

2. **Distribution.** Because of the well-known uneven distribution of leprosy, it seems necessary to clarify the level of population to be used as denominator to monitor the decrease in prevalence and incidence rates (e.g. total population of a country? Only the population of endemic areas?).
3. **Incidence.** Decreasing incidence is the only true indication of progress towards elimination. Reports from a number of countries show declining incidences following MDT programmes. It is essential to assess the real impact of MDT and other factors in these situations.

The points outlined above will be discussed along with some other relevant issues (definition of cure, under detection of cases at the maintenance phase of MDT programmes, and problems in "difficult areas").

It should be possible to agree on standardized concepts and indicators to allow adequate monitoring of progress in the elimination plan. The demonstration of progress would in turn be a great stimulus for those engaged in this effort.

EPIDEMIOLOGY

EPI

THE STUDY OF APPLYING TWO-STAGE CATALYTIC MODELS TO COMPARISON BETWEEN LEPROSY AGE-SPECIFIC PREVALENCE RATES

YANG Zhong-Min*, LUO Xi-Gu**, YE Gan-Yun*,
TAO Ming-Bo**, LUO Jun**
* Institute of Dermatology, CAMS, P.R.China
** Yangzhou Institute of Dermatology, P.R.China

The Two-stage catalytic models can be used to simulate the distribution of age-specific prevalence rates of some infectious diseases and age-specific positive rates of some indicators, to measure their "force of infection" and "force of eliminating disease". It is certainly significant for researching and evaluating the prevalent features of infectious disease and the effect of the disease control programme. In this paper the author uses an improved two-stage catalytic model (LogTCM) developed by the author which is transformed in an equation to simulate age-specific prevalence rates of leprosy in Yangzhou Prefecture in 1985 and to analyse the results in comparison with 1975. The results of the study confirm that the parameters "a" and "b" in the model represent the force of infection and the force of eliminating disease respectively, by vertical section of leprosy endemic situation and leprosy control. By analysing and comparing the practical leprosy prevalence rates and the parameters of the catalytic model, it becomes clear that the prevalence rates are positivity related to parameter "a" and inversely related to parameter "b" and "k"(a/(a-b)). Catalytic models may be used to fit and analyse the epidemiological data in various periods, regions or populations.

EP2

EPIDEMIC SITUATION OF LEPROSY AFTER MDT IMPLEMENTATION AND PREDICTION OF BASIC ERADICATION IN YANGZHOU PREFECTURE

Jiang Cheng Chen Xiangsheng Yan Lianbin Li Wenzhong

Ye Ganyun Luo Jun Tao Ningbo Luo Xigu

Institute of Dermatology, CAMS, Nanjing, China

Yangzhou Prefecture of Jiangsu Province was one of the former leprosy hyper-endemic area in China, which had once the highest prevalence rate of 1.88% in 1973. Since 1983, all the active cases were treated with MDT recommended by WHO. At the end of 1990, 1176 (MB 621 and PB 555) patients have been treated with MDT. Through the comparative analysis of the theoretical endemic indicators of 1983-1990 calculated by the mathematical models of DDS mono-therapy (1973-1982) and the actual indicators, the results showed that the detection and prevalence rates after MDT were usually higher than the theoretical ones (difference between theoretical and observed values, $\Delta Y > 0$) and ΔY values declined significantly after 1989, moreover ΔY was less than 0 in some counties. However, the incidence rates of leprosy after MDT introduction were lower than the theoretical rates calculated, which means the effect of MDT on epidemiology would be presented significantly in 5 years. The time trend of this area have been fitted with the exponential function models ($Y = e^{bt}$) with $b < 0$ and $R^2 > 0.8558$ except one county with R^2 of 0.6027.

Through the results the authors suggested that the short-term endemic situation of leprosy can be predicted using the mathematical models fitted by the complete date of past years. The prediction results showed that leprosy will be basically eradicated by 1997 in Yangzhou Prefecture.

EP3

MEASURING EPIDEMIOLOGICAL IMPACT OF MULTIDRUG THERAPY IN LEPROSY CONTROL AREA

P S S Rao, P Vijayakumaran, J A Ponniah and
Kumar Jesudasan
Schieffelin Leprosy Research & Training Centre,
Karigiri-632106 and Christian Medical College,
Vellore-632002, India.

