years	0	732	0	1	688	0.145349	0	157	0	0	149	0
13 - 19 years	1	668	0.149701	2	721	0.277393	0	130	0	0	134	0
20 - 35 years	3	1503	0.199601	1	1446	0.069156	0	287	0	0	334	0
36 - 60 years	4	896	0.446429	7	821	0.852619	1	220	0.454545	1	201	0.4975124
61+ years	1	248	0.403226	1	222	0.45045	1	56	1.785714	1	43	2.3255814

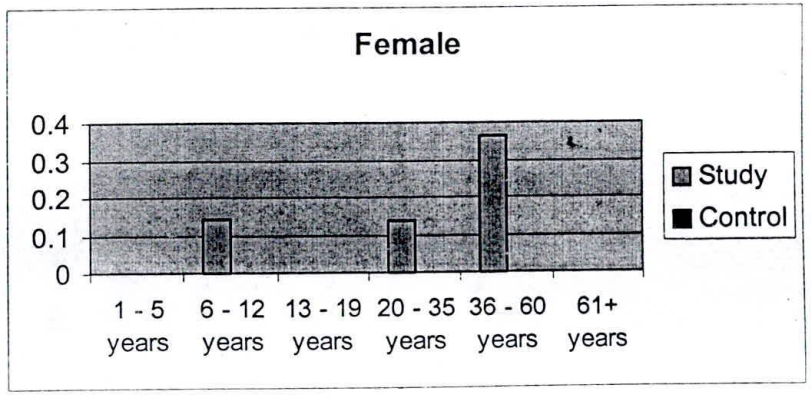




Heart Disease:

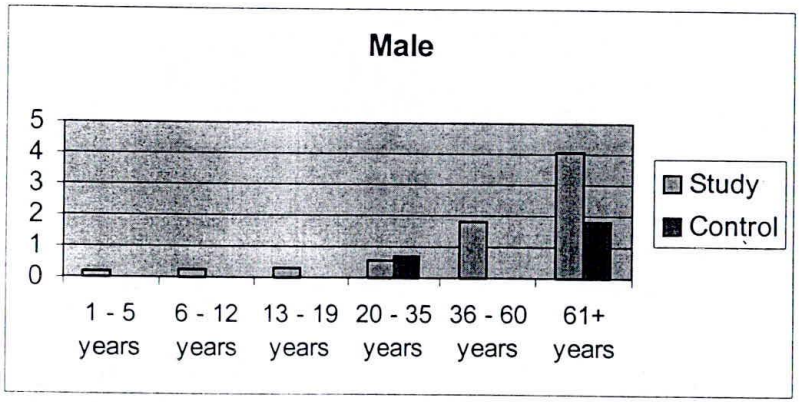
Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	0	493	0	0	487	0	0	116	0	0	122	0
6 - 12 years	1	732	0.136612	1	688	0.145349	0	157	0	0	149	0
13 - 19 years	1	668	0.149701	0	721	0	0	130	0	0	134	0
20 - 35 years	2	1503	0.133067	2	1446	0.138313	0	287	0	0	334	0
36 - 60 years	5	896	0.558036	3	821	0.365408	0	220	0	0	201	0
61+ years	1	248	0.403226	0	222	0	0	56	0	0	43	0

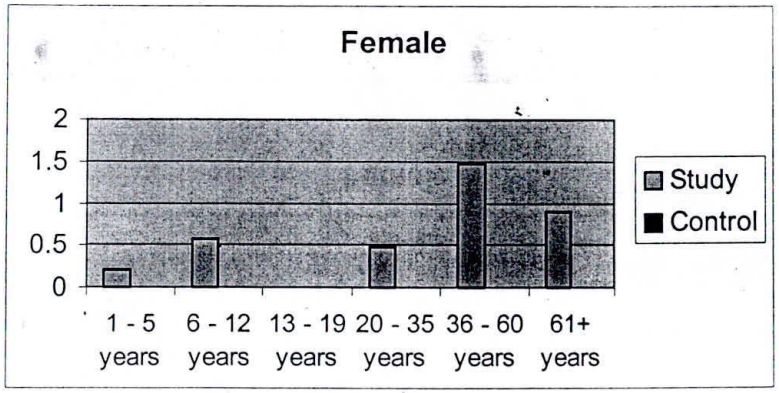




Bronchitis:

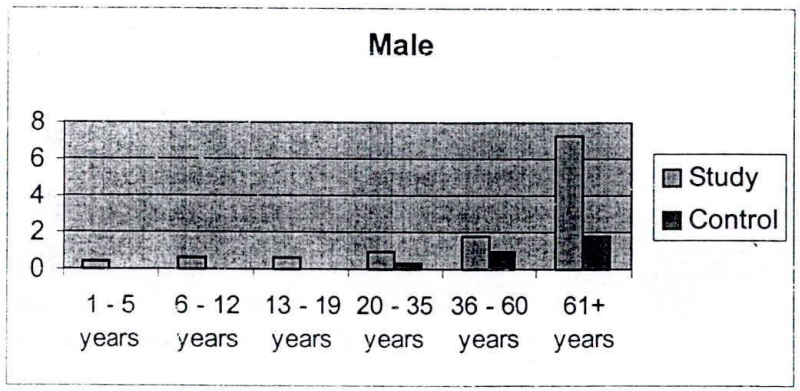
Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	1	493	0.20284	1	487	0.205339	0	116	0	0	122	0
6 - 12 years	2	732	0.273224	4	688	0.581395	0	157	0	0	149	0
13 - 19 years	2	668	0.299401	0	721	0	0	130	0	0	134	0
20 - 35 years	8	1503	0.532269	7	1446	0.484094	2	287	0.696864	0	334	0
36 - 60 years	16	896	1.785714	12	821	1.461632	0	220	0	0	201	0
61+ years	10	248	4.032258	2	222	0.900901	1	56	1.785714	0	43	0

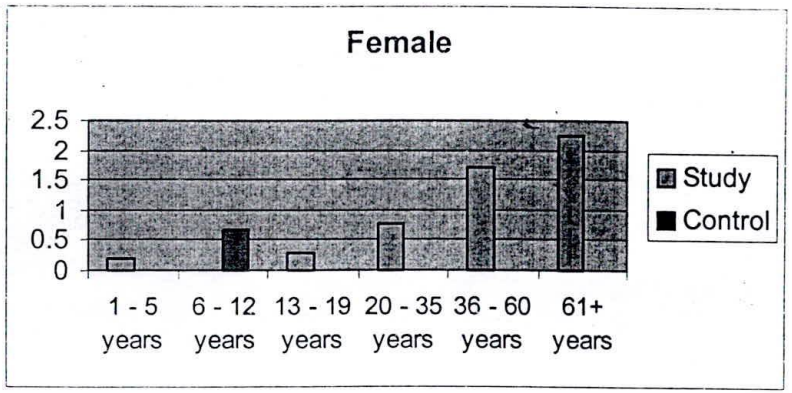




Asthma:

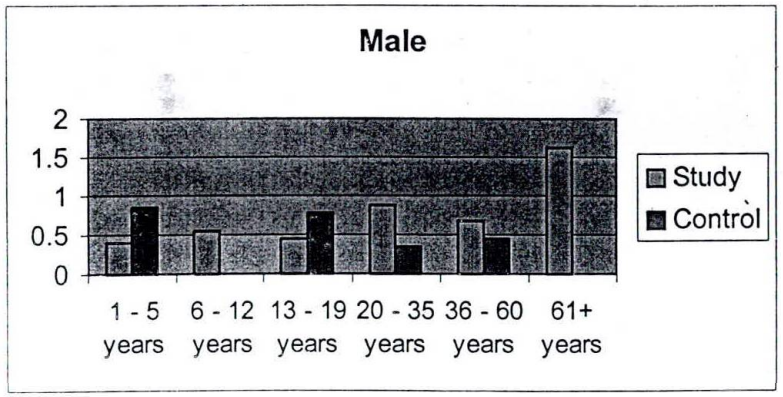
Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	2	493	0.40568	1	487	0.205339	0	116	0	0	122	0
6 - 12 years	5	732	0.68306	0	688	0	0	157	0	1	149	0.671141
13 - 19 years	4	668	0.598802	2	721	0.277393	0	130	0	0	134	0
20 - 35 years	14	1503	0.93147	11	1446	0.760719	1	287	0.348432	0	334	0
36 - 60 years	16	896	1.785714	14	821	1.705238	2	220	0.909091	0	201	0
61+ years	18	248	7.258065	5	222	2.252252	1	56	1.785714	0	43	0

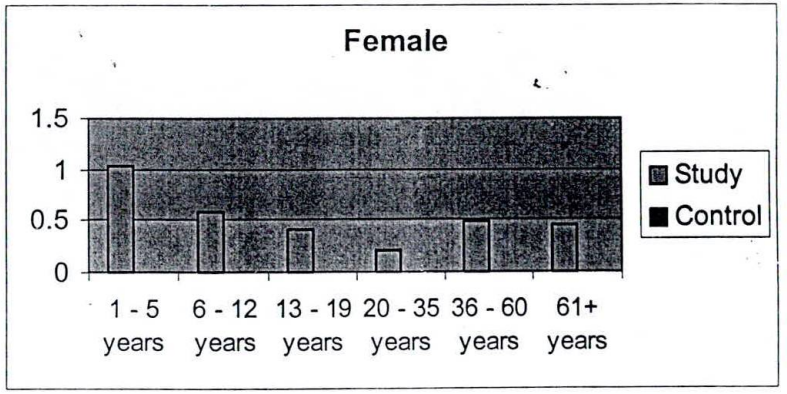




Ailergic Dermatitis:

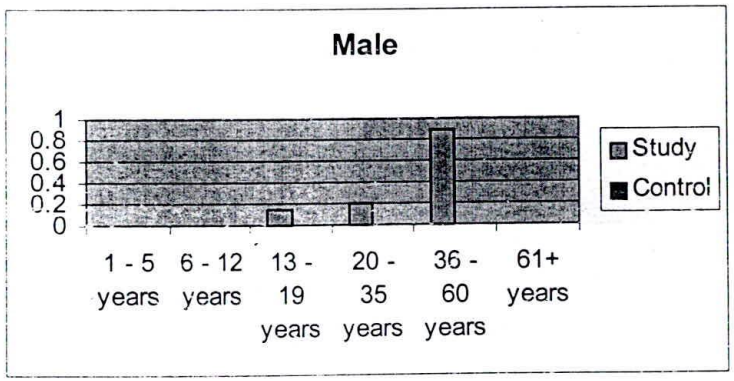
Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	2	493	0.40568	5	487	1.026694	1	116	0.862069	0	122	0
6 - 12 years	4	732	0.546448	4	688	0.581395	0	157	0	0	149	0
13 - 19 years	3	668	0.449102	3	721	0.416089	1	130	0.769231	0	134	0
20 - 35 years	13	1503	0.864937	3	1446	0.207469	1	287	0.348432	0	334	0
36 - 60 years	6	896	0.669643	4	821	0.487211	1	220	0.454545	0	201	0
61+ years	4	248	1.612903	1	222	0.45045	0	56	0	0	43	0

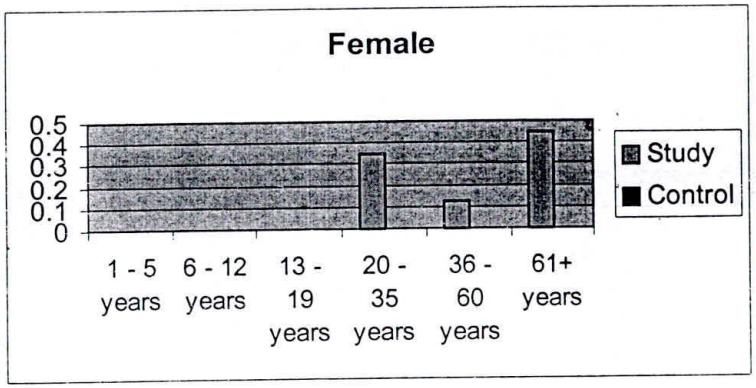




Stomach Ulcers:

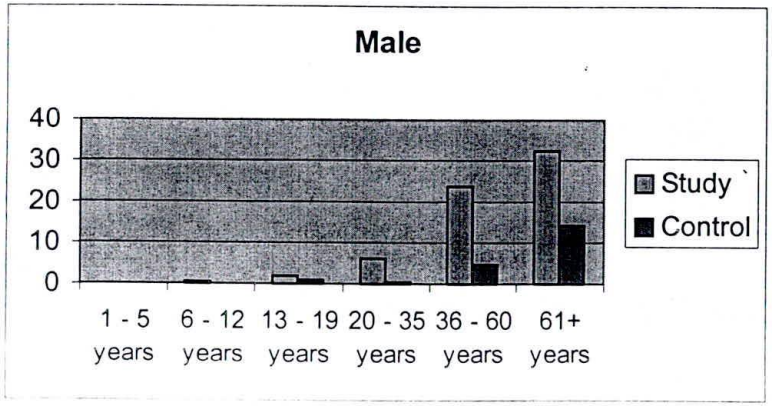
Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	0	493	0	0	487	0	0	116	0	0	122	0
6 - 12 years	0	732	0	0	688	0	0	157	0	0	149	0
13 - 19 years	1	668	0.149701	0	721	0	0	130	0	0	134	0
20 - 35 years	3	1503	0.199601	5	1446	0.345781	0	287	0	0	334	0
36 - 60 years	8	896	0.892857	1	821	0.121803	0	220	0	0	201	0
61+ years	0	248	0	1	222	0.45045	0	56	0	0	43	0

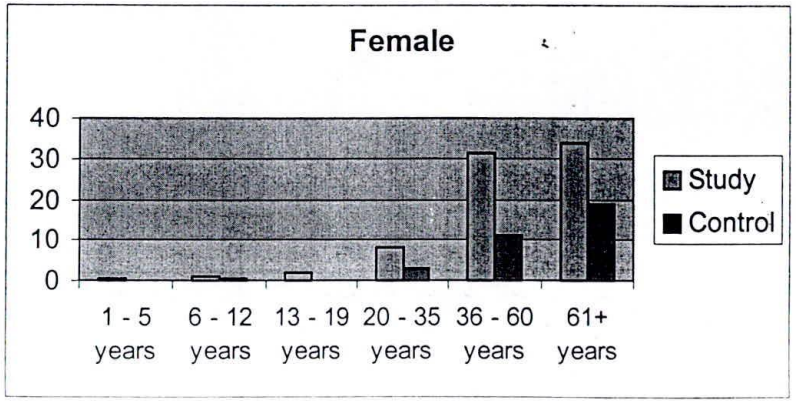




Arthritis:

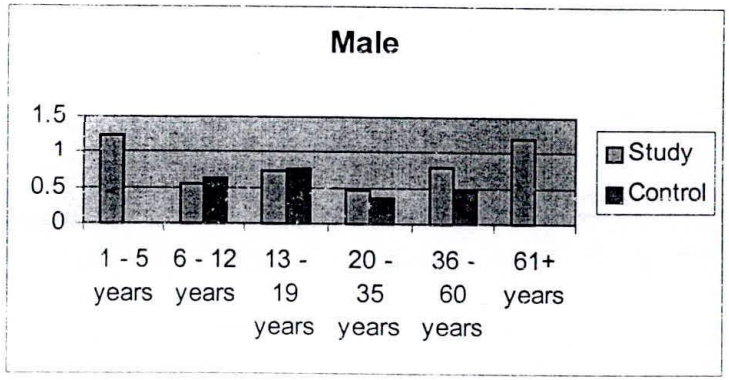
Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	1	493	0.20284	2	487	0.410678	0	116	0	0	122	0
6 - 12 years	5	732	0.68306	7	688	1.017442	0	157	0	1	149	0.671141
13 - 19 years	13	668	1.946108	14	721	1.941748	1	130	0.769231	0	134	0
20 - 35 years	95	1503	6.320692	119	1446	8.229599	2	287	0.696864	9	334	2.694611
36 - 60 years	212	896	23.66071	257	821	31.30329	11	220	5	22	201	10.94527
61+ years	80	248	32.25806	75	222	33.78378	8	56	14.28571	8	43	18.60465

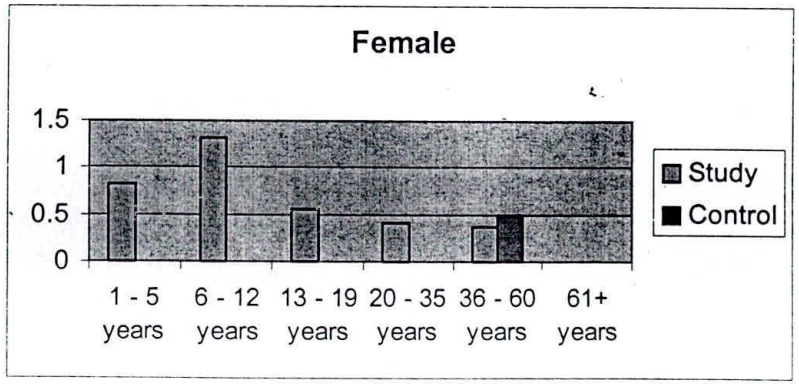




Skin Disease:

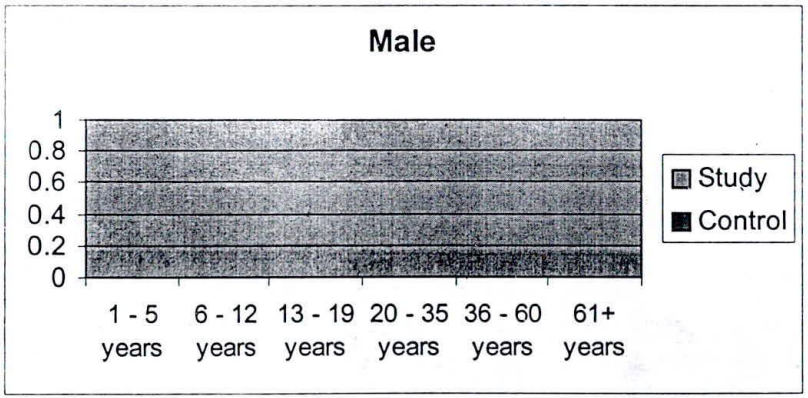
Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	6	493	1.217039	4	487	0.821355	0	116	0	0	122	0
6 - 12 years	4	732	0.546448	9	688	1.30814	1	157	0.636943	0	149	0
13 - 19 years	5	668	0.748503	4	721	0.554785	1	130	0.769231	0	134	0
20 - 35 years	7	1503	0.465735	6	1446	0.414938	1	287	0.348432	0	334	0
36 - 60 years	7	896	0.78125	3	821	0.365408	1	220	0.454545	1	201	0.497512
61+ years	3	248	1.209677	0	222	0	0	56	0	0	43	0

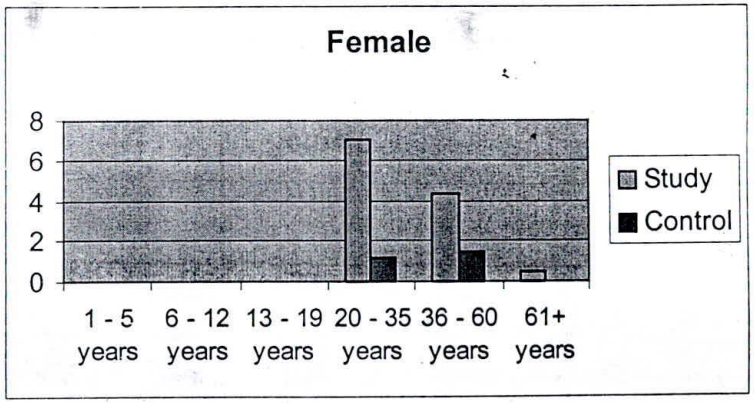




Uterus Removal:

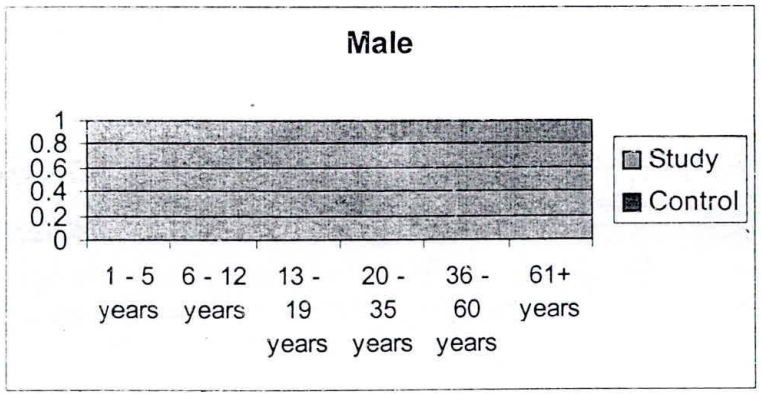
Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	0	493	0	0	487	0	0	116	0	0	122	0
6 - 12 years	0	732	0	0	688	0	0	157	0	0	149	0
13 - 19 years	0	668	0	0	721	0	0	130	0	0	134	0
20 - 35 years	0	1503	0	102	1446	7.053942	0	287	0	4	334	1.197605
36 - 60 years	0	896	0	36	821	4.384896	0	220	0	3	201	1.492537
61+ years	0	248	0	1	222	0.45045	0	56	0	0	43	0

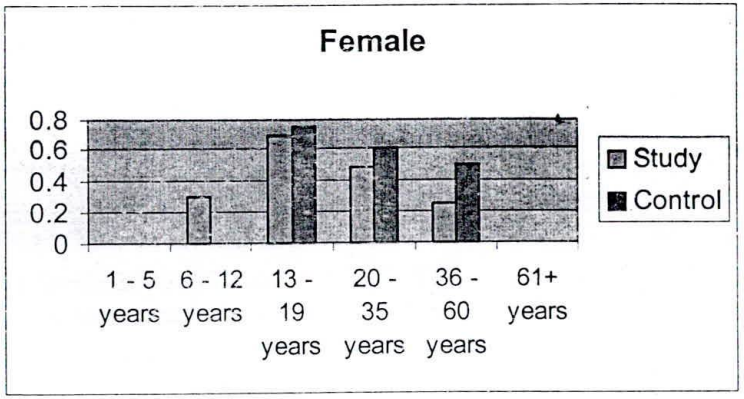




Menstrual Problems:

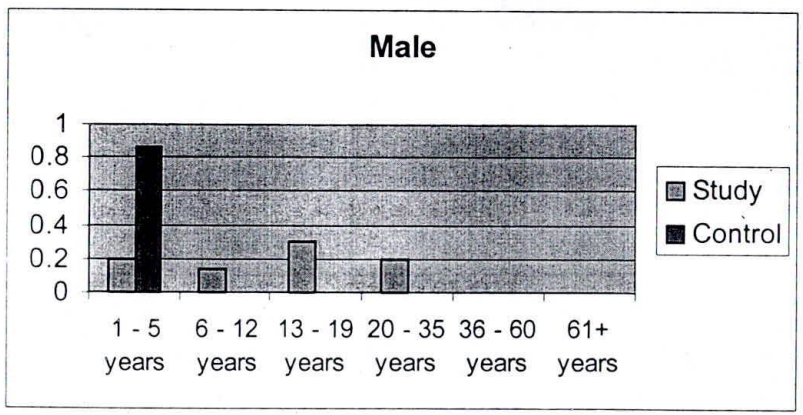
Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	0	493	0	0	487	0	0	116	0	0	122	0
6 - 12 years	0	732	0	2	688	0.290698	0	157	0	0	149	0
13 - 19 years	0	668	0	5	721	0.693481	0	130	0	1	134	0.746269
20 - 35 years	0	1503	0	7	1446	0.484094	0	287	0	2	334	0.598802
36 - 60 years	0	896	0	2	821	0.243605	0	220	0	1	201	0.497512
61+ years	0	248	0	0	222	0	0	56	0	0	43	0