Given the increased acceptance of MDT and greater political commitment, there are great hopes that the transmission of leprosy could virtually be stopped over a period of time. However, the expectations have not been fully realised, perhaps because the epidemiological impact depends on several other host and environmental factors that need assessment and proper management.

MDT has been in vogue for over a decade in Gudiyatham Taluk (400,000 population) and its epidemiological impact is measured through annual screening of a sample population. Leprosy newly found among those normal in the previous year are labelled as incident cases and other new cases discovered in the area considered case detections. During the decade, deaths, births and migrations have resulted in qualitative and quantitative changes in the population under study. These have been carefully monitored and documented. Using actuarial methods and Cohort analysis, as well as linked cross-sectional data, the epidemics of leprosy within geographically defined areas and time-trends in incidence of leprosy are determined and associated with relevant factors. After substantial initial declines, current rates are around 1/1000 with no further significant reductions. Possible reasons for this scenario and implications for future reductions are discussed

EP4

ASSOCIATION OF LEPROSY AND TUBERCULOSIS BETWEEN 1902 AND 1991 IN FRENCH POLYNESIA.

Philippe Glaziou, Jean-Louis Cartel, Jean-Paul Moulia-Pelat, Lam N'Guyen Ngoc, Suzanne Chanteau, Régis Plichart and Jacques Grosslet

Institut Louis Malardé, Papeete, Tahiti, French Polynesia

From 1902 onwards, notification and lifelong follow-up of leprosy patients has been systematic in French Polynesia. Since

1960, notification of tuberculosis is mandatory. Leprosy case detection rates per 100,000 decreased from 50 in 1902 to 25 in 1959 and to 8 in 1991. Tuberculosis case detection rates per 100,000 decreased from 568 in 1960 to 25 in 1991.

From 1902 to 1959, 673 cases of leprosy were detected. Of them, 89 (13%) died from tuberculosis. Mortality from tuberculosis between 1901 and 1930 was 21%, and decreased to 8% between 1931 and 1959. From 1960 to 1991, 350 new cases of leprosy were detected. Of them, 12 (3%) developed tuberculosis.

From 1902 to 1959, mortality from tuberculosis occurred significantly more frequently in multibacillary patients (13%) than in paucibacillary (4%). Relative Risk (RR) = 3.2, $p = 0.003$. From 1960 to 1991, incidence of tuberculosis seemed more frequent in multibacillary patients (RR = 3, $p = 0.07$), whatever the sequence of detection of the two diseases.

Our study suggests that lepromatous patients share factors of susceptibility to mycobacterial diseases with patients developing tuberculosis.

EP5

THE APPLICATION OF OPTICAL MARK READER (OMR) TO CHINA LEPROSY SURVEILLANCE SYSTEM

YANG Zhong-Min, HUA Ju-Xiang, JIANG Cheng, LI Wen-Zhong, YANG Jian, YE Gan-Yun
Institute of Dermatology, CAMS, P.R.China

Computers have been widely applied to various domains. The first step is to input the data into a disk in order to rapidly process a vast amount of data. Up to now in many fields, data are slowly entered into the computer by hand. A slow input of data is not appropriate with the microcomputer may process them quite rapidly. It produces a bottleneck, which makes the use of the computer irrelevant. The application of Optical Mark Reader (OMR) to input data is a way to solve this problem. The China Leprosy Surveillance System uses the OMR to enter the data of leprosy cases. It is a good start in order to solve this problem. The data of leprosy cases must be coded in a set of number "0-9" and the codes of each item have to be located on the special form for leprosy case in blank marks. While the different forms are automatically passed the gap in the reader of the OMR, the codes of data can be read by the sensors in the reader and then are transferred into computer in a character string. Soon afterwards the string are divided into many parts and sent to different databases as fields by programme control. In this way to input data are processed more rapidly and more accurately. One form takes only a second, more than 6 000 forms can be processed per day, and the reading error is below 1/1000000 marks. The method of inputting data with OMR provides a powerful tool to input a large amount of data not only in leprosy epidemiology, but also in other fields.

EP6

A TWENTY YEAR FOLLOW-UP STUDY OF INCIDENCE RATES OF LEPROSY IN DDS PROPHYLAXIS AND CONTROL GROUPS

V. PRABHAKARA RAO
GANDHI MEMORIAL LEPROSY FOUNDATION
WARDHA-442 103 MAHARASHTRA INDIA

DDS was believed to be a good prophylactic tool around 60's & 70's. 2 Experiments were conducted in India to assess this. During 70's & 80's, a few studies suggested that DDS has inhibitory effect on CMI.

The author has analysed the post-prophylactic data of incidence rates during last 20 years in the project of Gandhi Memorial Leprosy Foundation where DDS as prophylaxis was given for 8 years to 1 group of 9200 (L), for 4 years to 8829 (L,U) and 18674 (W) were kept under placebo. The analysis was done to assess whether DDS exerted any prophylactic value or was inhibitory to CMI.

In the 20-year period, 153 cases occurred in L (mid-term population 5120), 171 in L-W (5361) and 354 in W (11103) groups. The respective cumulative incidence rates were 29.8, 31.8 and 31.8. No significant differences were noticed in incidence rates. DDS did not seem to have either prophylactic value or inhibitory effect on CMI.

Further detailed analysis of age-type occurrence, deformity & relapse rates and responses to treatment were made and discussed.

EP7

LEPROSY AND HIV IN TANZANIA

H.J. Chum, A.R. Kitumba, M. Gunzareth,
P. Graf.

National Tuberculosis and Leprosy Programme
Tanzania TB/Leprosy Central Unit, Dar es Salam
Tanzania.

Association between TB and HIV is well documented in Tanzania. A TB/HIV study was conducted between 1992 and 1993 during which time all available new leprosy patients were tested for "HIV" virus, as control.

Over 300 leprosy cases were studied from some 12 Regions. The results were compared with existing blood donors or antenatal mothers blood samples as well as with the TB patients blood.

The paper will present the results and discuss implication of HIV with regards to leprosy in Tanzania. Preliminary results so far shows however no significant difference between leprosy and blood donors / antenatal mothers. Detail analysis might show some difference. This will be reflected in the details and paper discussions.

EP8

THE EPIDEMIOLOGY OF HANSEN'S DISEASE IN THE ENGLISH-SPEAKING CARIBBEAN AND SURINAME: CURRENT STATUS AND TRENDS

J.E. Tollefson, M.D., M.H.Sc., F.R.C.P.C., F.M.M. White, M.D., C.M., M.Sc., F.R.C.P.C., C.J. Hospedales, M.B.B.S., M.Sc., M.F.C.M., M.E. Brown, R.N., C.W. Thompson, R.N., M.S., M.P.H.

Caribbean Epidemiology Centre, Port of Spain, Trinidad, West Indies

Hansen's Disease is still endemic in some Caribbean countries. This paper documents the current epidemiology of Hansen's Disease in 19 countries which are served by the Caribbean Epidemiology Centre. According to World Health Organization guidelines, based on estimated prevalence, this disease can currently be considered a 'public health problem' in two of these countries: Suriname and St. Lucia. In other words, their populations can be considered to be at significant risk of infection. However, there is uncertainty regarding the amount and sensitivity of case detection in the other countries. Active transmission is still occurring, evidenced by the continued detection of new cases aged less than 15 years. Patients are still suffering disabilities due to lateness of diagnosis and treatment. Thus, in pursuing the goal of leprosy elimination in CAREC member countries, the definition of elimination and the steps taken to attain the goal will require careful deliberation.

EP9LEPROSY AND SOCIO-ECONOMIC DEVELOPMENT :
BETWEEN AND WITHIN COUNTRY COMPARISONS

W C S Smith

The Leprosy Mission, Katong P O Box 149, Singapore 9143

Leprosy disappeared from Northern Europe before effective chemotherapy was available, probably as a result of social, economic and environmental improvements. The current downward trend in the occurrence of leprosy in some rapidly developing countries may also be the result of socio-economic improvement as well as due to the impact of chemotherapy.