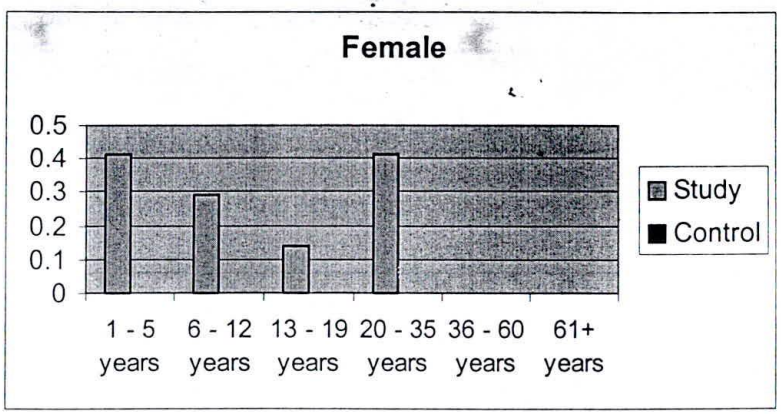




Birth Defects:

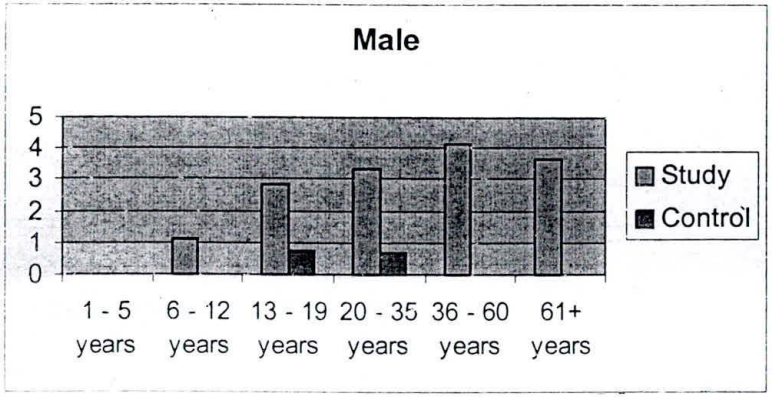
Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	1	493	0.20284	2	487	0.410678	1	116	0.862069	0	122	0
6 - 12 years	1	732	0.136612	2	688	0.290698	0	157	0	0	149	0
13 - 19 years	2	668	0.299401	1	721	0.138696	0	130	0	0	134	0
20 - 35 years	3	1503	0.199601	6	1446	0.414938	0	287	0	0	334	0
36 - 60 years	0	896	0	0	821	0	0	220	0	0	201	0
61+ years	0	248	0	0	222	0	0	56	0	0	43	0

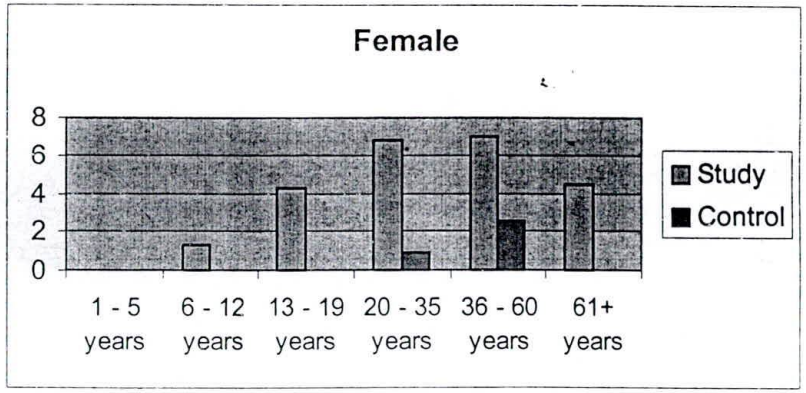




Recurring Headaches:

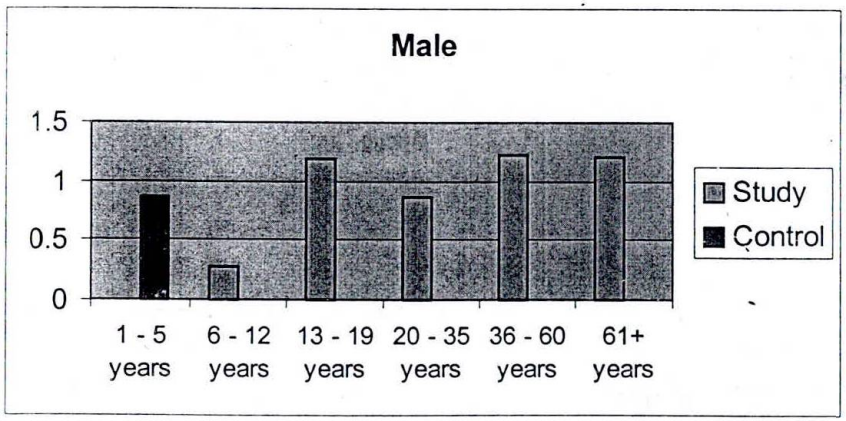
Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	0	493	0	0	487	0	0	116	0	0	122	0
6 - 12 years	8	732	1.092896	9	688	1.30814	0	157	0	0	149	0
13 - 19 years	19	668	2.844311	31	721	4.299584	1	130	0.769231	0	134	0
20 - 35 years	50	1503	3.32668	98	1446	6.777317	2	287	0.696864	3	334	0.898204
36 - 60 years	37	896	4.129464	57	821	6.942753	0	220	0	5	201	2.487562
61+ years	9	248	3.629032	10	222	4.504505	0	56	0	0	43	0

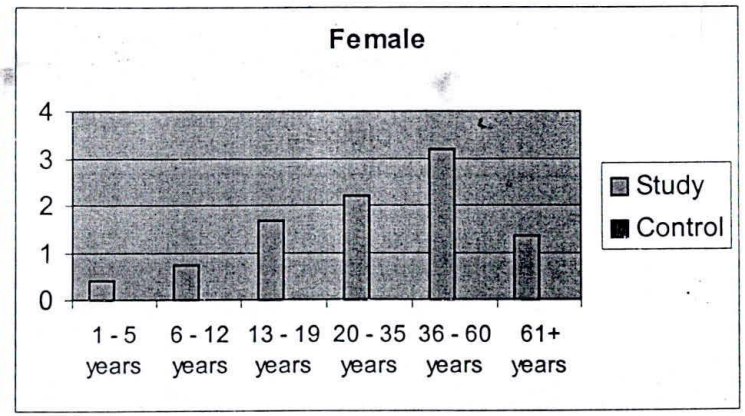




Headache:

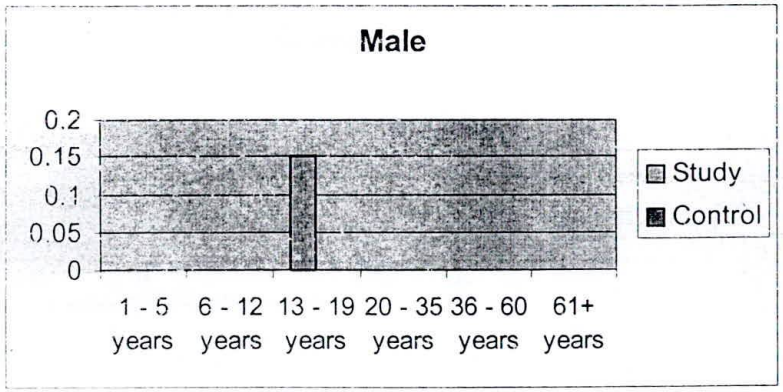
Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	0	493	0	2	487	0.410678	1	116	0.862069	0	122	0
6 - 12 years	2	732	0.273224	5	688	0.726744	0	157	0	0	149	0
13 - 19 years	8	668	1.197605	12	721	1.664355	0	130	0	0	134	0
20 - 35 years	13	1503	0.864937	32	1446	2.213001	0	287	0	0	334	0
36 - 60 years	11	896	1.227679	26	821	3.16687	0	220	0	0	201	0
61+ years	3	248	1.209577	3	222	1.351351	0	56	0	0	43	0

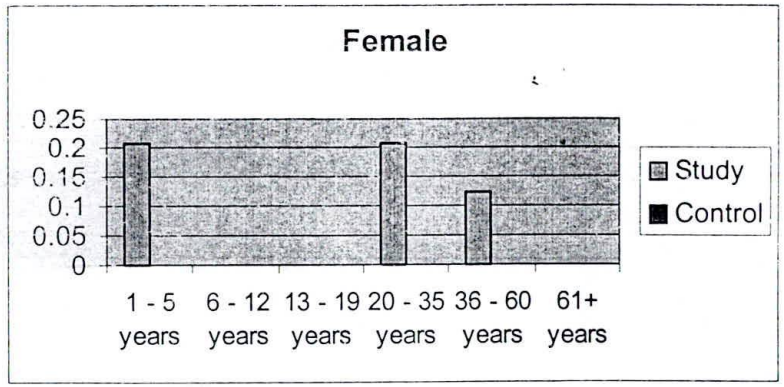




Vomiting Due to Direct Exposure:

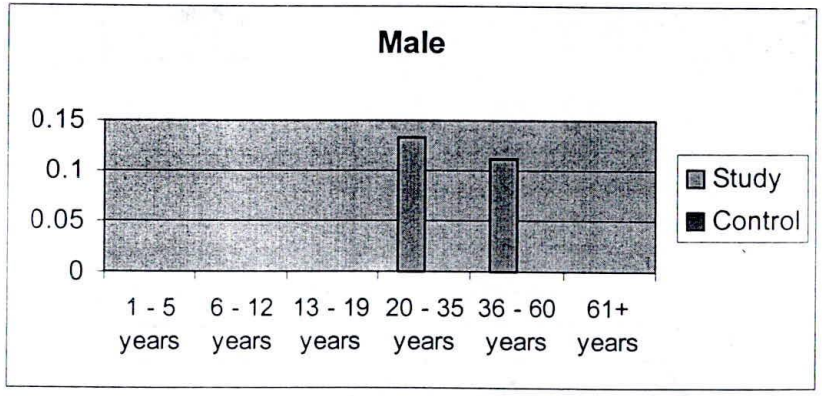
Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	0	493	0	1	487	0.205339	0	116	0	0	122	0
6 - 12 years	0	732	0	0	688	0	0	157	0	0	149	0
13 - 19 years	1	668	0.149701	0	721	0	0	130	0	0	134	0
20 - 35 years	0	1503	0	3	1446	0.207469	0	287	0	0	334	0
36 - 60 years	0	896	0	1	821	0.121803	0	220	0	0	201	0
61+ years	0	248	0	0	222	0	0	56	0	0	43	0

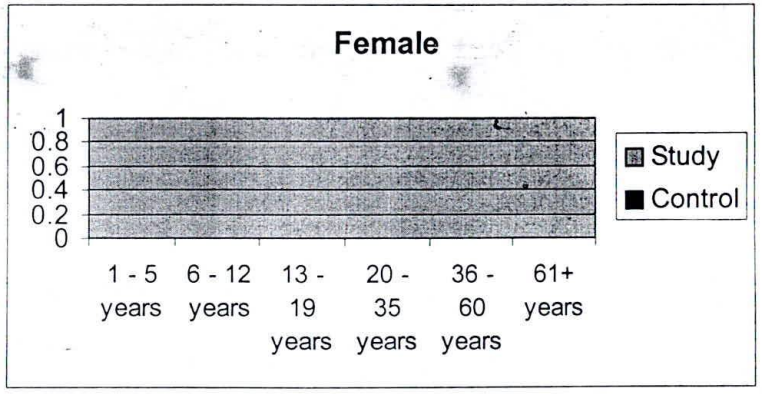




Factory Accident:

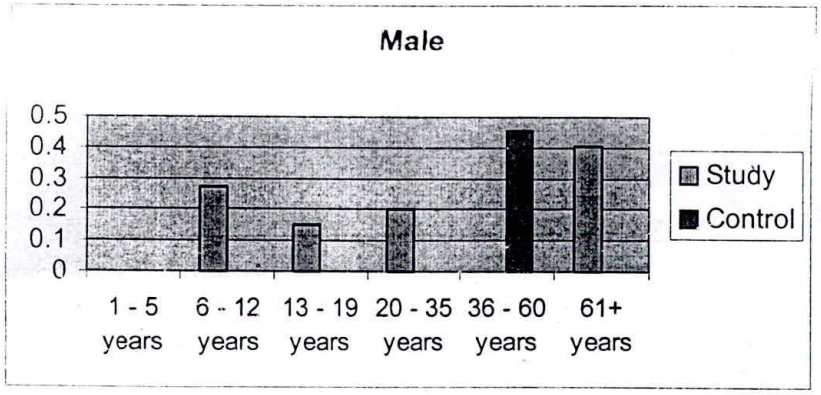
Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	0	493	0	0	487	0	0	116	0	0	122	0
6 - 12 years	0	732	0	0	688	0	0	157	0	0	149	0
13 - 19 years	0	668	0	0	721	0	0	130	0	0	134	0
20 - 35 years	2	1503	0.133067	0	1446	0	0	287	0	0	334	0
36 - 60 years	1	896	0.111607	0	821	0	0	220	0	0	201	0
61+ years	0	248	0	0	222	0	0	56	0	0	43	0

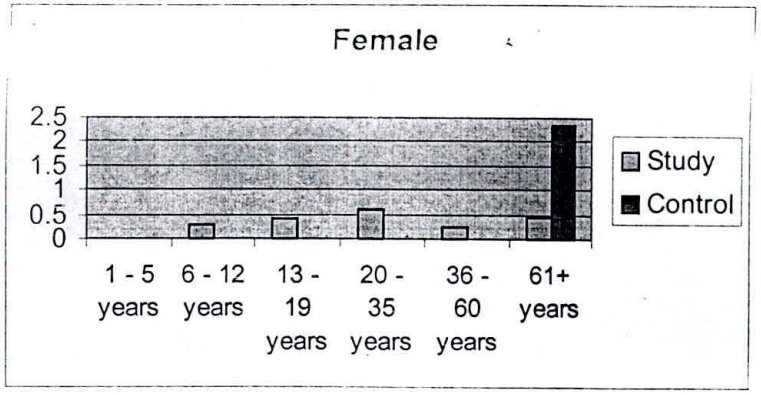




Anaemia:

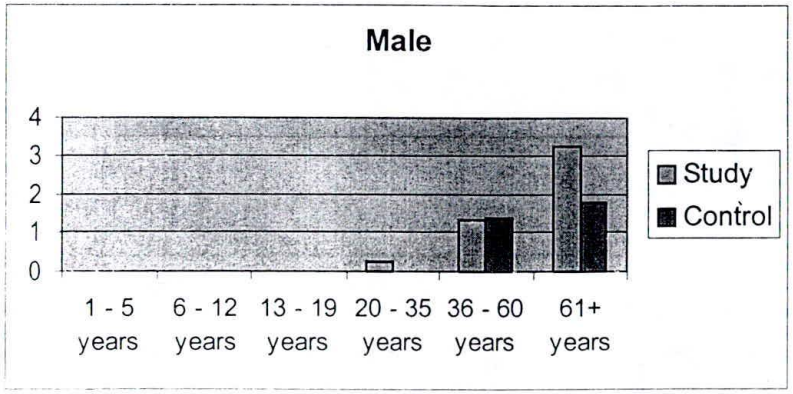
Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	0	493	0	0	487	0	0	116	0	0	122	0
6 - 12 years	2	732	0.273224	2	688	0.290698	0	157	0	0	149	0
13 - 19 years	1	668	0.149701	3	721	0.416089	0	130	0	0	134	0
20 - 35 years	3	1503	0.199601	9	1446	0.622407	0	287	0	0	334	0
36 - 60 years	0	896	0	2	821	0.243605	1	220	0.454545	0	201	0
61+ years	1	248	0.403226	1	222	0.45045	0	56	0	1	43	2.325581

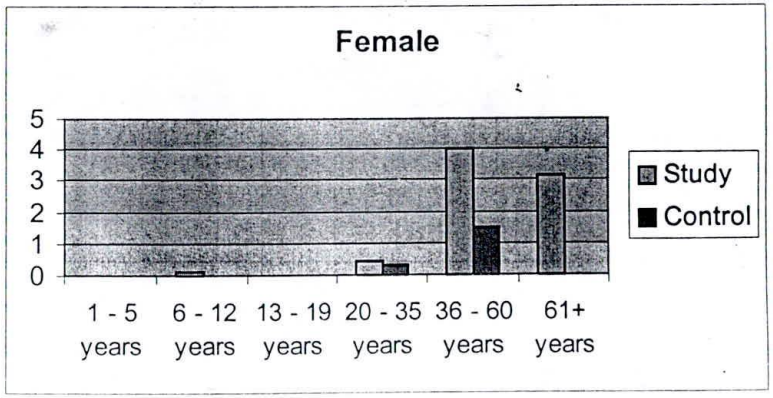




High Blood Pressure:

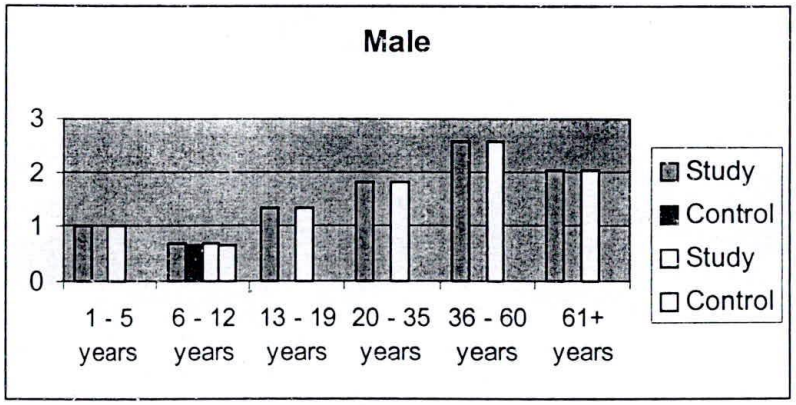
Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	0	493	0	0	487	0	0	116	0	0	122	0
6 - 12 years	0	732	0	1	688	0.145349	0	157	0	0	149	0
13 - 19 years	0	668	0	0	721	0	0	130	0	0	134	0
20 - 35 years	4	1503	0.266134	6	1446	0.414938	0	287	0	1	334	0.299401
36 - 60 years	12	896	1.339286	33	821	4.019488	3	220	1.363636	3	201	1.492537
61+ years	8	248	3.225806	7	222	3.153153	1	56	1.785714	0	43	0

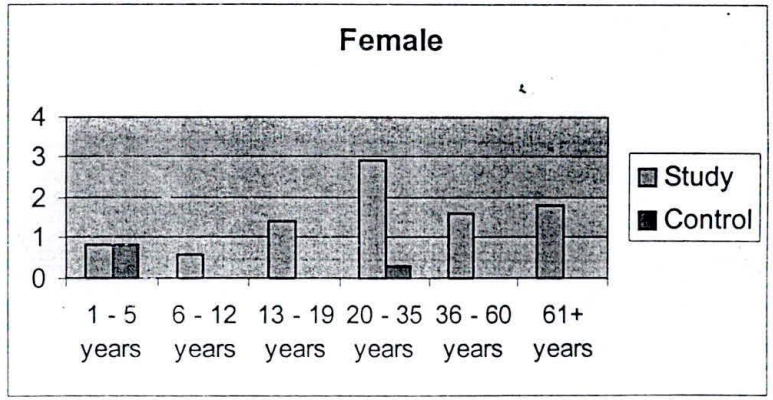




Weakness:

Age Group	Male	total pop male	male%	Female	total pop female	female%	Male	total pop male	male%	Female	total pop female	female%
1 - 5 years	5	493	1.014199	4	487	0.821355	0	116	0	1	122	0.819672
6 - 12 years	5	732	0.68306	4	688	0.581395	1	157	0.636943	0	149	0
13 - 19 years	9	668	1.347305	10	721	1.386963	0	130	0	0	134	0
20 - 35 years	27	1503	1.796407	42	1446	2.904564	0	287	0	1	334	0.299401
36 - 60 years	23	896	2.566964	13	821	1.583435	0	220	0	0	201	0
61+ years	5	248	2.016129	4	222	1.801802	0	56	0	0	43	0

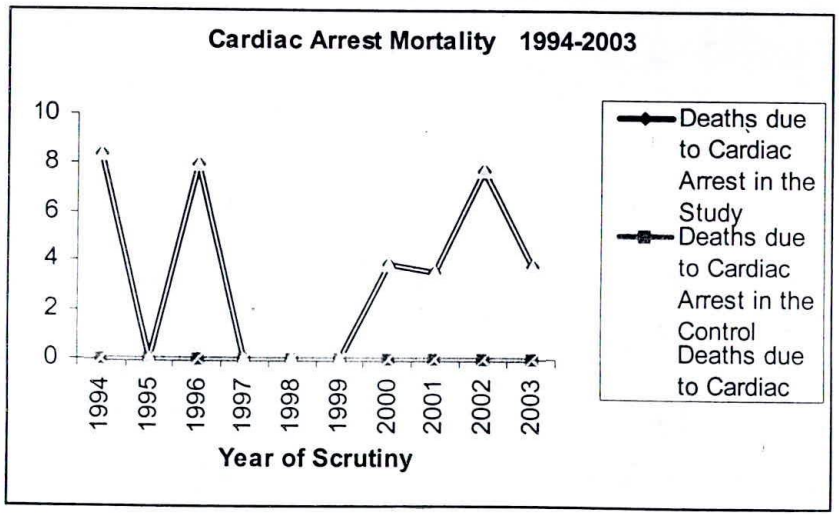




Bronchitis Mortality

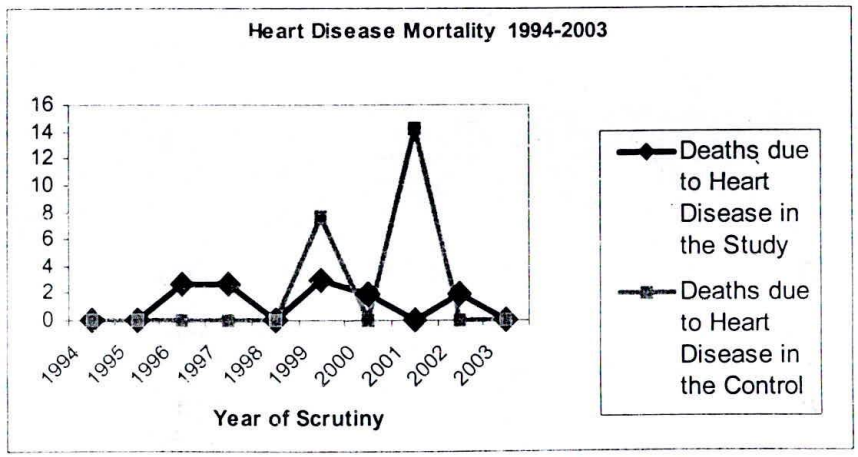
Cardiac Arrest Mortality Graph

Year of Death	Study	Total dec. popn.	Percentage	Control	Total dec. popn.	Percentage
1994	1	12	8.33333333	0	9	0
1995	0	18	0	0	2	0
1996	3	38	7.89473684	0	8	0
1997	0	37	0	0	6	0
1998	0	43	0	0	5	0
1999	0	34	0	0	13	0
2000	2	52	3.84615385	0	7	0
2001	1	28	3.57142857	0	7	0
2002	4	52	7.69230769	0	15	0
2003	2	53	3.77358491	0	9	0