Current leprosy data and socio-economic, health, education and population data from 158 countries has been analysed. Significant correlation is noted between leprosy prevalence and incidence, and many socio-economic indicators. The relationship is log-linear and such that, for example, no country with a Gross National Product of more than US\$5500 per capita has a leprosy prevalence of greater than 4 per 10 000. MDT coverage is correlated with leprosy prevalence but shows no relationship with incidence. A similar analysis within Malaysia has shown MDT coverage to be related to leprosy prevalence but not to incidence, however housing standards were closely related to incidence.

These between country and within country analysis demonstrate the relevance of socio-economic development to the decline prevalence and incidence of leprosy.

EP10

STUDIES OF TRENDS OF HANSEN'S DISEASE IN BRAZIL

Gerson O. Penna, Maria F. S. Alvim, Gerson F. M. Pereira,
Megumi Sadahiro e Ruth GlattCoordenação Nacional de Dermatologia Sanitária,
Ministério da Saúde, Brasília, Brasil.

The study of trends Hansen's Disease in Brazil has been used to assess the endemy's evolution and estimate targets for the annual programming of control activities.

We used the historical series of detection rates for the country, the macroregions and each unit of the federation, from 1973 to 1992, applying the exponential adjustment method. For each region, we built three curves of the endemy's trend, corresponding to the periods 1973-1981; 1982-1992; and 1973-1992.

The authors discuss the influence of operational factors from the Programme for the control and elimination of Hansen's Disease on the results shown and the validity of using these curves in assessing the endemy's evolution in the country.

EP11EVOLUTION OF THE LEPROSY DETECTION RATE IN ANJOUAN
(COMORES) FROM 1981 TO 1992S. Grillon, S. Pattyn

Intensive case finding and combined treatment regimens for all patients were introduced in Anjouan in 1981. The mean yearly detection rate (not taking into account the unknown increase in population) during successive 4 year periods was for 1981-84: 9 per 10,000, for 1985-88: 4.8 and for 1989-92: 5 per 10,000. The MB rate during the same periods was 20, 34 and 30 respectively. The % of children (< 15 yrs) at diagnosis among PB declined from 57 to 52 and 49; among MB it was 23, 30 and 13. The disability rates at diagnosis decreased 10 fold. However, between 1989 and 1992 the yearly detection rate declined steadily from 6 to 3.8/10,000. These figures together with the decrease of the proportion of leprosy in children may indicate that after 10 years of intensive antileprosy activities the incidence of the disease finally declines.

EP12

LEPROSY PREVALENCE IN RUSSIA

A. Juscenko, V. Duiko, M. Parshin
Leprosy Research Institute, Astrakhan, Russia

In 1992 in Russian Federation (population - 150 million) 1104 cases of leprosy were registered. Additionally, about 100 patients from other countries of CIS also received multidrug therapy in Russia. There are 4 leprosy centres for approximately 500 beds, responsible for outpatient treatment, post-treatment surveillance and other activities on leprosy control. Among the patients 34% are males and 66% are females. The patients aged over 50 years old prevail. In 1961-1965 on the whole Russian territory in average 73 new leprosy cases were registered annually, and for the last five years' period of 1986 - 1990 - only six new cases per year. Multibacillary forms prevail (56%). Formerly the Lower Volga and some territories in the North Caucasus as well as Yakutia in Siberia were considered as leprosy endemic foci. Sporadic leprosy cases were found out throughout the whole country. In nowadays only Astrakhan region (population - 1 million) situated in the delta of the Volga is of epidemiological significance: here 550 cases are on the register, i.e. 50% of the total amount of leprosy patients. In the south of Russia, excepting Astrakhan region, another 400 cases are registered, and there are totally 150 cases in central, north and eastern regions. Retrospective computerized analysis of the annual rates of leprosy prevalence, incidence and mortality suggest that provided the trends found out have retained, by 2000 epidemiological situation in Russia will remain unchanged.