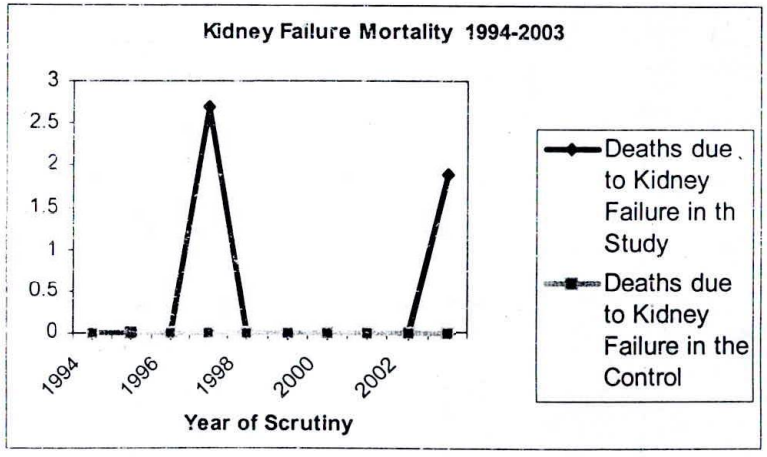
Heart Disease Mortality Graph

Year of Death	Study	Total dec. popn.	Percentage	Control	Total dec. popn.	Percentage
1994	0	12	0	0	9	0
1995	0	18	0	0	2	0
1996	1	38	2.63157895	0	8	0
1997	1	37	2.7027027	0	6	0
1998	0	43	0	0	5	0
1999	1	34	2.94117647	1	13	7.69230769
2000	1	52	1.92307692	0	7	0
2001	0	28	0	1	7	14.2857143
2002	1	52	1.92307692	0	15	0
2003	0	53	0	0	9	0



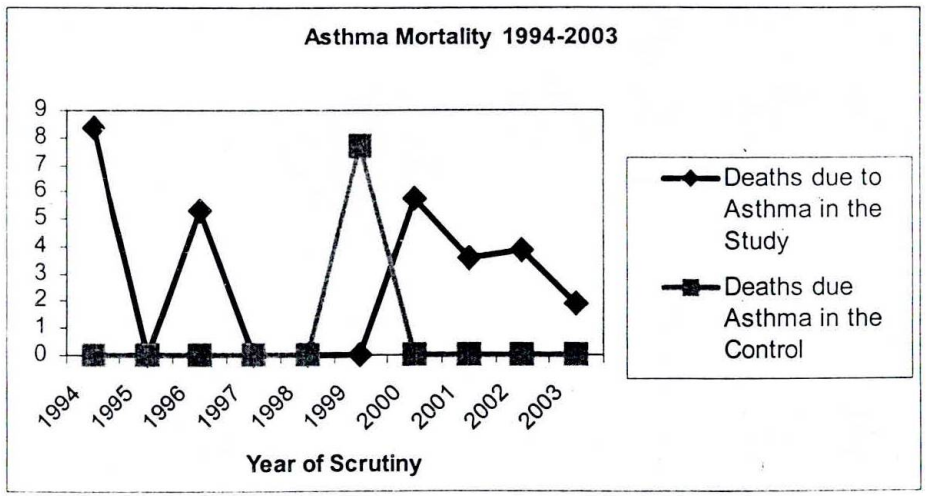
Kidney Failure Mortality Graph

Year of Death	Study	Total dec. popn.	Percentage	Control	Total dec. popn.	Percentage
1994	0	12	0	0	9	0
1995	0	18	0	0	2	0
1996	0	38	0	0	8	0
1997	1	37	2.7027027	0	6	0
1998	0	43	0	0	5	0
1999	0	34	0	0	13	0
2000	0	52	0	0	7	0
2001	0	28	0	0	7	0
2002	0	52	0	0	15	0
2003	1	53	1.88679245	0	9	0



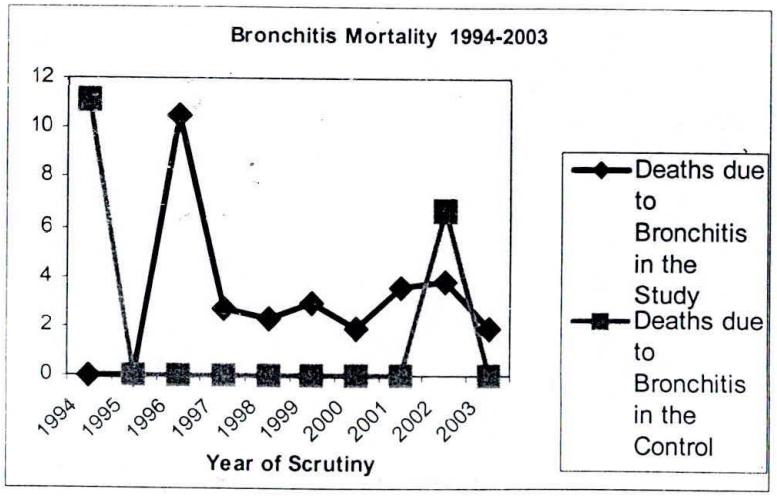
Asthma Mortality Graph

Year of Death	Study	Total dec. popn.	Percentage	Control	Total dec. popn.	Percentage
1994	1	12	8.33333333	0	9	0
1995	0	18	0	0	2	0
1996	2	38	5.26315789	0	8	0
1997	0	37	0	0	6	0
1998	0	43	0	0	5	0
1999	0	34	0	1	13	7.69230769
2000	3	52	5.76923077	0	7	0
2001	1	28	3.57142857	0	7	0
2002	2	52	3.84615385	0	15	0
2003	1	53	1.88679245	0	9	0



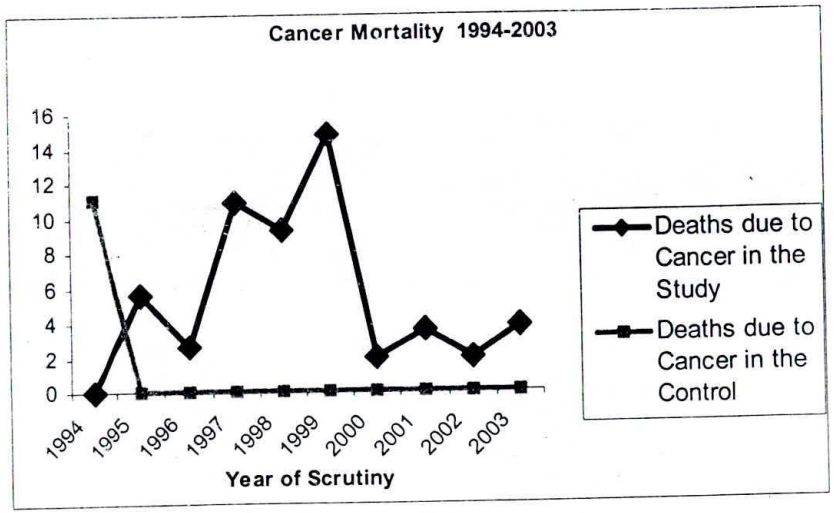
Bronchitis Mortality Graph

Year of Death	Study	Total dec. popn.	Percentage	Control	Total dec. popn.	Percentage
1994	0	12	0	1	9	11.1111111
1995	0	18	0	0	2	0
1996	4	38	10.5263158	0	8	0
1997	1	37	2.7027027	0	6	0
1998	1	43	2.3255814	0	5	0
1999	1	34	2.94117647	0	13	0
2000	1	52	1.92307692	0	7	0
2001	1	28	3.57142857	0	7	0
2002	2	52	3.84615385	1	15	6.66666667
2003	1	53	1.88679245	0	9	0



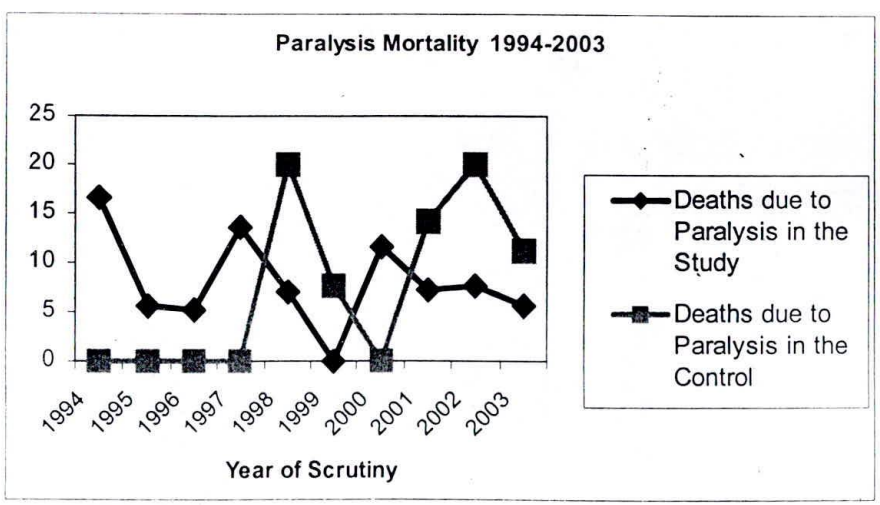
Cancer Mortality Graph

Year of Death	Study	Total dec. popn.	Percentage	Control	Total dec. popn.	Percentage
1994	0	12	0	1	9	11.1111111
1995	1	18	5.55555556	0	2	0
1996	1	38	2.63157895	0	8	0
1997	4	37	10.8108108	0	6	0
1998	4	43	9.30232558	0	5	0
1999	5	34	14.7058824	0	13	0
2000	1	52	1.92307692	0	7	0
2001	1	28	3.57142857	0	7	0
2002	1	52	1.92307692	0	15	0
2003	2	53	3.77358491	0	9	0



Paralysis and Paralytic Strokes Mortality Graph

Year of Death	Study	Total dec. popn.	Percentage	Control	Total dec. popn.	Percentage
1994	2	12	16.6666667	0	9	0
1995	1	18	5.55555556	0	2	0
1996	2	38	5.26315789	0	8	0
1997	5	37	13.5135135	0	6	0
1998	3	43	6.97674419	1	5	20
1999	0	34	0	1	13	7.69230769
2000	6	52	11.5384615	0	7	0
2001	2	28	7.14285714	1	7	14.2857143
2002	4	52	7.69230769	3	15	20
2003	3	53	5.66037736	1	9	11.1111111



High Blood Pressure Mortality Graph

Year of Death	Study	Total dec. popn.	Percentage	Control	Total dec. popn.	Percentage
1994	0	12	0	0	9	0
1995	1	18	5.55555556	0	2	0
1996	0	38	0	0	8	0
1997	1	37	2.7027027	0	6	0
1998	0	43	0	0	5	0
1999	0	34	0	0	13	0
2000	2	52	3.84615385	0	7	0
2001	0	28	0	0	7	0
2002	0	52	0	1	15	6.66666667
2003	0	53	0	0	9	0

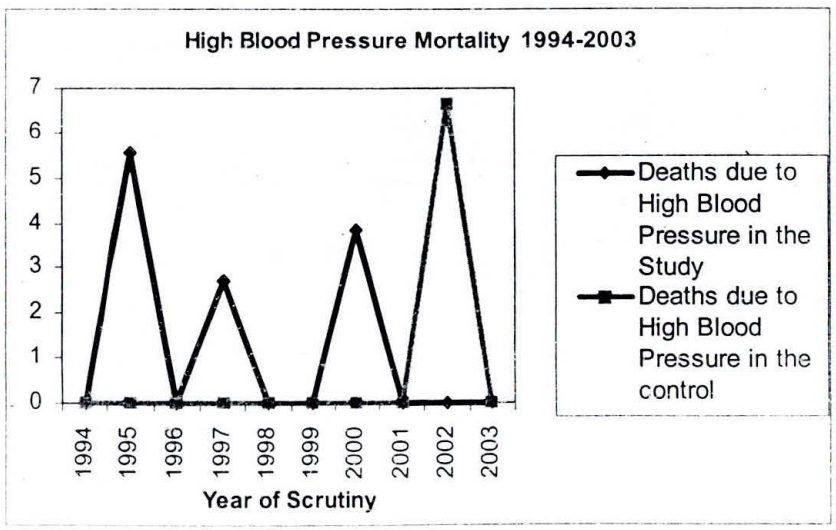
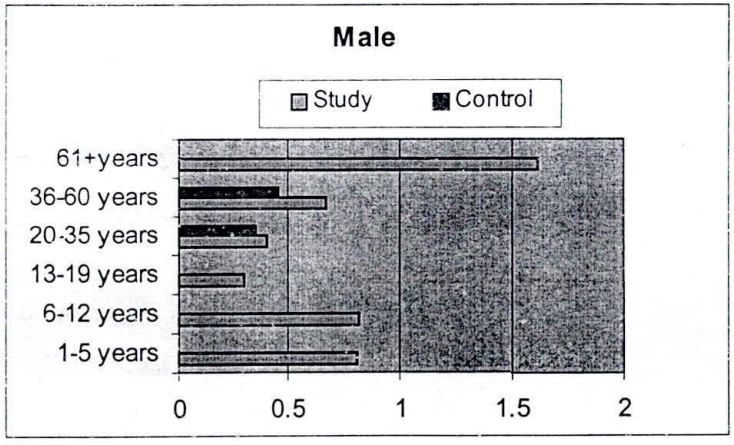
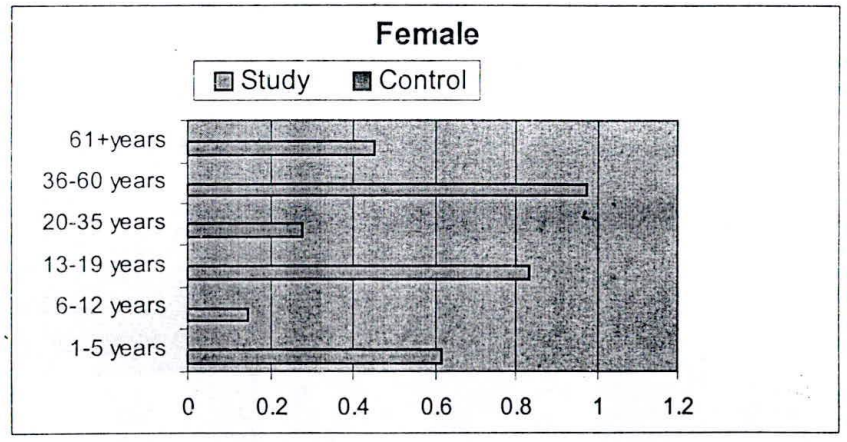


CHART - 1: Certain Infectious and parasitic diseases - Chapter 1 ICD-10 (International Classification of Diseases)

	Male	Total		Female-	Total		Male	Total		Female-	Total	

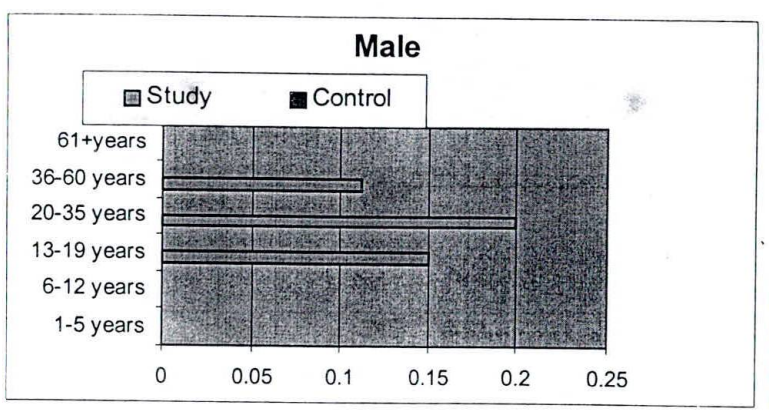
Age Group	Study Affected	Population-Male	% Male	Study Affected	Population-Female	% Female	Control Affected	Population-Male	% Male	Control Affected	Population-Female	% Female
1-5 years	4	493	0.81136	3	487	0.6160164	0	116	0	0	122	0
6-12 years	6	732	0.81967	1	688	0.1453488	0	157	0	0	149	0
13-19 years	2	668	0.2994	6	721	0.8321775	0	130	0	0	134	0
20-35 years	6	1503	0.3992	4	1446	0.2766252	1	287	0.34843	0	334	0
36-60 years	6	896	0.66964	8	821	0.9744214	1	220	0.45455	0	201	0
61+years	4	248	1.6129	1	222	0.4504505	0	56	0	0	43	0

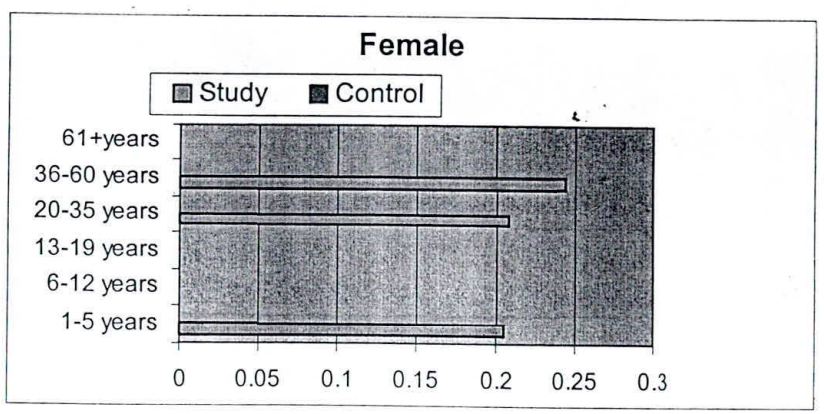




Neoplasms - Chapter 2 ICD - 10 (International Classification of Diseases)

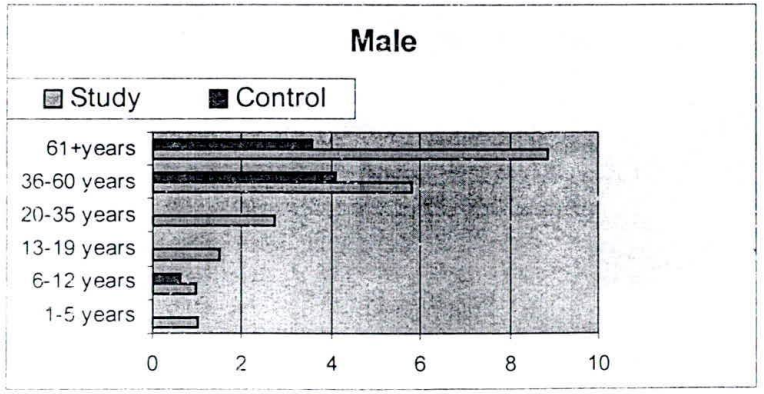
Age Group	Male Study Affected	Total Population-Male	% Male	Female-Study Affected	Total Population-Female	% Female	Male Control Affected	Total Population-Male	% Male	Female-Control Affected	Total Population-Female	% Female
1-5 years	0	493	0	1	487	0.2053388	0	116	0	0	122	0
6-12 years	0	732	0	0	688	0	0	157	0	0	149	0
13-19 years	1	668	0.1497	0	721	0	0	130	0	0	134	0
20-35 years	3	1503	0.1996	3	1446	0.2074689	0	287	0	0	334	0
36-60 years	1	896	0.11161	2	821	0.2436054	0	220	0	0	201	0
61+years	0	248	0	0	222	0	0	56	0	0	43	0

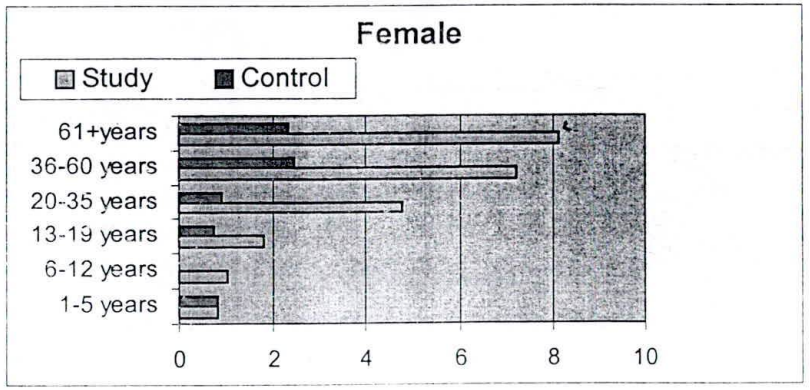




Diseases of blood and blood forming organs and certain disorders - Chapter 3 ICD - 110 (International Classification of Diseases)

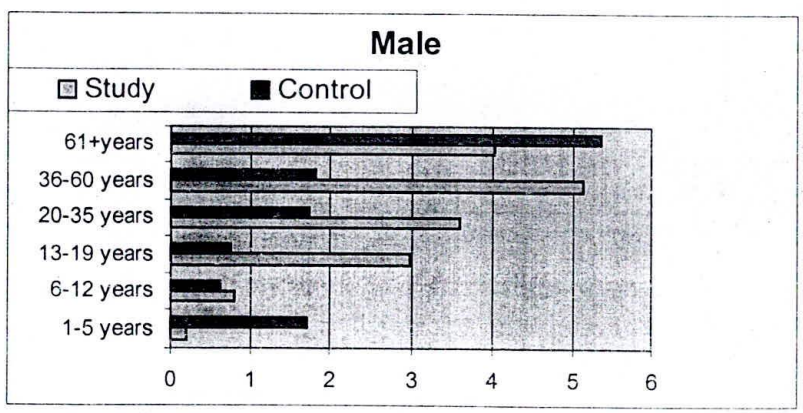
Age Group	Male Study Affected	Total Population-Male	% Male	Female-Study Affected	Total Population-Female	% Female	Male Control Affected	Total Population-Male	% Male	Female-Control Affected	Total Population-Female	% Female
1-5 years	5	493	1.0142	4	487	0.8213552	0	116	0	1	122	0.8196721
6-12 years	7	732	0.9563	7	688	1.0174419	1	157	0.6369	0	149	0
13-19 years	10	668	1.497	13	721	1.8030513	0	130	0	1	134	0.7462687
20-35 years	41	1503	2.7279	69	1446	4.7717842	0	287	0	3	334	0.8982036
36-60 years	52	896	5.8036	59	821	7.1863581	9	220	4.0909	5	201	2.4875622
61+years	22	248	8.871	18	222	8.1081081	2	56	3.5714	1	43	2.3255814

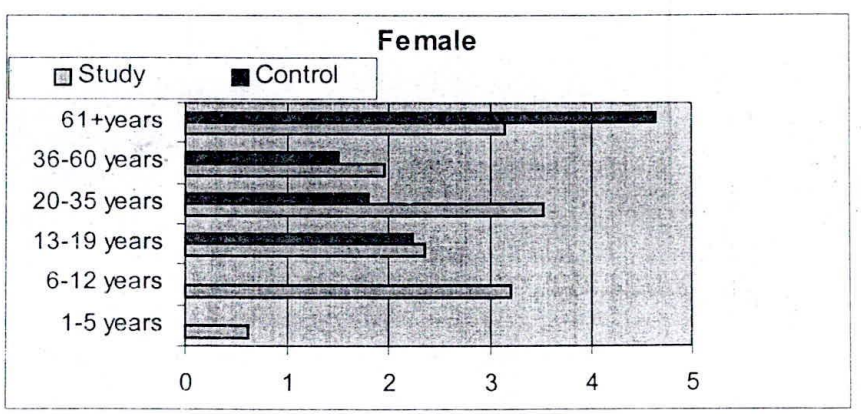




Endocrine, nutritional and metabolic diseases - Chapter 4 ICD 10 (International Classification of Diseases)