EP13

LEPROSY IN THE FORMER USSR

A. Juscenko
Leprosy Research Institute, Astrakhan, Russia

Leprosy was never a major problem of public health in the former USSR. The highest number of leprosy cases was registered in 1964 and equaled 7436 patients. In the period of 1950-1964 annually 250-600 new cases of leprosy were registered. Sulphones were implemented into the practice of leprosy treatment in 1952 in the USSR. In 1970 chemoprophylaxis of contacts of multibacillary leprosy patients was introduced. Since the middle of 1960 leprosy incidence has been continuously declining. In 1990 only 15 new leprosy cases were registered. For the last 50 years over 20 governmental decrees and guidelines on leprosy control have been issued. On the beginning of 1991 in the republics of the USSR 3976 leprosy patients were registered: Russian Federation - 1152, the Ukraine - 75, Byelorussia - 2, Kazakhstan - 1185, Uzbekistan - 1003, Tadjikistan - 166, Turkmenistan - 141, Kirgizia - 33, Azerbaijan - 104, Armenia - 40, Georgia - 21, Moldova - 6, Latvia - 22, Lithuania - 1, Estonia - 25. There are 12 antileprosy centres where 974 cases were treated as inpatients and 1576 - as outpatients (the rest 1426 patients were under surveillance). With desintegration of the USSR active case-finding, survey and treatment activities have worsened, but Leprosy Research Institute is trying to avoid a severance of professional relations between leprosy centres. Today's economic hardships adversely affect the care of the patients and surveillance of leprosy contacts and every efforts are required to escape worsening epidemiological situation.

EPI4

10-12 YEARS FOLLOW-UP OF HEALTHY CONTACTS OF LEPROSY CASES USING FLA-ABS AND LEPRIMIN TESTS

V.P.Bharadwaj Kiran Katoch, A.S.Bhatia and V.S.Yadav

Central JALMA Institute for Leprosy (ICMR),
Tajganj, Agra-282 001, India

In leprosy, the risk factors and course of the disease in the healthy contacts is not known with certainty. At C.J.L., Agra more than 1000 healthy contacts of different types of leprosy patients attending the OPD of the Institute have been followed-up for 10-12 years. Their initial lepromin status and positivity for *M.leprae* specific antibodies by fluorescent antibody absorption test (FLA-ABS) was recorded. During this follow-up of more than a decade, a large number of contacts have developed disease ranging from tuberculoid to lepromatous types. Various risk factors including the predictability to get disease either using FLA-ABS, lepromin alone or in various combinations has been statistically evaluated. Analysis of the results indicates that FLA-ABS test is a very sensitive test for monitoring the subclinical infection in the community specially the childhood contacts. It was also observed that by the combination of FLA-ABS and lepromin tests, the relative risk can be better predicted than using these tests alone. The contacts with initial FLA-ABS positivity and lepromin negativity were found to be at significantly higher risk in compared to other groups. FLA-ABS positivity was observed to appear before lepromin responses in many childhood contacts and is thus a more sensitive method for detection of subclinical infection in this age group.

It is concluded that FLA-ABS test is a highly sensitive test which can be used for monitoring the transmission of disease. Alongwith lepromin testing, this can be used for detecting the contacts at higher risks of developing the disease.

EPI5

A SEROEPIDEMIOLOGICAL STUDY OF LEPROSY IN HOUSEHOLD CONTACTS AND HEALTHY POPULATION BASED ON ELISA USING ND-0-BSA AND PGL-I AS ANTIGENS

Li Wenzhong Ye Ganyun Chen Xiangsheng Wu Qinxue

Huang Wenbiao Liu Fengwu Zhang Shibao Ran Shunpeng

Institute of Dermatology, CAMS, Nanjing, China

Using the ELISA assay of detecting antibodies to ND-0-BSA (A-ND) and PGL-I (A-PGL), a seroepidemiological study of leprosy was carried out in 723 leprosy household contacts (HCP), including 1632 healthy persons in endemic areas (EHP) in Yunnan Province and 131 healthy persons in nonendemic area (NHP). The seropositive criteria were identified by EHP and NHP respectively, namely EHPC and NHPC. For A-ND and A-PGL, EHPC were 0.23 and 0.225, NHPC were 0.14 and 0.17. According to NHPC, the seropositive rates for A-ND and A-PGL were 20.19% and 15.21% for HCP, 15.13% and 9.38% for EHP, presenting a significant difference between HCP and EHP for both antibodies. According to EHPC, the seropositive rates for A-ND and A-PGL were 6.36% and 8.44%, respectively. Among the three groups of population, the mean antibody levels were not significantly different between HCP and EHPC, and significantly different between others. According to NHPC, the relative risk (RR) of HCP and EHP were 4.04 and 3.02 for A-ND positive, and 3.04 and 1.88 for A-PGL positive. According to EHPC, RR of HCP were 1.27 and 1.88 for A-ND and A-PGL. The results of the study suggested that the detection of antibody was a useful tool for epidemiological research, but was questionable as a serological tool for early diagnosis of leprosy.

EPI6

STUDY ON LEPROSY SERO-EPIDEMIOLOGY IN CHINA

Wu Qinxue Su Heiwen Li Xinyu Wei Wanhui Ye Ganyun

Institute of Dermatology, CAMS, Nanjing, China

We reported the results studied by sampling survey on leprosy sero-epidemiology in different provinces in China.

The provinces selected were: Jiangsu (Baoying, Gaoyou), Shaanxi (Chenggu, Giyuan), Hunan (Chengbu, Shangzhi), Hubei (Tianmen, Jiashi) and Liaoning (Benxi). A sum of 5,861 samples, including household contacts (HC) 1,083, matched random population (MR) 452, random population (RP) 3,171 and normal controls (NC) 380 from endemic area and non-endemic area for leprosy (ENC 95 and NNC 285). The above samples, except those using Ms-ELISA in Benxi, were all detected by PGL-I-ELISA for antibody against PGL-I.

The results indicated that:

1. cross section studies: 1) The order of positive rates (PR) was HC>MR>RP>ENC>NNC; 2) Ig level increased gradually from that of HC to that of LL, but in BT/TT, IgG>IgM and in LL-BL IgM>IgG; 3) PR was 29.1% in the group aged 15-25 more than those in the other age groups and was higher in HC contacted with MB than in those contacted with PB, and the PR were relative to blood relationship and type of index cases contacted and so on.

2. longitudinal studies: in weakly positive HC, a minority of them, antibody level became strongly positive, a majority of them, negative, in strongly positive cases, there were no case who turned to be negative and two of them have developed clinical leprosy (BT and BL). In 19 cases of them (lepromin test $- \sim \pm$), except those with increased antibody levels, AFB in blood or skin smear have been found in some cases.

EPI7

DETECTION OF LEPROSY INFECTION BY SEROLOGY AND POLYMERASE CHAIN REACTION. AN EPIDEMIOLOGICAL STUDY IN SOUTH SULAWESI, INDONESIA.

Stella van Beers 1), Baedah Madjid 1), Shinzo Izumi 2), Paul R. Klatser 3), Madeleine Y.L. de Wit 3), and Mohammad Asri 4).

1) Dept. of Microbiology, Hasanuddin University, P.O.Box 11, Ujung Pandang, Indonesia; 2) National Institute for Leprosy Research, Tokyo, Japan; 3) Royal Tropical Institute, Amsterdam, The Netherlands; 4) Provincial Health Services, South Sulawesi, Indonesia.

A population based study was carried out in two adjacent villages in South Sulawesi, Indonesia. The prevalence of clinical leprosy was 10.0 per thousand inhabitants. A total of 1015 serum samples were examined. IgM antibodies to phenolic glycolipid-1 (PGL-1) were demonstrated by the gelatin particle agglutination test (MLPA) and by indirect ELISA test. PGL-I-IgG and Lipoarabinomannan-B (LAM-B) antibodies were measured by indirect ELISA. IgM antibodies were present in 32 % of the population, with the highest prevalence in the younger agegroups. The seropositivity rates in females were consistently higher than in males. PGL-I-IgG and LAM-B antibodies were found in 6.7 and 11.6 % of the population respectively, and no age related pattern was observed. There was no difference in IgM and IgG seropositivity between household contacts of leprosy cases and non-contacts. Nasal swabs from 1228 persons were examined by polymerase chain reaction (PCR). The presence of *Mycobacterium leprae* was demonstrated in 7.8 % of the swabs. No relation was found between the PCR and the serological results.