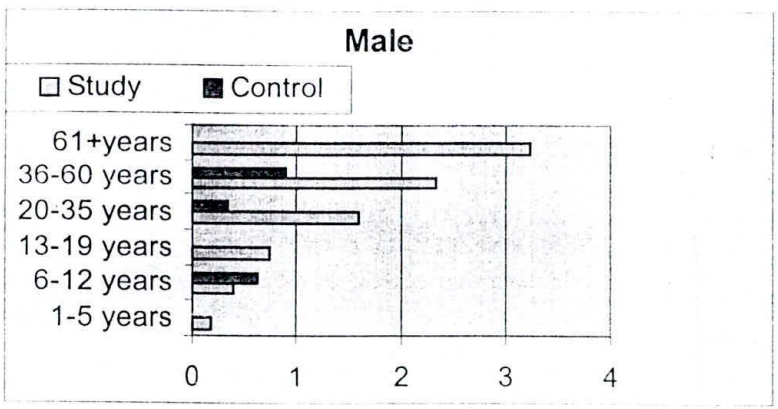
Age Group	Male Study Affected	Total Population-Male	% Male	Female-Study Affected	Total Population-Female	% Female	Male Control Affected	Total Population-Male	% Male	Female-Control Affected	Total Population-Female	% Female
1-5 years	1	493	0.20284	3	487	0.6160164	2	116	1.72414	0	122	0
6-12 years	6	732	0.81967	22	688	3.1976744	1	157	0.63694	0	149	0
13-19 years	20	668	2.99401	17	721	2.3578363	1	130	0.76923	3	134	2.238806
20-35 years	54	1503	3.59281	51	1446	3.526971	5	287	1.74216	6	334	1.7964072
36-60 years	46	896	5.13393	16	821	1.9488429	4	220	1.81818	3	201	1.4925373
61+years	10	248	4.03226	7	222	3.1531532	3	56	5.35714	2	43	4.6511628

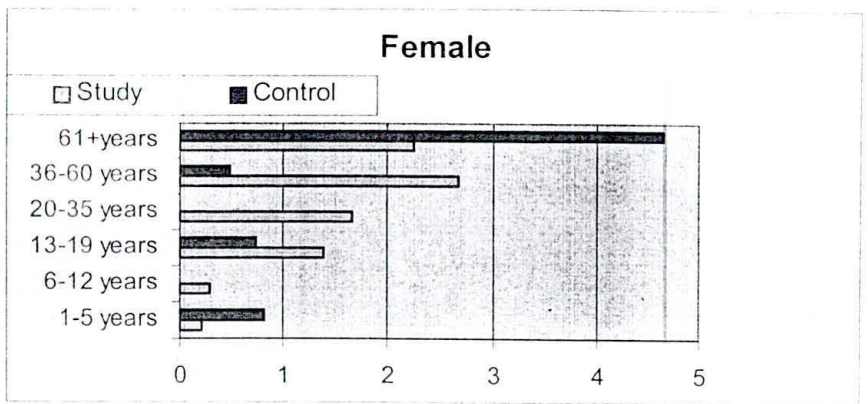




Mental and behavioural disorders - Chapter 5 ICD - 10 (International Classification of Diseases)

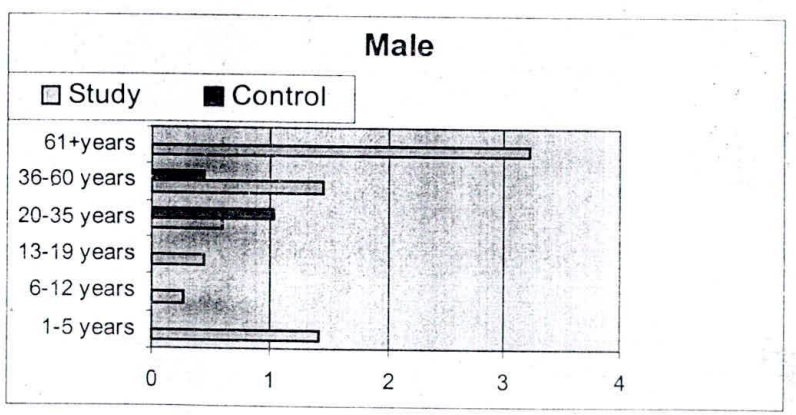
Age Group	Male Study Affected	Total Population-Male	% Male	Female-Study Affected	Total Population-Female	% Female	Male Control Affected	Total Population-Male	% Male	Female-Control Affected	Total Population-Female	% Female
1-5 years	1	493	0.2028	1	487	0.2053388	0	116	0	1	122	0.8196721
6-12 years	3	732	0.4098	2	688	0.2906977	1	157	0.63694	0	149	0
13-19 years	5	668	0.7485	10	721	1.3869626	0	130	0	1	134	0.7462687
20-35 years	24	1503	1.5968	24	1446	1.659751	1	287	0.34843	0	334	0
36-60 years	21	896	2.3438	22	821	2.679659	2	220	0.90909	1	201	0.4975124
61+years	8	248	3.2258	5	222	2.2522523	0	56	0	2	43	4.6511628

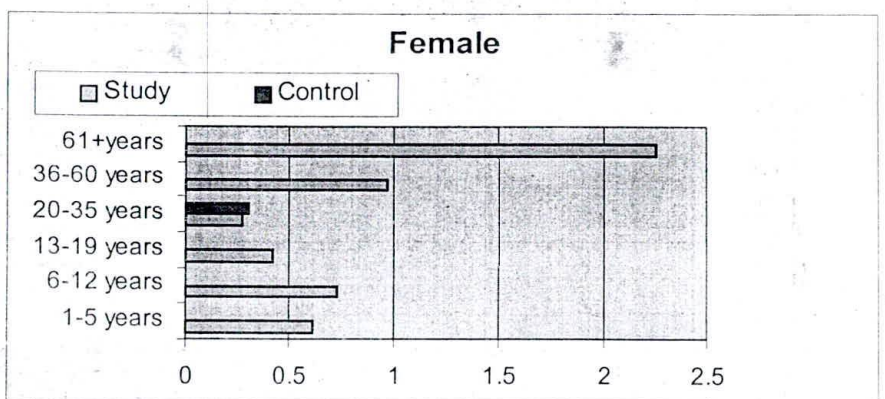




Diseases of the nervous system Chapter 6 ICD - 10 (International Classification of Diseases)

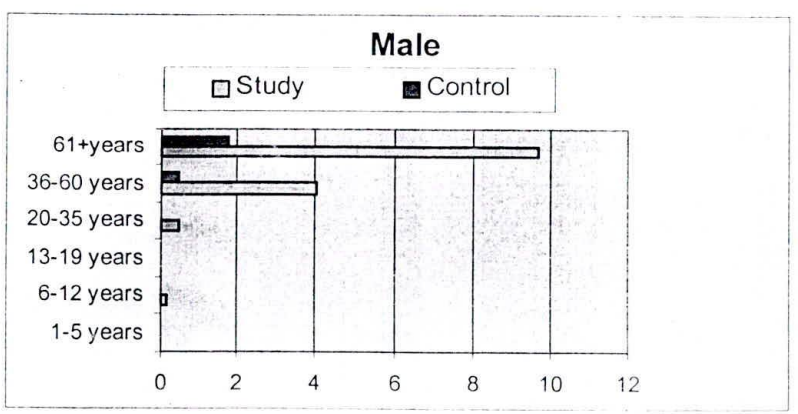
Age Group	Male Study Affected	Total Population-Male	% Male	Female-Study Affected	Total Population-Female	% Female	Male Control Affected	Total Population-Male	% Male	Female-Control Affected	Total Population-Female	% Female
1-5 years	7	493	1.41988	3	487	0.6160164	0	116	0	0	122	0
6-12 years	2	732	0.27322	5	688	0.7267442	0	157	0	0	149	0
13-19 years	3	668	0.4491	3	721	0.4160888	0	130	0	0	134	0
20-35 years	9	1503	0.5988	4	1446	0.2766252	3	287	1.0453	1	334	0.2994012
36-60 years	13	896	1.45089	8	821	0.9744214	1	220	0.4545	0	201	0
61+years	8	248	3.22581	5	222	2.2522523	0	56	0	0	43	0

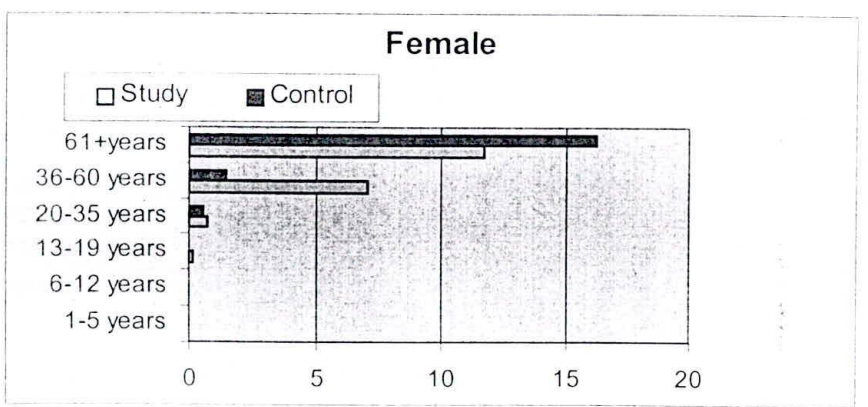




Diseases the eye and adnexa - Chapter 7 ICD - 10 (International Classification of Diseases)

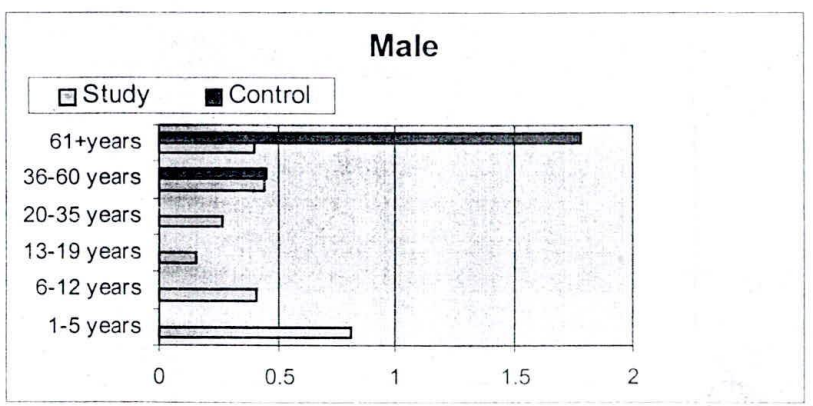
Age Group	Male Study Affected	Total Population-Male	% Male	Female-Study Affected	Total Population-Female	% Female	Male Control Affected	Total Population-Male	% Male	Female-Control Affected	Total Population-Female	% Female
1-5 years	0	493	0	0	487	0	0	116	0	0	122	0
6-12 years	1	732	0.1366	0	688	0	0	157	0	0	149	0
13-19 years	0	668	0	1	721	0.1386963	0	130	0	0	134	0
20-35 years	7	1503	0.4657	11	1446	0.7607192	0	287	0	2	334	0.5988024
36-60 years	36	896	4.0179	58	821	7.0645554	1	220	0.45455	3	201	1.4925373
61+years	24	248	9.6774	26	222	11.711712	1	56	1.78571	7	43	16.27907

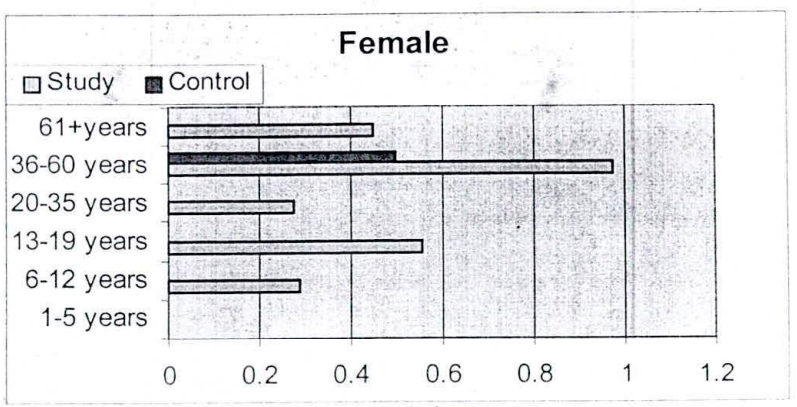




Diseases of the ear and mastoid process - Chapter 8 (International Classification of Diseases)

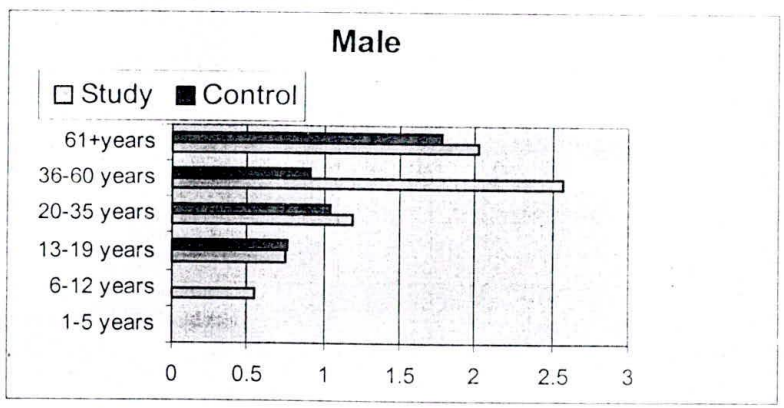
Age Group	Male Study Affected	Total Population-Male	% Male	Female-Study Affected	Total Population-Female	% Female	Male Control Affected	Total Population-Male	% Male	Female-Control Affected	Total Population-Female	% Female
1-5 years	4	493	0.81136	0	487	0	0	116	0	0	122	0
6-12 years	3	732	0.40984	2	688	0.2906977	0	157	0	0	149	0
13-19 years	1	668	0.1497	4	721	0.554785	0	130	0	0	134	0
20-35 years	4	1503	0.26613	4	1446	0.2766252	0	287	0	0	334	0
36-60 years	4	896	0.44643	8	821	0.9744214	1	220	0.45455	1	201	0.4975124
61+years	1	248	0.40323	1	222	0.4504505	1	56	1.78571	0	43	0

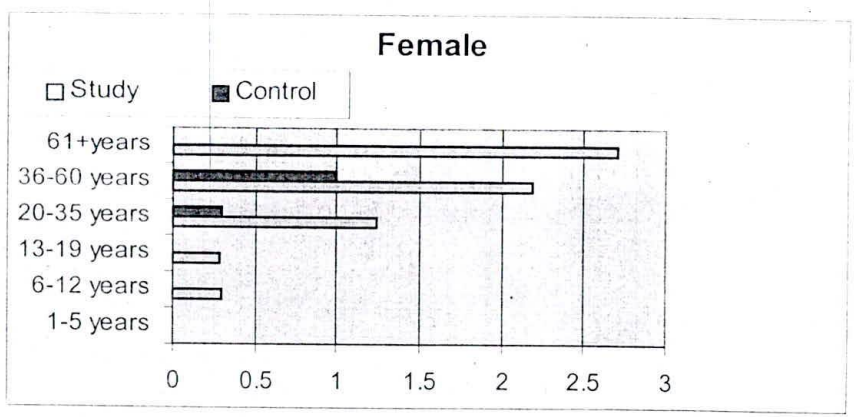




Diseases of the circulatory system - Chapter 9 ICD - 10 (International Classification of Diseases)

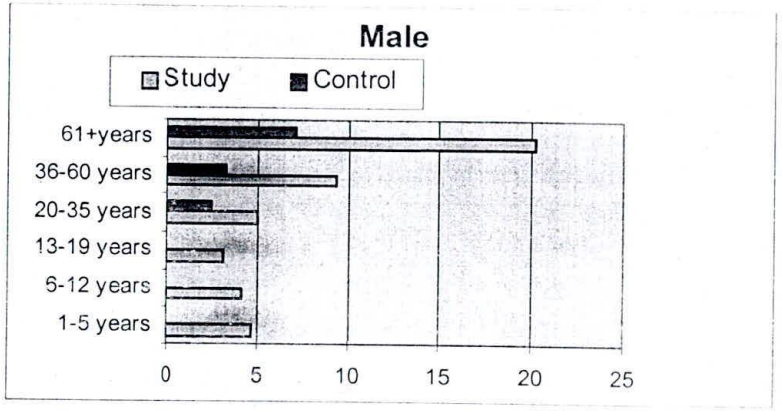
Age Group	Male Study Affected	Total Population-Male	% Male	Female-Study Affected	Total Population-Female	% Female	Male Control Affected	Total Population-Male	% Male	Female-Control Affected	Total Population-Female	% Female
1-5 years	0	493	0	0	487	0	0	116	0	0	122	0
6-12 years	4	732	0.5464	2	688	0.2906977	0	157	0	0	149	0
13-19 years	5	668	0.7485	2	721	0.2773925	1	130	0.76923	0	134	0
20-35 years	18	1503	1.1976	18	1446	1.2448133	3	287	1.0453	1	334	0.2994012
36-60 years	23	896	2.567	18	821	2.1924482	2	220	0.90909	2	201	0.9950249
61+years	5	248	2.0161	6	222	2.7027027	1	56	1.78571	0	43	0

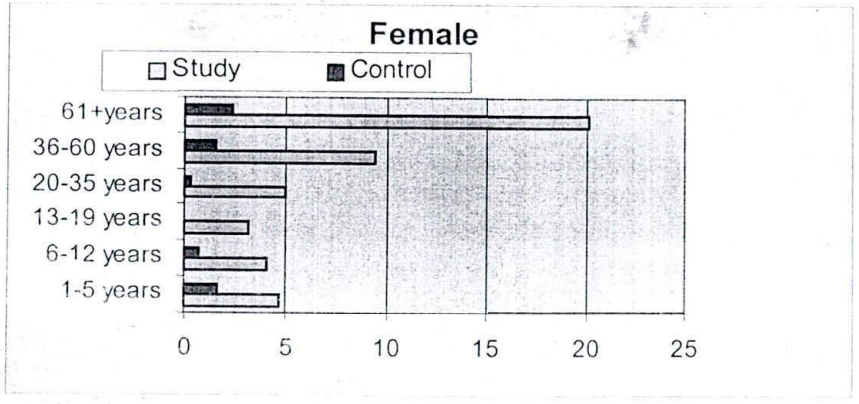




Diseases of the respiratory system Chapter 10 ICD - 10 (International Classification of Diseases)

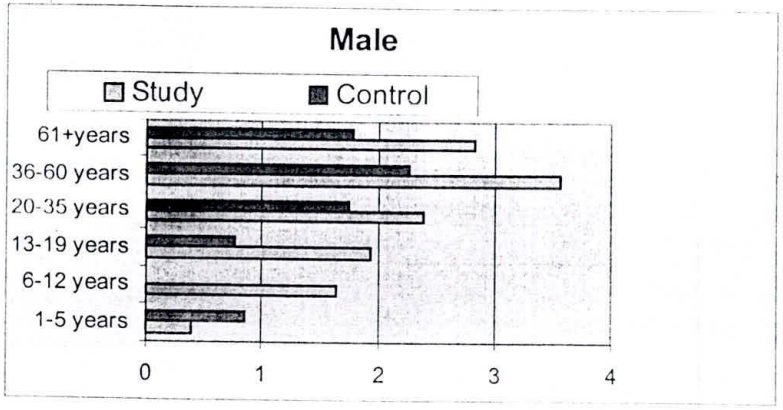
Age Group	Male Study Affected	Total Population-Male	% Male	Female-Study Affected	Total Population-Female	% Female	Male Control Affected	Total Population-Male	% Male	Female-Control Affected	Total Population-Female	% Female
1-5 years	23	493	4.66531	24	487	4.9281314	0	116	0	2	122	1.6393443
6-12 years	30	732	4.09836	24	688	3.4883721	0	157	0	1	149	0.6711409
13-19 years	21	668	3.14371	12	721	1.6643551	0	130	0	0	134	0
20-35 years	75	1503	4.99002	49	1446	3.3886584	7	287	2.43902	1	334	0.2994012
36-60 years	84	896	9.375	50	821	6.090134	7	220	3.18182	3	201	1.4925373
61+years	50	248	20.1613	12	222	5.4054054	4	56	7.14286	1	43	2.3255814

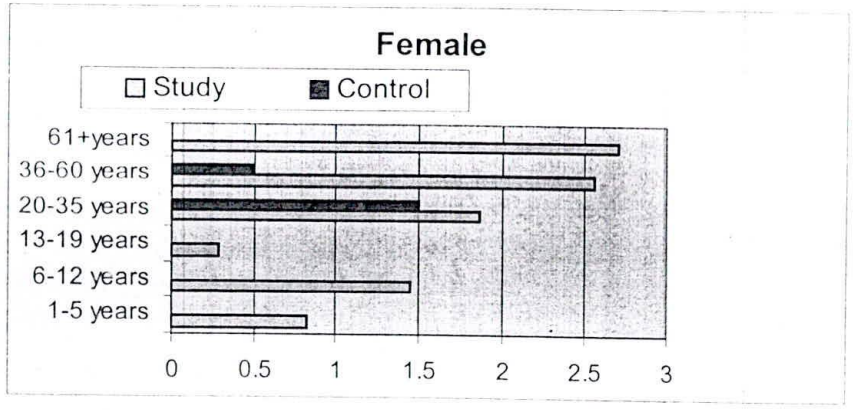




Diseases of the digestive system - Chapter 11 ICD - 10 (International Classification of Diseases)

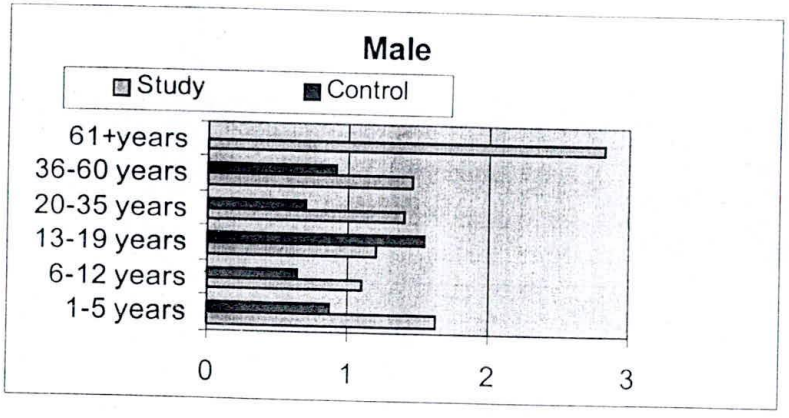
Age Group	Male Study Affected	Total Population-Male	% Male	Female-Study Affected	Total Population-Female	% Female	Male Control Affected	Total Population-Male	% Male	Female-Control Affected	Total Population-Female	% Female
1-5 years	2	493	0.4057	4	487	0.8213552	1	116	0.86207	0	122	0
6-12 years	12	732	1.6393	10	688	1.4534884	0	157	0	0	149	0
13-19 years	13	668	1.9461	2	721	0.2773925	1	130	0.76923	0	134	0
20-35 years	36	1503	2.3952	27	1446	1.8672199	5	287	1.74216	5	334	1.497006
36-60 years	32	896	3.5714	21	821	2.5578563	5	220	2.27273	1	201	0.4975124
61+years	7	248	2.8226	6	222	2.7027027	1	56	1.78571	0	43	0

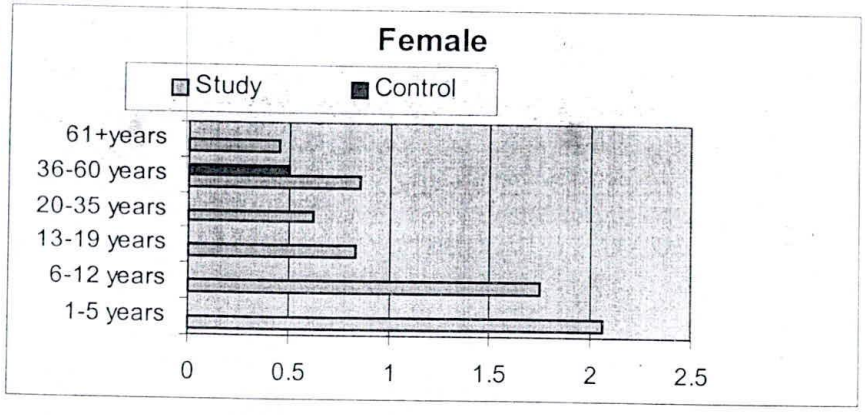




Diseases of the skin and subcutaneous tissue - Chapter 12 ICD - 10 (International Classification of Diseases)

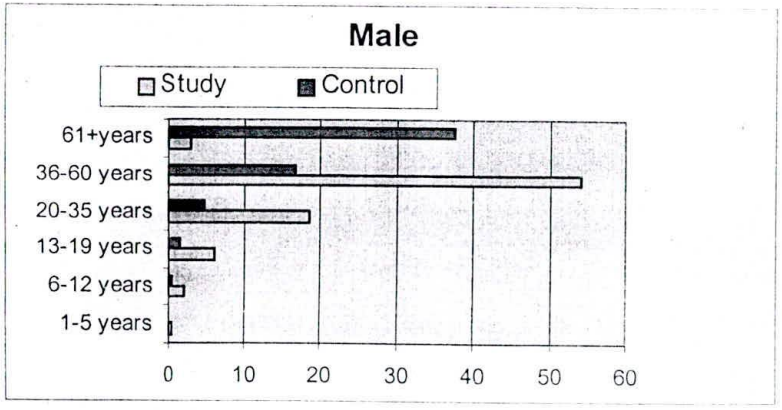
Age Group	Male Study Affected	Total Population-Male	% Male	Female-Study Affected	Total Population-Female	% Female	Male Control Affected	Total Population-Male	% Male	Female-Control Affected	Total Population-Female	% Female
1-5 years	8	493	1.62272	10	487	2.0533881	1	116	0.86207	0	122	0
6-12 years	8	732	1.0929	12	688	1.744186	1	157	0.63694	0	149	0
13-19 years	8	668	1.1976	6	721	0.8321775	2	130	1.53846	0	134	0
20-35 years	21	1503	1.39721	9	1446	0.6224066	2	287	0.69686	0	334	0
36-60 years	13	896	1.45089	7	821	0.8526188	2	220	0.90909	1	201	0.4975124
61+years	7	248	2.82258	1	222	0.4504505	0	56	0	0	43	0

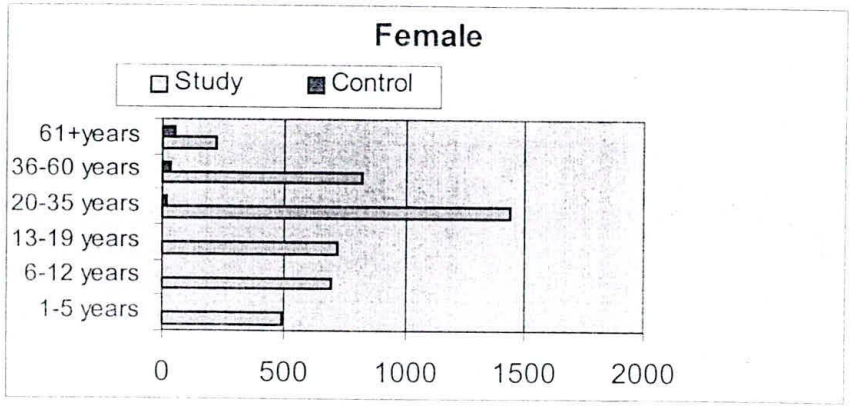




Diseases of the muscoskeletal system and connective tissue Chapter 13 ICD - 10 (International Classification of Diseases)

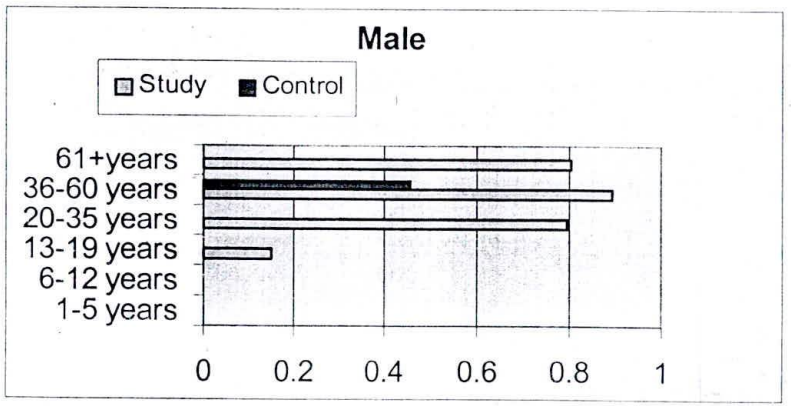
Age Group	Male Study Affected	Total Population-Male	% Male	Female-Study Affected	Total Population-Female	% Female	Male Control Affected	Total Population-Male	% Male	Female-Control Affected	Total Population-Female	% Female
1-5 years	2	493	0.40568	4	487	0.8213552	0	116	0	0	122	0
6-12 years	16	732	2.18579	17	688	2.4709302	1	157	0.63694	2	149	1.3422819
13-19 years	41	668	6.13772	61	721	8.4604716	2	130	1.53846	2	134	1.4925373
20-35 years	282	1503	18.7625	451	1446	31.189488	14	287	4.87805	46	334	13.772455
36-60 years	485	896	54.1295	572	821	69.671133	37	220	16.8182	61	201	30.348259
61+years	7	248	2.82258	180	222	81.081081	21	56	37.5	20	43	46.511628

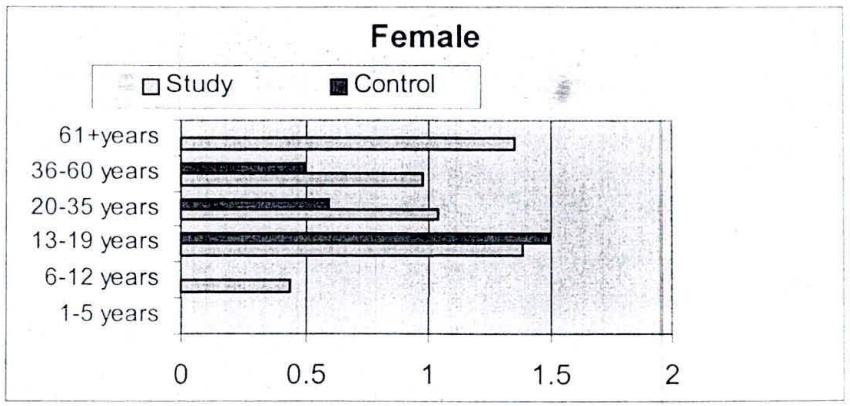




Diseases of the Genitourinary systerm - Chapter 14 ICD - 10 (International Classification of Diseases)

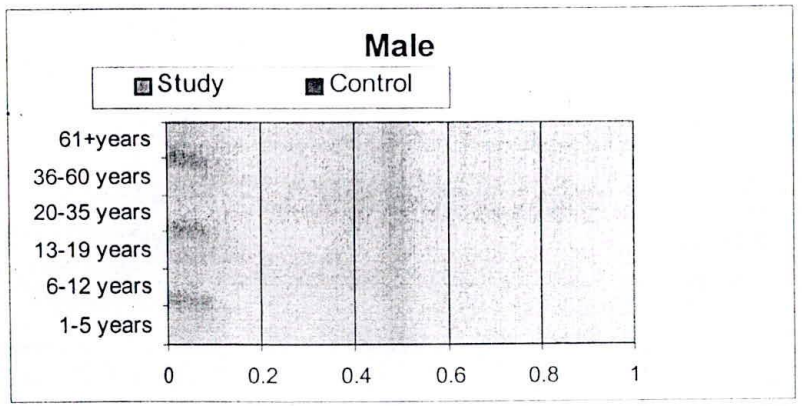
Age Group	Male Study Affected	Total Population-Male	% Male	Female-Study Affected	Total Population-Female	% Female	Male Control Affected	Total Population-Male	% Male	Female-Control Affected	Total Population-Female	% Female
1-5 years	0	493	0	0	487	0	0	116	0	0	122	0
6-12 years	0	732	0	3	688	0.4360465	0	157	0	0	149	0
13-19 years	1	668	0.1497	10	721	1.3869626	0	130	0	2	134	1.4925373
20-35 years	12	1503	0.7984	15	1446	1.0373444	0	287	0	2	334	0.5988024
36-60 years	8	896	0.89286	8	821	0.9744214	1	220	0.45455	1	201	0.4975124
61+years	2	248	0.80645	3	222	1.3513514	0	56	0	0	43	0

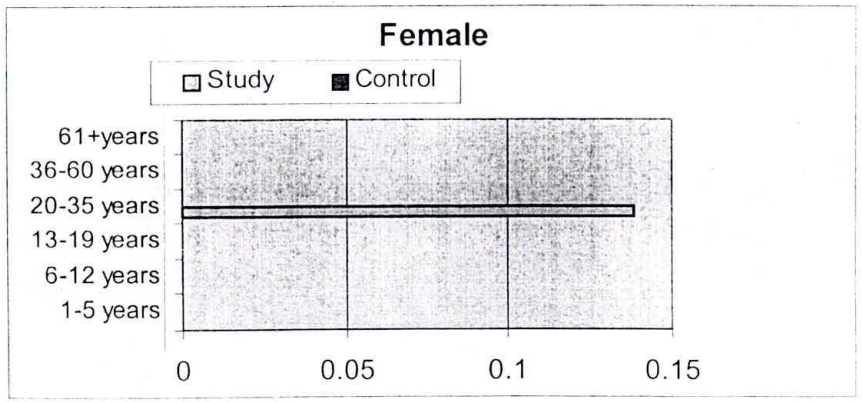




Pregnancy, childbirth and the puerperium - Chapter 15 ICD -10 (International Classification of Diseases)

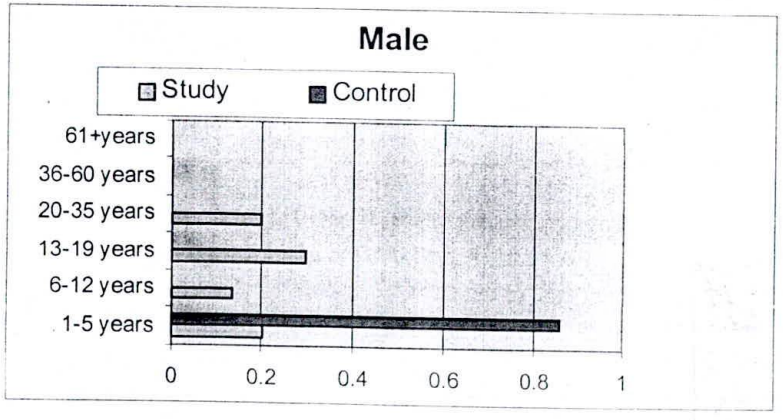
Age Group	Male Study Affected	Total Population-Male	% Male	Female-Study Affected	Total Population-Female	% Female	Male Control Affected	Total Population-Male	% Male	Female-Control Affected	Total Population-Female	% Female
1-5 years	0	493	0	0	487	0	0	116	0	0	122	0
6-12 years	0	732	0	0	688	0	0	157	0	0	149	0
13-19 years	0	668	0	0	721	0	0	130	0	0	134	0
20-35 years	0	1503	0	2	1446	0.1383126	0	287	0	0	334	0
36-60 years	0	896	0	0	821	0	0	220	0	0	201	0
61+years	0	248	0	0	222	0	0	56	0	0	43	0

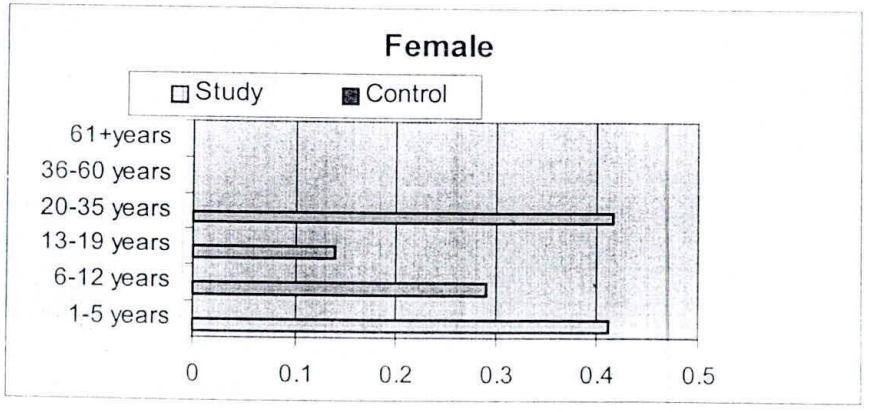




Congenital malformations, deformations and chromosomal abnormalities - Chapter 17 ICD - 10 (International Classification of Diseases)

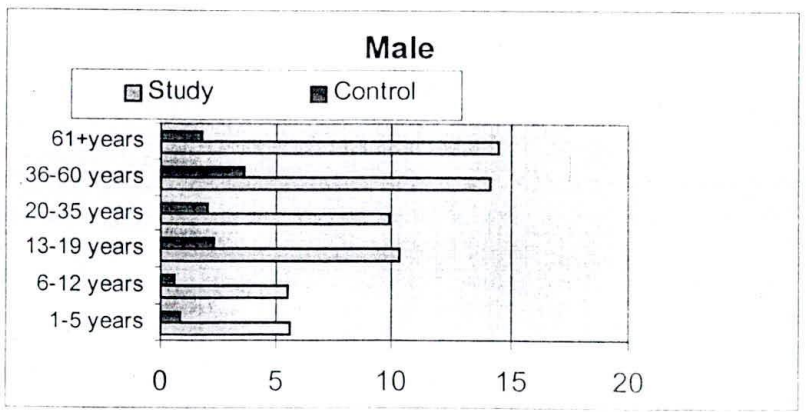
Age Group	Male Study Affected	Total Population-Male	% Male	Female-Study Affected	Total Population-Female	% Female	Male Control Affected	Total Population-Male	% Male	Female-Control Affected	Total Population-Female	% Female
1-5 years	1	493	0.2028	2	487	0.4106776	1	116	0.8621	0	122	0
6-12 years	1	732	0.1366	2	688	0.2906977	0	157	0	0	149	0
13-19 years	2	668	0.2994	1	721	0.1386963	0	130	0	0	134	0
20-35 years	3	1503	0.1996	6	1446	0.4149378	0	287	0	0	334	0
36-60 years	0	896	0	0	821	0	0	220	0	0	201	0
61+years	0	248	0	0	222	0	0	56	0	0	43	0

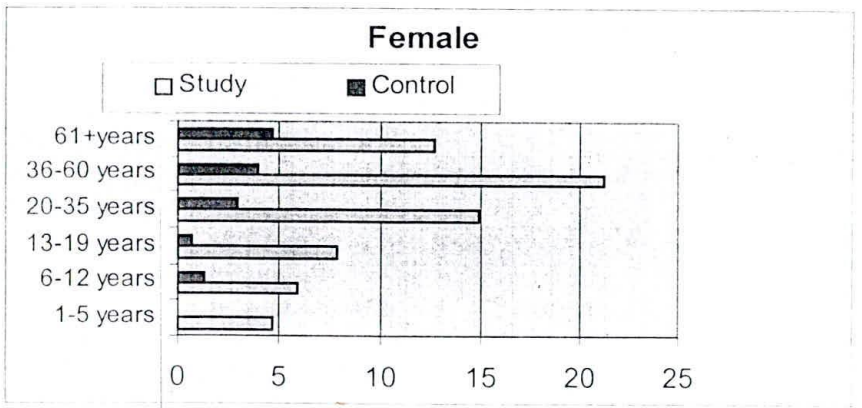




Symptoms, signs and abnormal clinical and lab.findings not elsewhere classified - Chapter 18 ICD - 10 (International Classification of Diseases)

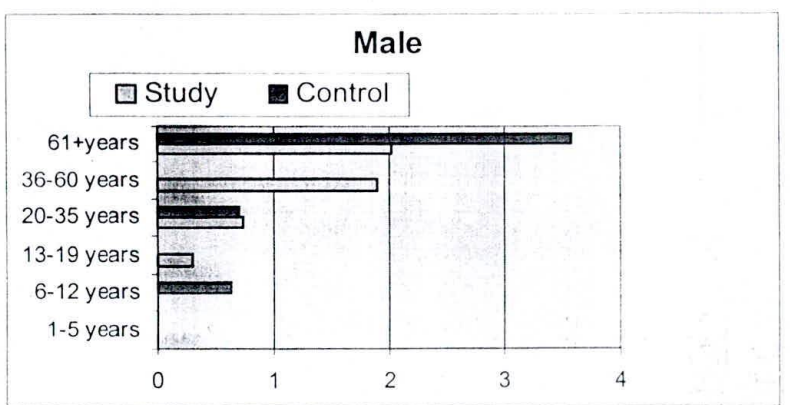
Age Group	Male Study Affected	Total Population-Male	% Male	Female-Study Affected	Total Population-Female	% Female	Male Control Affected	Total Population-Male	% Male	Female-Control Affected	Total Population-Female	% Female
1-5 years	28	493	5.67951	23	487	4.7227926	1	116	0.86207	0	122	0
6-12 years	41	732	5.60109	41	688	5.9593023	1	157	0.63694	2	149	1.3422819
13-19 years	69	668	10.3293	57	721	7.9056865	3	130	2.30769	1	134	0.7462687
20-35 years	149	1503	9.91351	216	1446	14.937759	6	287	2.09059	10	334	2.994012
36-60 years	127	896	14.1741	174	821	21.193666	8	220	3.63636	8	201	3.9800995
61+years	36	248	14.5161	28	222	12.612613	1	56	1.78571	2	43	4.6511628

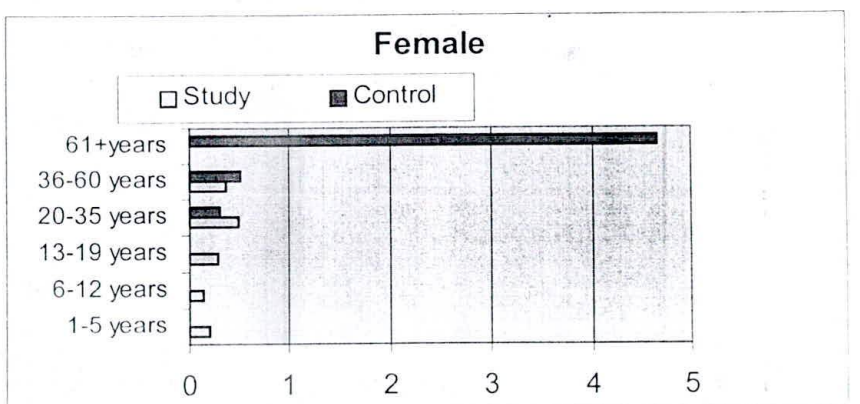




Injury, poisoning and certain other consequences of external causes - Chapter 19 ICD - 10 (International Classification of Diseases)

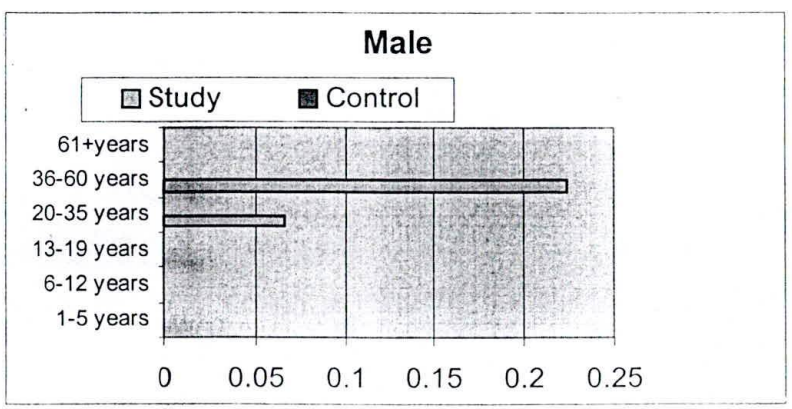
Age Group	Male Study Affected	Total Population-Male	% Male	Female-Study Affected	Total Population-Female	% Female	Male Control Affected	Total Population-Male	% Male	Female-Control Affected	Total Population-Female	% Female
1-5 years	0	493	0	1	487	0.205339	0	116	0	0	122	0
6-12 years	0	732	0	1	688	0.145349	1	157	0.63694	0	149	0
13-19 years	2	668	0.2994	2	721	0.277393	0	130	0	0	134	0
20-35 years	11	1503	0.73187	7	1446	0.484094	2	287	0.69686	1	334	0.2994012
36-60 years	17	896	1.89732	3	821	0.365408	0	220	0	1	201	0.4975124
61+years	5	248	2.01613	0	222	0	2	56	3.57143	2	43	4.6511628

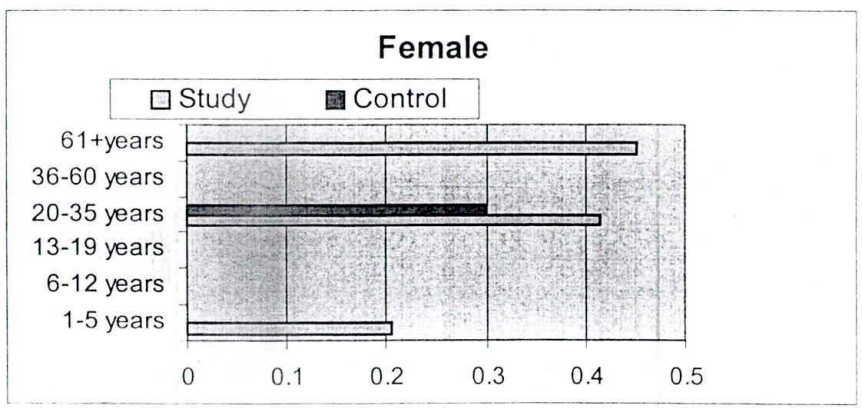




External causes of morbidity and mortality - chapter 20 ICD - 10 (International Classification of Diseases)

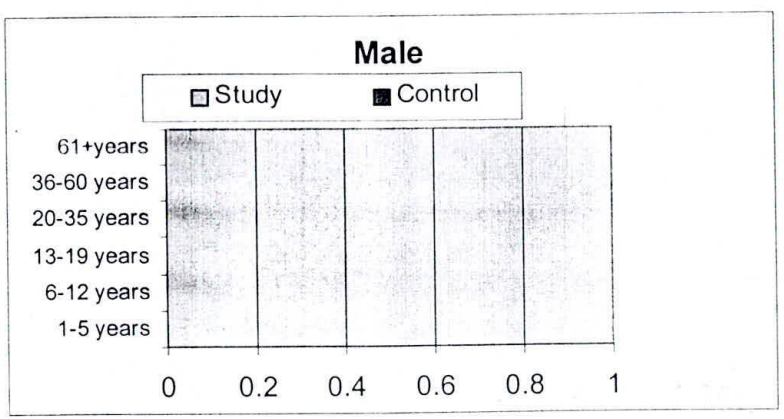
Age Group	Male Study Affected	Total Population-Male	% Male	Female-Study Affected	Total Population-Female	% Female	Male Control Affected	Total Population-Male	% Male	Female-Control Affected	Total Population-Female	% Female
1-5 years	0	493	0	1	487	0.2053388	0	116	0	0	122	0
6-12 years	0	732	0	0	688	0	0	157	0	0	149	0
13-19 years	0	668	0	0	721	0	0	130	0	0	134	0
20-35 years	1	1503	0.06653	6	1446	0.4149378	0	287	0	1	334	0.2994012
36-60 years	2	896	0.22321	0	821	0	0	220	0	0	201	0
61+years	0	248	0	1	222	0.4504505	0	56	0	0	43	0

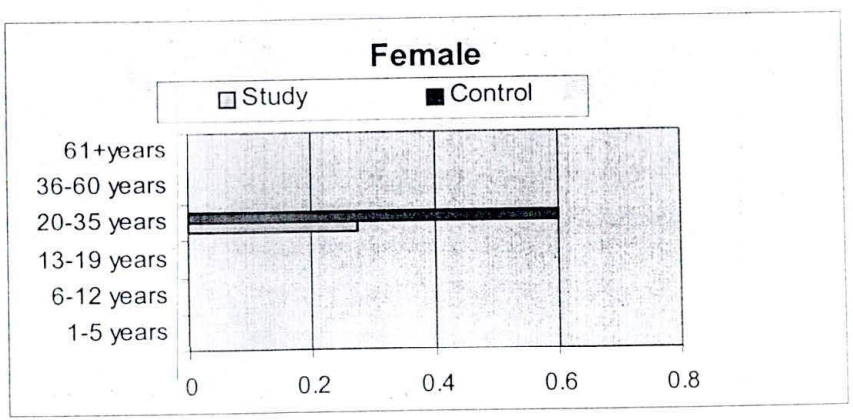




Factors influencing health status and contact with health services - Chapter 21 (International Classification of Diseases)

Age Group	Male Study Affected	Total Population-Male	% Male	Female-Study Affected	Total Population-Female	% Female	Male Control Affected	Total Population-Male	% Male	Female-Control Affected	Total Population-Female	% Female
1-5 years	0	493	0	0	487	0	0	116	0	0	122	0
6-12 years	0	732	0	0	688	0	0	157	0	0	149	0
13-19 years	0	668	0	0	721	0	0	130	0	0	134	0
20-35 years	0	1503	0	4	1446	0.2766252	0	287	0	2	334	0.5988024
36-60 years	0	896	0	0	821	0	0	220	0	0	201	0
61+years	0	248	0	0	222	0	0	56	0	0	43	0





Appendix 6: Disease Investigation : Cattle Death; Poster Mortem Certificate
(Source: Veterinary Hospital, Jinnaram Mandal) Dated: 20.08.2003
Disease Suspected : Chemical Toxicity

POSTEM CERTIFICATE: She Buffalo

Post mortem Certificate

P.M. No: 10/2003 .... Dated. 20-8-2003

1. Name & Address of the farmer } Sri. Balugari [illegible]
S/o Balaiah
R/o. Chetla Potharam
Jinnaram (M)
Medak (Dt)

2. Kind of Animal died : She Buffalo

3. Date of death : 20.8.2003

4. Date of P.M. Conducted : 20.8.2003

5. Post mortem lesions :

Liver Congested
Lungs Normal
Rumen
Reticulum } Full of cud
Omasum
Abomasum } Black discolouration & mucosa
Intestines Congested
Lymph nodes Normal

6. General Symptoms Anorexia, No pyrexia.

7. Disease suspected. Chemical toxicity ?

8. Not Medico legal case.

[illegible signature] 20/8/03
Veterinary Asst Surgeon
Veterinary Dispensary
JINNARAM, Dist. Medak A.P.

We got similar reports of livestock deaths; from the same veterinary hospital the reason stated in the laboratory report is suspected insecticide poisoning and chemical toxicity.

Appendix 7: Who's document is it?

We had to walk into the office of the MRO Jinnaram to get the voters list after several phone calls and visits.

The MRO, Jinnaram cooperated with us after getting a phone call from the District Collectors' office.

O/o the MRO
Jinnaram.

X.N.B?/03 D) 20-XI-03

1) Returned

2) The voter list will not be supplied to any organisations (NGO) unless specific permission is issued by the Dist Collector. Hence we are unable to supply copy of voter list of Kajipally (V)

[signature]
20/XI/03

M.R.O., Jinnaram (M)

Mandal Revenue Officer,
JINNARAM.

LPH-43

Appendix 8

Lawyers Speak

M.C.Mehta (Senior Advocate, Supreme Court)

Patancheru is really a sad story, nothing much has changed on the ground, even after courts' intervention. In 1988, when I visited the place I was shocked to see the state of toxicity in the region. The prime necessity and the source of life, water was taken away from people. The lakes and streams were full of toxic wastes. Agricultural crops were withering away.

The people of Patancheru got some relief after courts' intervention, in the name of drinking water, compensation. The court has done what it can in its own capacity. Now it's for the government machinery to enforce the courts' order and look after the implementation; they have failed in their duty. They lack responsibility. The pollution control board along with the industry is the cause of suffering for the people of Patancheru.

So many thesis have been written, PhD's done about the state of the region, but the plight of the people are same as 1988. Eco-restoration should take place in Patancheru. The concerned authorities and agencies should act.

Niroop Reddy – Supreme Court Lawyer

"Patancheru Industrial pollution by major export oriented pharmaceutical units is a classic example of corporate social irresponsibility and a symptom of a faulty development model, where farmers have being displaced from their traditional habitat and livelihood without any alternative resettlement.

If industrial activity is not to have an adverse impact on the ecology – Land, Water and Air & Human Health than the standard prescribed in the rules under Environment Protection Act, 1986 have to be of such an order so as to contain the effluent and emission standard in a comprehensive manner.

The criteria for effluent pollutant in USEPA is 85 in number; where as in India it is 13 and for emission pollutant the USEPA is about 55 and in India it is 5.

The court orders are derived under such limitations and ultimately the people are on the receiving end and the industries who gain.

(the classic example is of coke where it can clearly get away because there is no national standard for potable water)"

Appendix 9
Doctors Speak:

I still shudder at the thought of the nasty chemical smell that pervaded the air in Khazipally, like a sickening miasma, sucking all cheer from the lives of the hapless villagers. Not a day goes by when I don't feel a twinge of regret and guilt over the strong urge that overwhelmed me when I first set foot into Sultanpur: the urge to run away, the urge to return back to the familiar environs of Hyderabad, full of modern flyovers, steel and chrome towers which, for long I had deluded myself, where testament to the relentless "progress" India was making towards becoming a "developed" nation. I am glad I didn't act on the urge. The next five days were a revelation for me in more ways than one. Those five days of walking door to door, meeting people, sharing their pain and looking into their hopeful eyes have transformed me irrevocably. I realized, albeit with a great degree of embarrassment, that we, the aware, opinionated, extremely educated young citizens of the country are completely blind to the greatest criminal activity of all that is going on right under our very noses: the rape and the destruction of our land, our rivers and our groundwater because of the greed and the irresponsibility of a few rogue companies.
And what pains me the most is the realization that somewhere each one of us is responsible for this relentless destruction of our environment. We choose to keep quiet and turn a blind eye just because it suits our pockets to do so. In our myopic viewpoint of the world and conventional notions of success, we do not care about sustainable development because that would mean bringing about a sea change in the ideology of the very companies, which we have upheld all our lives as role models of entrepreneurial zeal, good corporate governance and as sources of great jobs which will help us "arrive" in society. And in a company which is the true beacon of the new, mint-fresh globalized capitalist India and its remarkably effervescent pharmaceutical sector, any efforts spent on proper waste disposal and treatment of toxic effluents are perfectly dispensable. After all, this great Indian "economic war" is being fought solely on the underpinning of low costs of production. Sustainable development means greater costs, lower profit margins, higher prices and lower salaries. Drug companies can ill-afford to waste money on processes that would make even a minor dent on profit margins. So what if the surrounding fields have fallen fallow and a few thousand people have lost their source of livelihood and so what if a few people have "allegedly" contracted chronic illnesses (the reports of illnesses anyways never get validated). All this is just "collateral damage", a necessary price that has to be paid in the path towards "growth" and a thriving economy. Anyways, the managerial cadre of these companies and the rest of us (the middle class citizens of the country who, in our eyes, are the only ones who truly matter) live in cities where there are great supermarkets in which we can buy the best of organic farm produce and where we have easy access to bottled pure, mineral water completely free of the arsenic, barium and the rest of the many chemicals which the drug companies in Medak district expel with complete and unabashed impunity into the river waters. And many of these drug companies are actually so "socially responsible." There are so many beautiful and moving articles in the Bombay Times and similar supplements that sing paeans about the many charitable acts of the Piramals, the Reddy's etc.

But this distorted reasoning misses the very crux of the matter, the very crux of the point being made by environmentalists all over: any economic victory that rides piggy back on the destruction of our environment, the destruction of the habitat and source of livelihood of many is necessarily pyrrhic. How long will it take for our apathy to rebound on us? How long will it take for the great Manjira waters, which supply the whole of Hyderabad to get polluted? How long will it take for the groundwater and the pure streams of our country, which form the source of all our bottled water to get irreparably polluted? We choose to ignore the warning signs only at our own peril. What kind of India have we created in which poor villagers (like the ones in Digwal) have to fight a court battle for two years only to earn the right to get clean drinking water: water

which is the fundamental right of all and not the preserve of a few. What kind of people are we that we cannot empathize with the plight of the poor farm labourers who are being squeezed from all sides. It was heartbreaking to hear the same stories being repeated in every village I visited: barren fields forcing farm labourers to search for odd jobs in the city. Not only was there no security of a steady income, most families I visited had a string of health complaints ranging from headaches to major illnesses, adding greatly to their financial burden. The insensitive public health system had also forced many to visit private doctors and to take crippling loans from moneylenders to pay for their medical bills. There was a feeling of desperation which was very difficult for even me, a doctor who has seen a great deal of pain, illness and death in her line of work, to take. And the irony of the entire situation was that the root cause of the illnesses was the apathy and the lack of accountability of the very drug companies whose function it is to manufacture drugs, ostensibly to help people recover from illnesses. How can the corporate bigwigs of these companies resolve this irony in their minds and function with a clear conscience: the irony of saving lives on the one hand and destroying others in the process of doing so.

What kind of a lesson are we teaching our children: that it is okay to steal from the environment and strip poor people of their livelihood for the development of the already developed. What kind of a world are we, the present generation, leaving behind for them? A world, in which global warming and polluted rivers and deforestation will wreak havoc and ruin countless lives. Why should they be made to pay a heavy price for our apathy and callousness? It is time to act before it is too late. It is time to wake up and smell the bacon. It is time to take responsibility and learn to value the beauty and life sustaining nature of Mother Earth. Each one of us can make a difference and the time to do so is now, before it is too late.

Dr. Aparna
Ex-Lecturer, Department of Obstetrics and Gynecology,
Gynecology Endoscopic Surgeon
Lokmanya Tilak Municipal college and general Hospital

1. Incidence of cancer in the affected area is significantly higher than in the control area. The incidence of cancer was validated by senior surgeons from Mumbai. This is an underestimation because; we did not add the cancer incidences which was detected in hospitals and nursing homes and autopsy data. It was based on house to house survey with validation of pathology reports of all cancer detections in a year.
2. Lung function tests were affected significantly ($p<0.01$), both Fev1 and Fvc of the affected population as compared with the control group.
3. Environmental Asthma was validated in a few cases but due to logistic problems, could not be confirmed by Lung Function tests in a larger population.
4. Allergic Contact dermatitis, which was validated by doctors from Mumbai, was significantly more in the affected group.
5. The other medical conditions like mental health, gastrointestinal conditions etc... showed a pointer to a possible higher incidence in the affected population, but a medically validated comment cannot be made, at present, hence there is a need for a more elaborate and validated study preferably with the governmental health infrastructure.
6. Local medical facilities are very inadequate and people spend a sizable percent of their income on private, mostly irrational treatment. Only when it comes to the final advanced stages, they are shifted to a major hospital in big cities like Hyderabad.
7. It is urgently required to upgrade local government medical facilities and provide free medical treatment to people of the affected communities.

Dr Murlidhar V
Dr Ashwini
Dr Deepali
Dr Archana
Lokmanya Tilak Municipal college and general Hospital, Mumbai

Appendix 10

Officials Speak:

The District Judge, Medak at Sangareddy
In his Report submitted to Supreme Court through the High court dated 27.01.96

"It is unfortunate that the State owned A.P.I.I.C which is incharge of day to day operations of CETP (Common Effluent Treatment Plant), in utter disregard of the provisions contained in the Environment (Protection) Act, 1986 and its Rules, is discharging such partially treatment effluent into the stream Nakkavagu. The industrialists have very cleverly entrusted the management to the State owned A.P Industrial Infrastructure Corporation in order escape themselves from the penal provisions of the Environment (Protection) act, 1986and its Rules."

Deputy Director, Ground Water Department at Sangareddy, Medak district
In a report submitted on 24.01.1996 to Director Ground Water Department, Hyderabad (Memo No. 12-4-92/ Hd. 6/93. dt. 15.7.1993)

"My survey confirms that Nakkavagu and Pamulavagu catchment areas are polluted and level of pollution are very high causing danger to lives of man, animals and agricultural activity."

Tishya Chatterjee
Member secretary
AP Pollution Control Board (APPCB)
In an article published in Down to Earth 31st August 1999.

It is common knowledge in Patancheru that most of the 400 industrial units cannot treat effluents properly and that they dump them in the open or inject them directly into the ground.

"We caught Paks Trade, a Patancheru-based company, for pumping arsenic-laced effluents into borewells," says Tishya Chatterjee, member secretary, AP Pollution Control Board (APPCB). "We have also found high levels of cadmium in the groundwater samples in AP's industrial areas," he adds. Chatterjee points out that there are several other industrial units that also indulge in such practices, but there are no clear-cut rules to stop such polluters.

An NGRI study found high levels of strontium in the groundwater.

ITW Signode, another Patancheru-based company, was discharging toxic, strontium-laced effluents into a nearby drain. "We located this industry and closed it," says Chatterjee." A study by the groundwater department of the state government confirms that the pollution level is very high and has endangered human lives, animals and agricultural activity.

"The common effluent treatment plants (CETPs) at Patancheru and Bollaram do not work up to the required efficiency. So, effluents with TDS levels of more than 20,000 mg/l are only treated up to 8,000-9,000 mg/l levels. And many a time, these CETPs discharge the effluents in the nearby streams without treatment," Chatterjee reveals. (Down to Earth,)

Appendix 11
Ethnography

Name:Gangamma:
Age: 75 years
Address: Sultanpur

Earlier crops used to grow well but after the factory came in, the yield reduced considerably. For the last 15 years, fields have not been providing any substantial yield for the farmer's consumption. She says that it is a common fact that children are born with defects and illnesses and adolescents suffer body aches and bone related problems unlike in the earlier days. Respiratory illnesses like asthma are common. Now there are no fields to go back to and youngsters do not have as much strength to do any work.

Name:Sailu:
Age: 60 years
Address: Khazipally

Sailu who works as a labor in a paddy field says that 20 years back there was good water and the fields were flourishing now there is no such produce and the young boys are not in a position to do any proper work. The industries around Kazhipally lake has been dumping effluents into the lake and the lake is now unrecognizable. You cant stand the foul smell.

Name:Syed Razzak:
Age: 80 years
Address: Khazipally

Razzak was born in Kazhipally and has been living here ever since. For the last 15 years, the tamarind tree growing opposite his house does not produce any tamarinds. Kazhipally Lake has been polluted completely and that was the areas main source of water for the irrigating fields. Earlier, he used to get about 30 bags of paddy from 1 acre and so in 2 seasons he used to get around 60 bags. That number has now come down to about half now. There were different kinds of fish in the lake. The whole village was self - sufficient. They were able to sell around about 20 bags, apart from keeping enough for their consumption. There is no water in the wells now. Their livestock have also perished because of the contaminated water. The trees in the forest near by have dried up because of the concentration of chemicals in the soil and very few animals are now found.

Name:G.Saraswati
Age:(32 years)

Village: Gandigudam ; Farmer

The Gandigudam cheruvu used to be our main source of daily life. The drinking water for villagers as well the livestock, the fishermen's fish, The Washermen, the quality time spent by children, the irrigation of 100 acres of land, everything is gone by the contamination done by industrial effluents. The main source of contamination is Khazipally industrial area, where the effluent is released, which joins Khazipally lake which links to Gandigudam cheruvu. Before the industries came, we used to have healthy crop yield. We used to grow sufficient rice for our family. The entire field is barren now. We are not getting anything since 12 years. Now the bore water is also contaminated. In past few years, we have seen livestock deaths, which has severely affected the livelihood of the villagers. The tank is full of chemicals now. The foul smell has brought constant unknown diseases in the area. We suffer continuously from headache, burns in eyes, body ache, weakness, and water release from eyes, skin disease. We did protest at different points of time. We carried the dead buffalo to the district collector's office in the lorry last month. We have been complaining to the PCB for years. But nothing has changed. Things have to change now. Our demands are:

- The company's effluent should not come in Gandigudam cheruvu.
- Give back our lake. (Remediation)

If we stop contaminating further, we will get back our fields in 2-3 years, Saraswati said when asked about the use of land which got contaminated by the industrial effluents. When asked if the company gets closed, what about the livelihood of the workers inside? She said: The land, which are barren now, and the lake that is dead now will bring back livelihood to them, which will be healthy and more sustaining.

Name : Puli Raju
Age:(21 years)
Village : Gandigudam

The village of Gandi Gudda where Puli Raju age 21 lives is among the worst polluted regions of Andhra Pradesh. I used to be a farmer till about five years back, effluents from the nearby industrial area contaminated my land, degraded the water used for irrigation, and this area has lost its fertility. The Gandicheru (a tank) used to provide drinking water to four nearby villages -- Gandi Guda, Dayara, Sultanpur, and Kistareddypet. Now the tank's water is so polluted that if anyone consumes its water he or she is sure to fall sick immediately. Many of us suffer from chronic diseases, many have weak vision, and stomach problems are also very common.

Name: Mallaiah
Age: 80

Address:Pocharam

Mallaiah aged 80; a resident of Pocharam said that their health has been adversely affected after the establishment of the industries. They are suffering from arthritis, stomach pains and mouth ulcers. They cannot walk properly. Their fields are also affected due to the chemical water. The crop yield has reduced. Chemicals polluted underground water at the depth of 30 feet. Mosquitoes are also developed due to the smells. In one bore only chemical water comes, the color of the water is black. During the nights at around 11 p.m. the industries release smoke, due to which they get severe headaches and coughs. The water has also affected their livestock, there have been deaths reported.

Name: Geetamma
Age : 65
Address: Pocharam,Patancheru

Geetamma a resident of pocharam feels the establishment of the industries had affected their health. They now suffer from skin diseases, stomach pains, arthritis and tumors in the stomach. Crop yields have also reduced. Winds bring along with them the smoke, which has been released by the industries, which has been responsible for frequent headaches. The villagers fought with the government, for which the government had sanctioned money for lands affected.
In her house, Kumar aged one and half years old has been suffering from vomiting and diarrhea since he was born, and Pentaiah who is 25 yrs old suffers from stomach pain and associated breathlessness.

Name:Mallaiah
Age :60
Address: Pocharam

Mallaiah a resident of Pocharam says that they had excellent health until the industries where established. With the establishment of the industries, their health has been deteriorating especially since the last 15 yrs. They now suffer from bronchitis, back pain, arthritis and skin diseases. Crop yields have reduced drastically. The chemicals from the industries pollute underground water that may be tapped within 30 feet.
In the night between 6 p.m. and 10 p.m. industries release smoke causing severe headaches and vomiting to the people around here.

Name: S.K. Sahib Hussain

Age:70
Address: Pocharam

According to Hussain when he came to Pocharam in 1995 with his family there was little development. He used to drink water from the bore, which was beside his home. The general health of the people and cattle was good. Vegetables were available cheap.

Now he feels that the pollution levels have increased and this he has attributed to the factories. He feels the high levels of pollution to be the cause for the diseases they suffer from. Visits to the doctor are frequent.

The underground water is polluted with the chemicals used by the industries.

He also adds that though the incidence of serious diseases is low, many people suffer from general diseases such as blood pressure, body pains, stomach pains, arthritis and so on.

Name: Durgaiah
Age: 82
Address: Ganpathiguda, Patancheru.

In those days there was a huge growth in the crops. There was tremendous cultivation and we used to make nice profits. Seasons were on time.

There was little development in the village. There were very few houses, people stayed in their farms.

The major source of water for the village was the Nakka vagu (stream), Pamula vagu, Kuntla bavi (well) and nadim bavi. Water from these sources was used for drinking and bathing purpose.

After the factories were established the water has become dirty, the color of the water is black and the fish in the water are also dying. Cattle that drank this water also died.

With pollution people suffer from many diseases, diseases which don't get cured even after frequent visits to the doctor.

I don't know when we will get salvation from this pollution and diseases.

Name: Veera Swamy Goud

Age: 54
Address: Pocharam, Patancheru.

It was the then Prime Minister Indira Gandhi's wish to make Patancheru an industrial area of Andhra Pradesh.
But before the factories were established the seasons were on time, and the profits that we could earn from farming was also good.
There were no major diseases; the average health of the villagers was good. The only prevailing disease was the common cold, which was due to the change in the seasons.
In 1978 the factories were established, with which started our doom days. Pollutants were released in the Nakka vagu and Pamula vagu to which loss of aquatic life maybe attributed.
Crops no longer grow here. The only crop that grows is rice. All other crops dry due to the polluted underground water. The underground water smells a lot.
Fruit bearing trees have flowers, which dry due to air pollutants such as ash, mica and so on. Trees no longer bear fruits or flowers.
He also mentioned that 'Dexo' a factory releases a chemical, which is yellow in color into the Nakka vagu. Novo pan releases asbestos, ash etc in the air.
He also added that the Effluent Treatment Plant (ETP), where more than 300-to500 lorries come, does not treat the chemical waste and in the night releases the untreated chemical water into the Nakka vagu.

PHR-16
Name: Kishtaiah
Age: 90
Address: Pocharam

Kishtaiah a resident of Pocharam said that until the factories were established the crop yield was good and groundwater was used for drinking.
With the establishment of the industries the crop yield has reduced. Intact they have stopped cultivation of crops. The underground water being polluted is no longer used for drinking purpose. He said if the regular supply of Manjeeera water was stopped then their condition would worsen.
He said that he is suffering from severe cough, vision loss, swollen legs, pain in the legs and arthritis.
His son Anthaiah who is working in 'Biological E ltd' is also suffering with arthritis and pain in the legs.
The livestock has been affected due to the polluted water.

Name: Rayagiri Yadi Reddy
Age:
Address: 1-85,Bachiguda, Pocharam.

Rayagiri informed of smell during the nights between 6-7 p.m. He says that the Pamula vagu water is black in color. Before the industries were established they used that water for drinking purpose. Now they no longer do so, as they develop skin diseases suddenly. They don't use the water for their buffalo's either. They no longer cultivate their own lands, infact they have abandoned their lands because of the polluted water. An industrialist had come and paid five thousand per acre when Dr. Kishan Rao had filed a case against them.
He felt that they were healthy before the industries started their work in their village, now their health has deteriorated. Bollaram, Gandigudam chemicals, pollutes Nakka vagu. They suffer from many diseases such as psychiatric morbidity, recurring headaches, asthma and anemia. When they walk in the water they develop skin diseases. Once they tried to meet the chief minister Chandra Babu Naidu, he ordered the police to lathi charge. Loss of cattle has been reported.

Name: Kishtaiah
Age: 53
Address: Bachi guda, Patancheru.

The village environment was goog. The water in the Pamula vagu, the chief water resource, was used for drinking purpose. The water was also used for livestock. Before the industries were established they never visited any doctor, home remedies were resorted to and they were effective.
Since the industries started their work, he feels the villagers' health has been affected. They suffer from many diseases, which don't get cured even after frequent visits to doctors and after having followed their prescriptions. Cattle die after drinking the water from the stream, which is totally black and sometimes white. A different color could be noted each day.
Bore water anywhere in the village is not without an oil slick
He feels polluted water is the cause for all the diseases they contract.

Name: G. Shankaraiah
Age: 60
Address: Pocharam

Shankaraiah a resident of Pocharam says everything is polluted. Crops have failed, and agriculture being their main source of income their standard of living is low.
He said the well water was used for drinking purpose, now the water in the well is acidic and yellow in color. He also added that the water had bad smell.
He says the bore water is also polluted; as a result there is no source of drinking water except the Manjeeera water, which is supplied by the government. He said if this water supply were to stop then they would face a lot of trouble for drinking water.
With regards Manjeeera water supply he said that during the rainy season the water supplied to them was polluted as the pipe lines get damaged due to the rains, so people suffered from various diseases.
The smell of the pollutants released by the factories comes during the night. This problem was much perceptible earlier, until there were protests.
With regards agriculture he says the yield has reduced. They manage to grow paddy but that paddy when consumed would lead to various diseases, as it is grown using polluted water.
Other crops don't grow. Rice is another crop which maybe grown but then quality has reduced.

KST-2
Name: K. Balanarasimha
Age: 39
Address: Kishtareddypet
Occupation: Sarpanch, Kishtareddypet.

Reports: -
Balanarasimha a resident of the village since 39 years is the Sarpanch of the village. He says before 1985 that is before the industries had started their activities in their village, the crop yield was good and the produce was nutritious and tasted good. The villagers drank the underground water. Cattle and other livestock were healthy.
After the factories were established, this is no longer the case; most people in the village have lost their sense of smell.
He says effluents from factories in his village, such as the AP metals engineering, Dr. Reddys labs etc, got mixed with the groundwater. Their most important source of water Posamudram was the most affected.
The crop yield has reduced and the size of the seed in the husk has reduced. Now they no longer use that water.
After the government order, 14 villages of Patancheru are getting their daily water supply, however Kishtareddypet is not supplied Manjeeera water by the

government. The same is done by a social welfare organization, 'Sri Sai Baba organization' (BHEL)

He says in 1986 the scientists from ICRISAT warned them that the men would become sterile in the next 20 years when the poison would have entered their body.

In Kazipally the effect of pollution from the factories is more than in Bollaram as the villages are on a lower plane and the wastes readily mix with the ground water.

He says the villagers mostly suffer from arthritis, back pain, loss of memory, and removal of the uterus, skin diseases, allergies, birth defects, respiratory diseases, fits and paralysis.

He feels the increase in the number of mosquitoes could be attributed to the factories and their operations, which has increased the number of malaria cases in the village.

Name: K. Sattamma
Age: 65
Address: Kishtareddypet

Sattamma says before the industries were established they drank water from the lakes, well, streams etc. she says they were very strong then. Cow dung was the only manure they used for their fields. The crop yield was good. Now however she feels there is no increase in yield even with so many fertilizers and pesticides available.

She says they used to walk to the Patancheru market, and walk back home.

When the factories were first established, she says everything was normal for the first few years. Later the aquatic life was lost due to the chemicals released by the industries in Bollaram.

She says, " paisalu neelala paduthe, paisa kanpichedi kani ippudu manishi kuda kanupichadu." (if a paisa fell into the water it could be seen, now however even a human being wouldn't be visible) .

The main crop that is grown in her village is rice. Last year due to poor rains the yield was poor, however this year the crop was good.

She feels the pesticides and other chemicals they use are also responsible for the diseases they suffer from. She says people were generally strong then, now however a person is equivalent to a person aged 85 in her time.

Name: Narsimhas
Age: 65

Address: Kishtareddypet

Narasimha says when he was a teenager the crop yield was good, and to his knowledge there were only two seasons when the yield would be low. And this was due to the poor rains. He says in one season they couldn't store a single grain, and they would eat 'Busa Vadlu' (rice which grows along the banks of the river). Sometimes they would have nothing to eat. The other season was better, thought there were no rains they didn't face much problem.
The cattle were healthy. He says they drank water from the lake, and in those days the water was very clean, so clean that if a paise was dropped it could be seen. The factories dumped their wastes into the lake and now the color of the water is black. The crop yield has reduced and so has the income. He says in a season 75% of the crop is lost. He says MLAs and collectors had come to his village, but they did nothing to improve their lives. He says that they are losing their lives and doesn't know when god would help them.

Name: Yadaiah
Age: 60
Address: Kishtareddypet

According to Yadaiah he worked as a labourer at Bollaram IDA, he worked in a private company. In his lifetime he says he worked for 3 companies. Now he feels weak and hence can't work anymore. He has no income, as both his sons are dead. The death of his elder son was a case of suicide. He says his son Srinivas had no option as he was suffering from severe stomach pain. He had studied up to class 10, and worked as an accountant at the brick maker's house. He was 27 years old. He says when he was 15 years old, one worked even at the age of 70. But now, though he is only 60years old he is unable to work because of the pollution.

Appendix 12

Status of Water contamination:

a)

- Effluents of the Industrial Development Areas (IDA) are discharged partly untreated into streams, underground water and ponds
- The effluents contain appreciable amounts of inorganic and inorganic chemicals and their bye-products
- The CETP in Bolaram and Patancheru lets out their untreated effluents in Pamulavagu and Peddavagu polluting Nakkavagu the main drainage.
- The Cocktail of effluent chemicals Pollutes the Drainage system. - Hazardous committee in 1997 - asks for Research to deal with the Cocktails.
- Irrigation tanks are used for effluent settlement tanks, the spill over joins Pamulavagu and Peddavagu
- Dispersal of contamination by interactions between surface water and the aquifer system

b)

- ✓ Six million litres of Water is drawn from Manjeera water supply and consumed by the industries in Patancheru area. A quantity of 5Mld of effluents is released into the natural streams without bringing it with the outlet standards prescribed by the EPA and Rules.
- ✓ CETP is discharging partially treated effluent into Nakkavagu. Water of the stream is not useful for irrigation. - District Judge's observation dated 27.01.1996 submitted to the Hon'ble Supreme Court
- ✓ PETL & industry major contributor for pollution.. All of them individually as well as cumulatively are discharging almost untreated effluents into the stream, the main source of water supply to the residents of several downstream villages - CRE Report based on study carried by Ms/.Bhagavathi Ana Labs Limited, Consulting Environmental Engineers
- ✓ Pollution around the Patancheru, Bolaram industrial areas has increased during the past one and half decade due to discharge of effluents into surface water bodies.
- ✓ The Polluted surface water is strongly influencing the quality of groundwater as TDS and elements Cu, Ar, Se and B reaching concentrations 5 to 10 times the permissible limits
- ✓ Elements with extremely variable pH interacting with sediments, soil and rock (chemical weathering) to release heavy metals which add to the degradation of groundwater quality

- ✓ All the toxic elements (except Fe & B) are migrating in NW direction with the groundwater down stream significantly affecting the quality of water in the Manjira River
- ✓ Arsenic in stream water near CETP as high as 40,000 ppb. Source clearly from the industrial effluents not natural rocks.
- ✓ Peddavagu and Nakkavagu streams showing high arsenic concentration of 5,000 ppb
- ✓ Groundwater having high concentration of arsenic
- ✓ Wells with 750 ppb of arsenic concentration, while the permissible limit is only 50 ppb.
- ✓ High levels of heavy metals in the ground water around Patancheru Industrial area was found, which was higher than the permissible WHO standards. - down to earth 31st Aug 1999.
- ✓ Toxic Effluents into the aquifers and other surface water streams and water bodies in an area of 250 sq km thus destroying the crops, flora, fauna of the surrounding areas admeasuring about 3000 acres

c)

Units in Patancheru and Bollaram discharge about five million litres of effluents everyday. A major part of the untreated effluents ultimately goes into nearby tanks and streams. A certain part is clandestinely disposed of in dry borewells.

d)

Names of Lakes Polluted:

1. Khazipally Cheruvu
2. Gandigudam Cheruvu
3. Nagulal Cheruvu
4. Kistareddypet Cheruvu
5. Mukta Kanta Cheruvu
6. Aminpur Cheruvu
7. Bollaram cheruvu
8. Saki Cheruvu
9. Muthangi Cheruvu
10. Isnapur Cheruvu
11. Chitkul Cheruvu
12. Lakadaram Cheruvu

Names of Rivers/Drains Polluted

1. Bollaram near sultanpur village
2. Iskavagu drain
3. Nakkavagu
4. Pamulavagu
5. Peddavagu
6. Manjeera upstream of Nakkavagu Confluence

e)
Main Contaminations:
Arsenic - Surface Water and Groundwater up to 0.7 ppm (mg/l)
Selenium - up to 0.038 ppm
Strontium - up to 3.0 ppm
Barium - up to 0.20 ppm
Boron - up to 4.0 ppm
Manganese - up to 1.5 ppm
Nickel - up to 1.0 ppm

Pesticides, Aldrin, Endosulphur, DDT, Phenol were highly concentrated in soil and water samples.

f)
SAFETY OF FRESH WATER RESERVOIR IN STUDY AREA
Analysis of hazard to fresh water reservoirs in the study area indicated that the Manjira river and Nizam Sagar located in the northwest of the city are in grave danger of contamination emanating from Gaddapothram - Bolaram - Patancheru industrial axis as they are located within 15 kms of the fresh water source. In case of Patancheru- Gaddapothram - Bolaram industrial area, the Nakkavagu river which is one of the principal tributary of Manjira River drains the area and is located at a distance of 5 kms. from Patancheru IDA . Although the area has a slope of < 1% from the industrial area towards Manjira river, the sediment load and contaminant flow poses a severe hazard to Manjira water supply system. Similarly, while the two pharmaceutical industries located at Aroor are situated at a distance of 26 k. ms from Manjira reservoir, the industry at Digwal is within 13 kms of the reservoir indicating a hazard to source of drinking water supply to Hyderabad.

REFERENCE:

*Europe and India Past Present and Future - Austrian Research Center Seibersdorf

*Toxic trace element pollution in groundwater around Patancheru and Bollaram Indusrial Areas by Shivkumar, Pande and Biksham in 1996

*'Arsenic Pollution in Ground water' at Patancheru IDA by Pradip K. Govil, NGRI. 2002

*Lakes and Water Bodies have been polluted by the nearby industries. - CPCB, 1998 Report

*Toxic Metals and Organic compounds: (NGRI Study, 1996-97)

*Down to Earth, CSE publication; 31st August 1999.

*GIS FOR ENVIRONMENTAL AUDIT OF HYDERABAD METROPOLITAN REGION, RANGA REDDY & MEDAK DISTRICTS OF ANDHRA PRADESH, INDIA
Dr.Kausalya Ramachandran, D.Sai kiran, M.Purnend & M.Kalpana
Central Research Institute for Dry land Agriculture

Appendix 13. Other Health Studies from the Study area: Table 1.

Title:
"Assessment of environmental health risk due to inorganic arsenic in the industrially contaminated areas of Hyderabad (A.P.), India"
Authors:
Chandra Sekhar K, N. S. Chary, C. T. Kamala, and A. Kishan Rao
Abstract:
Environment exposure of inorganic arsenic to humans was assessed by collecting clinical samples from the residents of the industrially contaminated area, **Patancheru,** Hyderabad. Arsenic levels in the clinical samples like blood, hair, nails, was measured by means of ICP-MS. Arsenic content of nails and hair were found to be higher than urine and blood. The nail concentration of arsenic in the range of 0.5-1.63 mg/kg and hair 0.3-0.94 mg/kg indicating longer exposure periods of arsenic. The man source of arsenic exposure is found to be contaminated waters (ground and surface) and also through the consumption of arsenic contaminated vegetables grown on the contaminated soils. It was further found that people consuming nutritious rich diet suffered least from the arsenic contamination than those who were malnourished.
Year of the Study:

Title:
"Status Report - Pollution and Actions Taken at RHC (Rural Health Centre) Patancheru Area"
Author/Investigator:
Dr. G. Nagaiah, Osmania Medical College, Hyderabad
Submitted to: The Additional Advocate General, A.P. High Court, Hyderabad
Remarks:
"Morbidity Survey 1998"
The study team came out with the report which showed 25.49% of general sickness rate, the report also showed more morbidity was due to orthopedic problems, followed by skin problems. The cause for diseases was to be established.
"Environmental Pollution and its effect on the health Nov-Dec 2000"
The study at Sulthanpur village, conducted in Nov-Dec 2000 was taken up in the academic interest and research oriented, useful for students, and helpful in planning health intervention. Though the results of the study are in favour of the fact that heavy metals like arsenic, mercury, aluminium, etc. are the determinants of the clinical manifestations and symptoms but the study is insufficient at this stage as the size of the study population constitutes only 0.93% of the total 32001 population distributed among 14 villages who are also exposed to environmental hazards.

Table 2

Title:
Report of Fact Finding Committee
Constituted by the Hon'ble High Court in its order dated 25th September 2003 in W.P.No. 19661/02
Index page Sl. No. 6 - 1;
(Page no. 13 ; para 6.3) - 2
Submitted to the court in March 2004.

The Terms of Reference States:
Study the adverse effect of pollution, caused by discharge of effluents by industries, on the health of inhabitants of the effected villages and suggest remedial measures required to be taken in this regard as also the proportion in which the cost thereof, if any, is to be borne by the polluting industries 1

Remarks:
The Report says that the Chairman and members of the committee met the inhabitants of the effected villages and held discussions with them on their health status. They complained that some of them have developed skin rashes after handling the water for washing purposes (Dobhi).
In majorities of the areas visited by the committee, villagers complained that the medical facilities in the village are inadequate. Steps have to be taken to improve medical facilities in these areas. 2

Table 3

Title:
Conservation and Management Plans for remediation of Asanikunta and Kistareddypet Cheruvu prepared by EPTRI Environment Protection Training and Research Institute, Hyderabad. December, 1998
9.0 page 41

Remarks:
The following problems are reported during the socio economic study in the surrounding of the Asanikunta and Kistareddipet cheruvu

- ✓ Morbidity is high in villages around these lakes
- ✓ Skin diseases are common
- ✓ Malarial incidence is high
- ✓ Respiratory diseases, loss of sight and digestive problems are prominent
- ✓ Decrease in soil fertility
- ✓ It is reported that the livestock population is reducing day by day and their life span in these villages is found lesser on an average
- ✓ Milk yield of these buffaloes is found 2 ½ litres per day which is very less when compared to the average yield
- ✓ Acqatic life in the water bodies is almost nit due to pollution

Appendix 14 **The Hard Fact**

During the past two decades, the industries around Patancheru has managed to dispose high volumes of chemical pollutants in the environment.

The concentrations of the released pollutants in the region has been reported by media, Committees set up be the Supreme court and A.P. High Court, APPCB, and independent authorities and institutions.

The Hard Fact : Report's & News (in 10 years)

No.	Title	Year	Abstract
1	The impact of paleo-channel on groundwater contamination K.Subrahmanyam (Y) National Geophysical Research Institute,Hyderabad, P.Yadaiah Geology Department,Osmania University,Hyderabad,	Received:17 November 1999 Accepted:14 March 2000	Amidst the granite terrain,the Nakka vagu has been identified as a paleo-channel (composed of clay –silt –sand facies);its presence in the area has immensely increased the spread of groundwater contamination.The transmissivity of the alluvial aquifer varies from 750 to 1315 m 2 /day.The adjoining granite has a transmissivity that varies from 30 –430 m 2 /day.
2	Shivkumar K, Pande AK, Biksham G (Dept Atom Energy, Atom Mineral Div, Civil Lines, Nagpur	1997	Present study on abundance and distr-ibution pattern of toxic trace elements indicates the quantitative aspect of pollution in the Nakkavagu Basin.
3	Assessment of contaminant migration in groundwater from an industrial development area, **Medak District** By V.V.S. Gurunadha Rao, R.L.Dhar and K. Subrahmanyam National Geophysical Research Institute)Council of Scientific Research), Hyderabad	Received 6 july 1999, accepted 7 june 2000	The degree of contamination is so intense that in some parts of the environment has become unsuitable for human living. The morbidity rate in the area is a shocking 80%, compared to the national average of 10%, all directly attributable to the industrial pollution. The chemical analysis of the treated effluent from the CETP was found to contain metals like arsenic, selenium and manganese (Dhar et al. 1998).
4	**Contamination of soil due to heavy metals in the Patancheru industrial development area, Andhra Pradesh** P.K.Govil, G.L.N.Reddy & A.K.Krishna NGRI, Hyderabad	Springer-Verlag 2001	The data reveal that soils in the area are significantly contaminated, showing two to three times higher levels of toxic elements than normal. Many heavy metals, such as Cr, V, Fe, As, Cd, Se, Ba, Zn, Sr, Mo and Cu, are present above the normal distribution in the soil. The heavy-metal loads of the soils in the study area are 240 mg/kg for Cr, 235 mg/kg for V, 1,350 mg/kg for Ba, 200 mg/kg for Cd, and 500 mg/kg for Cu. Most of the soils should be removed from agricultural production, and the area needs to be monitored regularly for heavy metal enrichment.
5	**90.85 p.c. units in AP complying with water standards, says study** By Our Special Correspondent, Hindu	HYDERABAD , APRIL 4 2001	The A P Pollution Control Board (APPCB), quoting a study done by the Programme Evaluation Organisation (PEO) at the instance of the Planning Commission, has claimed that it is was one of the few PCBs in the country which

			controlled pollution in an effective manner.
6	**Disaster in the pipeline ?** By K. Venkateshwarlu Hindu	HYDERABAD , NOV. 13 2000	The State Government's decision to go ahead with the laying of a 18-km-pipeline to carry industrial effluents from Patancheru industrial area to Sewerage Treatment Plant (STP) at Amberpet, has raised the hackles of city-based environmentalists who say that it amounts to "merely shifting pollution problem from one area to another."
7	Groundwater Polluted : Government Study on Ground WaterPollution: In compliance with Supreme Court order	Survey conducted on 27-6-1996	There is evidence in the field that the crop yields are reduced highly and some lands are abandoned from irrigation and cultivation.
8	Conservation and management plans for remediation KHAZIPALLY CHERUVU Final Technical report , Jawaharlal Nehru technological university, Hyderabad	January, 1999	**Soil Contamination:** In this period of 10 years the area of the land available for cultivation has come down from 240 acres to 80 acres a reduction of 66% mainly due to introduction and influence of industrial effluents into Khazipally lake.
9	STUDY OF GROUNDWATER POLLUTION IN PATANCHERU AND BOLARAM INDUSTRIAL DEVELOPMENT AREAS, MEDAK DIST. ANDHRA PRADESH, Sponsored by APPCB, Hyderabad National Geophysical Research Institute, Hyderabad	Dec, 1998	The Study area covers about 160 sq km. There are more than 400 big and small pharmaceutical and chemical industries. Some observations of the toxic metals are: The result shows high values of **Arsenic, Strontium, Barium, Selenium, Boron, Manganese, Nickel, Residual Pesticides, Aldrin, Endosulphur** in the groundwater as well as surface water in the area. It is well established that the high concentration of toxic metals are dangerous to human life and cause many diseases, which are called geochemical diseases. High concentrations of arsenic cause lung cancer, skin cancer and nickel is also a well-known carcinogen that causes cancer. Lead is known to increase the blood pressure in human beings.
10	Down to Earth, Centre for Science & Environment Publication		Paks Trade, a Patancheru-based company, was apprehended for pumping arsenic-laced effluent into the ground through borewells The DTE/IIT test conducted on a water sample from a handpump in Pocharam village of Patancheru Industrial Area (PIA) in Medak district of Andhra Pradesh showed that the level of mercury was 115 times the permissible limit.
11	Government Study on Ground WaterPollution: In compliance with Supreme Court order.	Survey conducted on 27-6-1996	From the samples collected it was clearly established in the field that groundwater is not potable in 8 villages. Out of 16 villages, the groundwater in 11 villages is found to be polluted and pollution is attributd to industrial activity as discharge of Nakkavagu and Pamulavagu is coloured and odoured. The source of pollution to

			groundwater is industrial effluent that is let into the 2 streams and affects groundwater body during rainy seasons mostly. On the whole the pollution areas fall within 100 to 500 mts either side of Nakkavage and Pamulavagu streams. There is evidence in the field that the crop yields are reduced highly and some lands are abandoned from irrigation and cultivation.
12	Contamination of Urban India Environment by Hazardous Industries **Kausalya Ramachandran** Senior Scientist **D. Sai Kiran** Research Associate **M. Kalpana and M. Purnendu** Project Associates CRIDA (ICAR), Hyderabad	1997 GISdevelopment.net.	Scattered location of hazardous chemical industries in urban areas and meager availability of proper waste management system in Hyderabad, Banglaore, Chennai and Delhi, are primary cause of non-point source pollution in these urban centres. ARCGIS was used in tandem with satellite data (IRS - 1D - LISS III& PAN merged data) to map location of hazardous industries in these urban areas and estimate the spread and direction of flow of contaminants. The pattern and extent of contamination of soil and water was mapped and quantified to facilitate undertaking of remediation plans. 1997 **GISdevelopment.net.**
13	INVESTIGATION REPORT: Environment pollution caused by patancheru and Bollaram industrial Estates in nearby villages of medak district in Andhra pradesh. By: National Environmental Engineering Research Institute, Nagpur.	October 1991.	A detailed survey has been carried out by NEERI in patancheru and Bollaram industrial Estates and in surrounding villages affected by pollution, which includes the river quality of Manjeera after the confluence with Nakkavagu, which carries wastewater from both the estates. Observations: • Wastewater is highly polluting and must be treated. • Samudram an irrigation tank at Kistareddypet has been totally spoiled by industrial discharge into it and now it looks like stabilization pond. • The analysis of the data reveals that the wells/bore wells and even Manjeera river waters have been contaminated. **HEALTH:** The incidence of disease and death has increased considerably. The data suggests that there is an increased rate of premature deaths. NEERI Scientists were informed by the farmers of the affected villages that: • Girls do not attain puberty at the proper age • Married women cannot conceive • Pregnant women deliver still born children • There is high rate if infant mortality • Death of cattle wealth takes place after drinking/coming in contact with the

			high polluted wastewater.
14	A STUDY ON THE ENVIRONMENTAL POLLUTION AND ITS EFFECTS ON THE HEALTH STATUS OF PEOPLE AT SULTANPUR VILLAGE BY DEPT. OF COMMUNITY MEDICINE, OSMANIA MEDICAL COLLEGE, HYDERABAD	NOV. 2000	"2974 people examined and 690 people found to be suffering from symptoms of toxicity. DR. Rao in Hell of Earth" . 1/4th of the population available for medical examination. Blood samples from some individuals with suspected heavy metal poisoning were taken.
15	ASSESSMENT OF ENVIRONMENTAL HEALTH RISK DUE TO INORGANIC ARSENIC IN THE INDUSTRIALLY CONTAMINATED AREAS OF HYDERABAD. BY Analytical Chemistry and Environment Sciences Division, Indian Institute of Chemical Technology and Yashodhara Hospital, Patancheru		The main source of arsenic exposure is found to be the contaminated waters (ground and surface) and also through the consumption of arsenic contaminated vegetables grown on contaminated soils. Concentration of arsenic in clinical samples clearly shows that there is a possible association of arsenic in blood, urine, hair and nail with age, sex and with concentration of arsenic in soil, water and vegetables.
16	STATUS HEALTH REPORT ON HEALTH PROBLEMS AND REMEDIAL MEASURES TAKEN AT PATANCHERU AREA. FROM Dr. G. Nagaiah to The additional advocate general, high court Osmania medical college	Morbidity survey, 1998.	Remarks of Chief Investigator. The report of the sample study in october 1998 showed quantitative values of the health problems. The study lacked specificity of cause effectivness. FINDINGS/OBSERVATIONS • Morbidity rate in this area showing increasing number trend which is evident from past rate of 10.18% in 1991 oct. to present ratio of 25.49% • In all the types of the diseases, the female population is experiencing higher morbidity.
17	EUROPE AND INDIA PAST, PRESENT AND FUTURE BY Austrian Research Centre Seibersdorf.	March 2001	Status of water contamination sources • Effluents of the IDAs are discharged partly untreated into the streams, underground and ponds • The effluents containing appreciable amounts of inorganic and organic chemicals and their bye-products.
18	GIS FOR ENVIRONMENTAL AUDIT OF HYDERABAD METROPOLITAN REGION, RANGA REDDY & MEDAK DISTRICTS OF ANDHRA PRADESH, INDIA Dr.Kausalya Ramachandran, D.Sai kiran, M.Purnend &		SAFETY OF FRESH WATER RESERVOIR IN STUDY AREA Analysis of hazard to fresh water reservoirs in the study area indicated that the Manjira river and Nizam Sagar located in the northwest of the city are in grave danger of contamination emanating from Gaddapothram – Bolaram – Patancheru industrial axis as they are located within 15 k. ms

	M.Kalpana *Central Research Institute for Dry land Agriculture,* *Hyderabad –*		of the fresh water source. In case of Patancheru-Gaddapothram – Bolaram industrial area, the Nakkavagu river which is one of the principal tributary of Manjira River drains the area and is located at a distance of 5 k. ms. from Patancheru IDA . Although the area has a slope of < 1% from the industrial area towards Manjira river, the sediment load and contaminant flow poses a severe hazard to Manjira water supply system. Similarly, while the two pharmaceutical industries located at Aroor are situated at a distance of 26 k. ms from Manjira reservoir, the industry at Digwal is within 13 k. ms. of the reservoir indicating a hazard to source of drinking water supply to Hyderabad. **14.0** CONCLUSION Hazardous chemical industries pose serious problem to soil, surface water body and groundwater aquifer in the study area. Creating facilities for safe disposal of hazardous waste is urgently required if the region has to be saved from irrevocable damage and decline. Treatment of solid waste and effluents requires strong efforts, both from polluters as well as the law enforcing agencies

Appendix: 15

Table . Water consumption and waste water generation by major polluting industries – patancheru industrial complex.

S.No	Industry	Raw material	Products	Water consumption	Waste water generation
1	Standard organics	Acetone, acetic acid, acrylonitrite, ammonia gas , benzene, caustic soda, dimethyloxalate, ethyl acetate.	Sulpha-methoxazole (60T) Trimethroprim (15T) Solbutanamol sulphate (0.4) T.H.B.Acid (10T)	240	130
2	Nova resins and chemicals	Formaldehyde-150T Helamine-12T Urea-75T	Aminoresins (450T)	4.6	1.0
3	Asian paints	NA	Paints and enamels-1250 T Aerific Emulsion 67T Synthetic resins 234 T	240	50
4	Reliable paper	Waste paper 288T Bosin 3.6T Alum 27.6T	Craft paper 360T	50	30
5	Deccan drugs	Dimethyl oxalate Acetone, Hydroxylaminesulphate, Sodium, Sulphuric acid, Ammonia gas, chlorine, benzene, 3,4,5-trimethoxybenzaldehyde, acrylonitrite , sodium methioxide, Glanidine nitrate	Trimethoprim 105T	35	20
6	Sri sai baba cellulose	Caustic dye 8T, Sulphuric acid 3T, common salt 1T Cotton linters 78T	Bleached cotton linters 35T	150	130
7	R.K.Industrial Chemicals	NA	Barium carbonate 27T, Sodium sulphide 12T	7	1(recycled)
8	National chemical industries	NA	Barium sulphide 60T		
9	Quinn Chemicals	Acetone, acrylic acid, aerosol, ammonia, cascin, Caprolactum, cyclohexanol. castoroil, butyl acetate, butyl acrylate, ethyl acrylate, 2-E.H.A.,Formate MC navyblue, Goldex(401), Direct Black,etc..	Leather finishing chemical 200T	10	4.5

10	Sahney paris rhone	NA	Automobile engg. Goods (4000 items)	3	1
11	Surana strips (bhagyanagar metals)	NA	Cold rolled steel strips 420T	3	1
12	Voltas chemnical division	Ortho amino phenol 38 T, urea 25 T, Formalin 31 T, chlorine 60 T, ethyl alchohol 60 T, caustic soda , HCL 16.2 T, mallic anhydride, formaldehyde 47 T, Ethyl mercaptan 30 T, Methylene bromide 49 T, nitrogen 4.5 T caustic soda 310 T, alchohol 75 T	Phoslone 1009T, Malathion 125T, phorate 100T, Ethion 100T.	560	72
13	Reliance cellulose	Hosiary cuttings and raw linters 150 T.,Caustic soda 60 T,chlorine gas 150 T,sulphuric acid 60 T,acetic acid and acetic..	MCA 116 T,Bleached cotton linters 35 T , Cellulose powder 25 T.	500	400
14	Asrani tubes	Steel strips, cutting oil,HCL, Zinc chloride, ammonium chloride, molten zinc.	Steel tubes (MS & GI)	6	2.5
15	Novopan India	Urea- formaldehyde resin, melamine-formaldehyde resin, wood, binders, adhesives, sizing materials	Chip boards	66	7.0
16	Hical pharma	NA	Analgin 12 T	18	1.5
17	Venkataram a chemicals	NA	Chloro-phericminimalate 4T	4	3
18	Charminar papers	Waste paper 270 T, alum 8T resin 2.5 T, dye 0.1 T,chlorine.	Kraft paper	140	30
19	ambuja petro chemicals	o-Xylene 900 T, sulphuric acid 5 T, sodium hydroxide (NaOH) 3 T.	Phthalic anhydride 600 T, fumeric acid 45 T.	325	300
20	Deccan leathers	Raw sheep and goat skins, chromium salts, dyes oil and Grease,acetic acid,formic acid	Finished leather /skin(1 lakh hides)	200	190
21	Gromor chemicals	NA	Dextro propocryhydrochloride 2 T	7	5
22	Ion exchange	NA	Water treatment chemicals 15 T.	10	5
23	Dexo lab chemicals	Sodium, methanol, Di Ethyl oxalate, Acetone, Sulphuric acid, Hydroxylamine sulphate, Ammonia, Caustic soda, chlorine, ethyl acetate, benzene, pyridine.	Sulpha methaoxazole 15 T.	30	20
24	Bhaghyanagar oil reifneries	Raw groundnut oil and cotton oil 300 T,rice bran oil 60 T, neem oil 30 T, sodium silicate 15 T, Bleaching earth 7.5 T, salt	Edible refined oil 300 T, soaps 150 T	3.2	2.5

		3T.			
25	Qure drugs	p-chloro benzoic acid, thio-urea, thionyl chloride, acetamilide, nitric acid, sulphuric acid, ammonia, iron, Dimethyl sulphate, chloro formate.	Mebendazole 2 T	25	15
26	N.S.L	HR steel strips 5200 T, Hcl 180 T, cutting and lubricating oils	MS cold rolled strips 3500 T.	150	100
27	V.B.C ferro alloys	Quartz 2100 T, charcoal 1560 T, Iron ore 4800 T, Limestone 390 T, Coke 1600 T.	Ferro silicon 2200 T, pig iron 100 T.	10 (domestic) 20 (coolin g)	10
28	Hindustan fluoro carbons	Anhydrous hydrofluoric acid, chloroform	Poly tetra fluoro-ethylene 45 T.	120	108
29	Ferro insulation	NA	Insulation boards	3	2

Appendix 16 LIST OF RESOURCES FOR COMMUNITY AND RESEARCH GROUPS (Community Health Assessment Guidebooks)

India:
Title: The Manual of Lay Epidemiology
Contact: The Community Health Cell
Address: # 367, Srinivasa Nilaya,
Jakkasandra 1th Main????
Koramangla Block 1
Bangalore-560034
Tel: +91-80-5525372/ 5531518
Website: www.sochara.org , www.phmindia.org
Description: The Community Health Cell is a group of Organised Health Professionals based in Bangalore, India dedicated to the cause of "Health for All" and the paradigm shift from 'disease-treatment' to 'health-preservation'. Their Library is a fabulous collection of rare manuscripts from around the world, most of them original works.

Canada
Title: Community Sustainability Auditing Resource Kit
Contact: University of Victoria
Address: PO Box 1700 STN CSC,
Victoria, BC V8W 2Y2
Canada
Tel: 250-721-7211
Web site: http://web.uvic.ca/~csap/frbc/reskit/menu.html
Description: An online resource for sustainable community auditing. This kit is mainly intended for communities with a threatened resource-based economy and has useful information about the development and use of sustainability auditing protocols.

Title: Environment and Sustainable Development Indicators (ESDI) Initiative
Contact: National Roundtable on Environment and the Economy
Address: National Round Table on the Environment and the Economy
344 Slater Street, Suite 200
Ottawa, Ontario K1R 7Y3
Canada
Tel: 613-992-7189
E-mail: admin@nrtee-trnee.ca
Web site: http://www.nrteetrnee.ca/eng/programs/Current_Programs/SDIndicators/Approach_to_Indicators/SDIndicators_Approach_e.htm
Description: A three-year project aimed at developing and testing indicators. Workshops are available for training in indicator selection and data gathering.

Title: Pilot Project to Develop a Community Health Measure for Small and Rural Communities
Contact: The Canadian Federation of Agriculture and Federation of Canadian Municipalities
Address: Federation of Canadian Municipalities
24 Clarence Street
Ottawa, Ontario K1N 5P3
Canada
Tel: 613-241-5221
E-mail: federation@fcm.ca
Web site: http://www.fcm.ca/english/national/ruralhealth-e.pdf
Description: This web site provides a description of a 1999 pilot project in three small Canadian communities. The report presents suggestions to be used as tools for small and rural communities to undertake future community discussion and action.

Title: Signs of Progress, Signs of Caution
Contact: Ontario Healthy Communities Coalition
Address: 1202-415 Yonge Street
Toronto, Ontario M5B 2E7
1-800-766-3418
Web site: http://www.opc.on.ca/ohcc/publications/signs/signspdf.htm
Description: The goal of this guidebook is to help the user(s) make "communities healthier and more sustainable". A number of steps necessary for developing health and sustainability indicators are described and worksheets to accompany each step are provided. A useful listing of potential indicators of health and sustainability is also included.

Title: Sustainable Community Indicators Program - User's Manual
Contact: CMHC and Environment Canada
Address: scip-pidd@ec.gc.ca
Web site: http://www.ec.gc.ca/scip-pidd/English/indicators.cfm
Description: Detailed manual and guide to conceptualizing sustainability, identifying target markets, choosing a framework and developing and evaluating indicators. The manual accompanies the Sustainable Community

Indicators Program database. A copy of the database and manual can be downloaded from the address listed above.

Title: Sustainable Community Resource Package

Contact: Ontario Roundtable on Environment and Economy

Address: The Ontario Roundtable was disbanded in 1995, but the resource can found at the web site listed below.

Web site: http://www.law.ntu.edu.tw/sustain/intro/ortee/

Description: A resource package on sustainable communities featuring case studies of community sustainability initiatives in Ontario. This package also provides a step-by-step guide to profiling a community including methods for looking at community activities in terms of four quadrants: environmental,
economic, social and health. The package also outlines action plans and evaluation processes for healthy community development as well as literature about models of sustainable community living.

United States

Title: Check Your Success. A Guide to Developing Indicators for Community Based Environmental Projects.

Contact: Department of Urban Affairs and Planning, Virginia Tech, US. EPA

Address: Dr. JoAnne Carmin
Department of Urban Affairs and Planning
105 Architecture Annex, MC 0113
Virginia Polytechnic Institute and State University
Blacksburg, VA 24061
USA

Tel: 540-231-5426

Web site: http://www.uap.vt.edu/checkyoursuccess

Description: Although the primary focus of this guide is environmental, the authors adopt a broad vision of environment (social, economic, environmental, social and organizational). The first part of the manual provides information on the benefits of developing and measuring indicators and then leads into a number of case studies. One of the most useful sections of this book is the "Indicator Workshop" which is presented in the appendices. This section is easy to follow and contains a number of useful worksheets and exercises.

Title: Community Based Environmental Protection: A Resource Book for Protecting Ecosystems and Communities.

Contact: US EPA

Address: Community Based Environmental Protection
1200 Pennsylvania Avenue, NW
Mail Code 1807T
Washington, DC 20460
USA

Tel: 202-566-2182

Web site: http://www.epa.gov/ecocommunity/tools/resourcebook.htm

Description: This resource book includes sections on how and why to select and use community indicators. It also includes discussion of how the ecosystem is integrally linked to the economy and to the quality of life and social aspects of each community.

The guide is available in PDF format on the US Environmental Protection Agency web site.

Title: The Community Health Indicators Handbook
Contact: Redefining Progress
Address: One Kearny Street
Fourth Floor
San Francisco, CA 94108
USA
Tel: 415-481-1191
Toll Free: 1-800-896-2100
Web site: www.rprogress.org
Description: A detailed handbook for creating measures of community health, wellbeing and sustainability progress toward community sustainability. The handbook contains extensive information on community indicators including a step-by-step guide to developing an indicator project, a glossary, case studies, resources and a national directory of indicator projects.

Title: Community Outcomes Toolkit
Web site: http://ag.arizona.edu/fcr/fs/nowg/prodev_newlinks.html
Description: This toolkit is part of the University of Arizona's web site for Evaluating National Outcomes. It contains a step-by-step plan for identifying and evaluating community building indicators. The web site provides examples of indicators and lists tools and resources available to help communities set goals and develop, measure and evaluate community indicators.

Title: The Community Toolbox
Contact: ToolBox@ukans.edu
Web site: http://ctb.lsi.ukans.edu/tools/EN/tools_toc.htm
Description: This web site was created by the University of Kansas Work Group on Health Promotion and Community Development in Lawrence, Kansas. The core of the Tool Box is the "how-to tools." The how-to sections use simple language to explain how to do the different tasks necessary for community health and development. There are sections on developing indicators, leadership, strategic planning, community assessment, advocacy, grant writing and evaluation. Each section includes a description of the task, advantages of doing it, step-by-step guidelines, examples, checklists of points to review and training materials.

Title: Community Visioning and Strategic Planning Handbook
Web site: The handbook is available at
www.scs.unt.edu/classes/CSAG/5790/001/CmtyVisioning/com_visioning_handbook1.htm
Description: The University of North Texas has posted this community visioning and strategic planning handbook on its student web site. The handbook was developed through a grant from the Ford Foundation and the Carnegie Corporation of New York and produced by the Alliance for National Renewal and the National Civic League. It presents steps toward developing a "community vision" and includes sections on selecting and evaluating key performance areas.

Title: Green Communities Assistance Kit
Contact: r3green@epa.gov
Web site: http://www.epa.gov/greenkit/indicator.htm#select

Description: The US Environmental Protection agency has a Green Communities Project Web site that details how to select, use, evaluate and report on community indicators..

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Title: Guide to Sustainable Community Indicators

Contact: Maureen Hart
Address: Sustainable Measures
P.O. Box 361
North Andover, MA 01845
USA
Tel: 978-975-1988
Web site: http://www.sustainablemeasures.com/

Description: This comprehensive guide covers all the steps necessary for developing indicators. It begins with a description of the issues associated with sustainability, and then leads the reader through the necessary steps for organizing and measuring sustainability indicators. The appendices contain helpful information such as: a listing of community indicators used by other projects, resources and examples of other community indicator
projects.

Title: Measuring Community Success and Sustainability: An Interactive Workbook

Contact: Northern Central Regional Center for Rural Development
Address: Iowa State University
108 Curtiss Hall
Ames, IA 50011-1050
USA
Tel: 515-294-8321
Web site: http://www.ncrcrd.iastate.edu

Description: This guide was developed to help communities learn how to measure the effects of rural development and conservation efforts. The focus of the guide is on five key outcomes that were developed by rural communities. The outcomes range from "increase in knowledge, skills and ability of local people" to "appropriately diverse and healthy economics". The guide begins with a general introduction to measuring indicators and then outlines a measurement plan and year-end assessment for each of the five outcomes stated.

Title: Monitoring Community Sustainability

Contact: Izaak Walton League
Address: 707 Conservation Lane
Gaithersburg, MD 20878
USA
Tel: (301) 548-0150
Toll-Free: (800) IKE-LINE (453-5463)
E-Mail: general@iwla.org or sustain@iwla.org
Web site: http://www.iwla.org/sep/pubs/monitor.html

Description: This 23-page workshop guide, published in 1998, provides directions for identifying and measuring indicators that reflect a community's progress toward goals that promote sustainability.

Title: Neighborhood Sustainability Indicators Guidebook
Contact: Crossroads Resource Center
Address: P.O. Box 7423
Minneapolis, Minnesota 55407
USA
Tel: 612-869-8664
kmeter@crcworks.org
Web site: http://www.crcworks.org/guide.pdf
Description: This guidebook was produced for the Urban Ecology Coalition of Minneapolis. It is aimed at building "strong, self-determined, sustainable communities." The guidebook defines "neighborhood sustainability indicators" and provides a guide to developing and refining indicators.

Title: Outcomes Toolkit: The Results Oriented System for Community Improvement
Contact: Michael Bilton, Director, ACT National Outcomes Network
Address: The Healthcare Forum Foundation
180 Montgomery St. Suite 1520
San Francisco, CA 94104
USA
Tel: 415-248-8411
Fax: 415-248-0411
E-mail: mbilton@healthforum.com
Web site: www.act-toolkit.com
Description: Web-based application for developing and tracking community indicators. On this web site, stakeholders can develop a community profile, receive technical assistance in developing indicators and share information.

Title: Sustainability Starts in your Community
Contact: earthday@earthday.net.
Address: **Earthday Washington, D.C., USA**
1616 P Street NW, Suite 200
Washington, D.C. 20036 USA
Tel: 202-518-0044
Fax: 202-518-8794
Earthday Seattle, USA
811 First Avenue, Suite 466
Seattle, WA 98104 USA
Tel: 206-876-2000
Fax: 206-876-2015
Web site: http://www.earthday.net/pdf/goals/Sustainability_Guide.pdf
Description: This community indicator guide was produced in April 2002 by Redefining Progress and Earth Day Network. It is a step-by-step guide to developing and reviewing community indicators. The guide also provides suggestions for ways to involve the larger community in indicator projects.

Title: Sustainable Community Indicators: a Review of National Methods and Suggestions
Contact: Long Island University, Institute for Sustainable Development
Web site: www.luinet.edu/sustain/si.html

Description: Review and comparison of ten leading indicator projects, definitions of sustainability and indicators and discussion of how to start an indicator project. Online tools are also available toward developing and maintaining community indicator projects.

Title: The Sustainable Development Toolkit

Contact: John Lambie, Director, Florida House, Institute for Sustainable Developmentjl@i4sd.org

Address: Florida House Institute for Sustainable Development, Inc.
4600 Beneva Road
Sarasota, Florida 34233
USA

Tel: 941-927-2020

Web site: http://www.i4sd.org/toolkit.htm

Description: A toolkit of process and design tools to support citizen-based sustainable community development planning processes. One of the sections in the toolkit is aimed at helping citizens and other stakeholders develop sustainable community indicators.

Europe

Title: Cities Environment Reports On the Internet (CEROI)

Contact: CEROI Secretariat

Address: UNEP/GRID-Arendal
Longum Park
Service Box 706
N-4808 Arendal
Norway

Fax: +47 37 03 50 50

E-mail:ceroi@grida.no

Web site: http://www.ceroi.net/ind/index.htm

Description: This project follows up on Chapter 40 of Agenda 21. CEROI provides a template and software including an Encyclopedia of Indicators for member cities wishing to create and use indicator data on the Internet.

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Title: Communities Count: The LITMUS Test

Contact: New Economics Foundation

Address: Cinnamon House
6-8 Cole Street
London SE1 4YH
UK

Tel: 020-7407 7447

Web site: http://www.neweconomics.org/uploadstore/pubs

Description: This useful guidebook describes the necessary steps to develop and monitor indicators. It also describes the approach taken and lessons learned from the LITMUS project (local indicators to monitor urban
sustainability). The guide is user friendly and easy to follow.

Title: The Dashboard of Sustainability

Contact: Consultative Group on Sustainable Development Indicators (CGSDI)

Address: CGSDI Secretariat
International Institute for Sustainable Development

161 Portage Avenue East, 6th Floor
Winnipeg, Manitoba R3B 0Y4
Canada
Tel: +1-204-958-7700
E-mail: phardi@iisd.ca
Web site: http://www.iisd.org/cgsdi/intro_dashboard.htm
Description: The Dashboard of Sustainability is an online tool designed to be understood by experts, the media, policy-makers and the general public. Using the metaphor of a vehicle's instrument panel, it displays countryspecific assessments of economic, environmental, social and institutional performance toward (or away from) sustainability.

Title: Local Quality of Life Counts
Contact: Mark Jeffcote, Sustainable Development Advisor
Address: Department of the Environment, Transport and the Regions
Free Literature
PO Box 236
Wetherby LS23 7NB
UK
Tel: 0870 1226 236
Web site: http://www.defra.gov.uk/environment/sustainable/index.htm
Or http://www.1a21-uk.org.uk
Description: A handbook offering a guide for measuring sustainable development and quality of life in local communities. It presents a menu of 29 indicators, guidance for preparing community strategies and developing indicators, suggested methodologies for collecting data, a checklist of issues to stimulate discussion and a list of eight "best value" performance indicators.

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Title: Local Sustainability: Campaign Interactive.
Contact: European Commission
Mr. Anthony Payne
Campaign Co-ordinator & Head of Office
E-mail: campaign.anthony@skynet.be
Address: European Sustainable Cities & Towns Campaign
Rue de Trèves/Trierstraat 49-51
box 3
B - 1040
Brussels
Phone: +32 2 230 53 51
E-mail: campaign.office@skynet.be
Web site: http://www.sustainable-cities.org/sub12a.html
Description: The European good practices Information Service and Best Practices Database. Contains examples of good practices and policy documents on sustainability and the urban environment.

Title: Towards a Local Sustainability Profile
Contact: Ambiente Italia
Address: Instituto di Ricerche (responsabile del coordinamento scientifco)
all'attenzione di Claudia Semenza

Via Poerio 39
20129 Milano, Italy
Tel: 0039 02 277441
E-mail: ecip@ambienteitalia.it.
Web site: http://www.sustainable-cities.org/indicators/index2.htm
Description: The European Common Indicators is a monitoring initiative focused on sustainability at the local level. The project is ongoing and accepting new participants. Support services are provided to participating authorities during the testing phase: technical support (scientific expertise, helpdesk, workshops, etc.), methodological development, pilot activities on the Ecological Footprint, good practice collection and exchange, dissemination activities, and evaluation, reporting, recommendations and guidelines.

Title: Urban Indicators Toolkit
Contact: United Nations Center for Human Settlements (Habitat)
Address: Global Urban Observatory and Statistics
Urban Secretariat, UNCHS (Habitat)
PO Box 30030
Nairobi
Kenya
Tel: 254-2-623119
Fax: 254-2-623050
E-mail: guo@unchs.org
Web site: www.urbanobservatory.org/indicators>
Description: UNCHS offers a toolkit and guide for cities participating in the implementation of the Habitat Agenda. The guide includes detailed indicator methodology sheets and examples of toolkit spreadsheets for reporting.

Title: WHO Healthy Cities Project
Contact: WHO Center for Urban Health
WHO Regional Office for Europe, Healthy Cities Project
Address: 8 Scherfigsvej
DK-2100 Copenhagen
Denmark
Tel: 45 39 17 12 24
Web site: http://www.who.dk/healthy-cities/hcp.htm
Description: Worksheets for 32 urban health indicators are presented in this booklet. The indicators listed have been developed from the data collected from the European Healthy Cities project. The worksheets provide definitions, methods of calculation, unit of measurement and a number of other descriptors.