EPI8

SPATIAL ANALYSIS OF THE ORIGINS AND RISKS OF ARMADILLO LEPROSY.

R.W. Truman, J.A. Kumaresan, S.A. Alexander

G.W.L. Hansen's Disease Center, Carville, USA

Nine-banded armadillos are highly endemic natural hosts of leprosy but the origin of their infection and risks they present to man has been unclear. In addressing these issues we've examined nearly 1400 armadillos from across the southern US and elsewhere using histopathology, PGL-1 serology, and PCR for a 360 Bp *M. leprae*-specific DNA fragment. Leprosy is absent among those US armadillos that arose as a segregated population in the state of

Florida but it is widely distributed among all others. There are no directional trends in its prevalence distribution that might suggest a nidus. Leprosy appears to be indigenous to armadillos. Both the detectability and transmission of armadillo leprosy appear to be affected by the environment. Antibody prevalence rates are highest in low lying habitats and average 15%. In regards to man, a review of US registry data since 1894 indicates that familial contacts have been the principle source for leprosy transmission. But analysis of recent patient histories in Texas, Louisiana and Florida suggest that contact with infected armadillos is an increasingly important associable risk factor. Leprosy remains rare among US citizens, but contact with armadillos may be a factor in its persistent low incidence in this country and armadillos can be useful models for studying environmental variables in leprosy transmission.

EP19

INCIDENCE RATES OF LEPROSY DECLINE WITH INCREASING DURATION OF SCHOOLING AND WITH IMPROVING STANDARDS OF HOUSING IN KARONGA DISTRICT, NORTHERN MALAWI

Jorg M. Ponnighaus¹, Paul EM Fipe², Jonathan AC Sterne², and Rosamund J Wilson²

¹Karonga Prevention Study, Chilumba, Malawi;

²Communicable Disease Epidemiology Unit, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK.

Although factors related to the poverty complex have long been postulated to be risk factors for leprosy, detailed relevant data are scarce. Confirmation of an association might clarify mechanisms of *M. leprae* transmission, and even provide a target for control programmes. We studied incidence rates of leprosy in more than 80000 individuals in Karonga District, Northern Malawi, followed for an average of five years. Leprosy rates were inversely related to increased duration of schooling and to improved standards of house construction as defined by data collected at the start of the study. Examination of these trends within strata defined by age and sex and adjusted for prior BCG vaccination suggested that the association with housing was a function of living conditions in early, rather than later, life (although confidence intervals were wide). Implications of these results for the natural history of leprosy will be discussed.

EP20

NEW SIMULATION MODEL FOR PREDICTING INCIDENCE AND PREVALENCE TRENDS IN SEVAGRAM AREA OF DISTRICT WARDHA - MAHARASHTRA - INDIA

Mukund Ranade

Gandhi Memorial Leprosy Foundation, Hindinagar, Wardha - Maharashtra - India, Pin-442 103.

Epidemiometric models are useful tools for studying dynamics of disease in populations. Simulation model that is used in this paper has been developed newly, with the Data from Sevagram Leprosy Control Unit, District Wardha in State of Maharashtra, India, run by Gandhi Memorial Leprosy Foundation. It was assumed that man is the only source of infection and natural events such as death, migration and birth have been considered in the model. The data is collected for the annual status of each individual that existed in the Unit anytime between follow-up period from 1952 to 1990 and followed up through annual surveys under SET plan. From this well coded data annual transit probabilities for changes of status of individuals from one year to next year are calculated annually. The probabilities were simulated on a cohort of population classified for sex. This generated sex specific incidence and prevalence rates, from 1952 to 1990. The mathematical equation based on experience of rate from 1952 to 1990 would be used to predict trend of leprosy in the area.

EP21

EFFECT OF NATURAL DEMOGRAPHIC CHARACTERS ON INCIDENCE OF LEPROSY - A CASE STUDY.

Mukund Ranade

Gandhi Memorial Leprosy Foundation, Hindi Nagar, Wardha - 442 103 Maharashtra - India.

The data is maintained in Sewagram Leprosy Control Unit of District-Wardha in Maharashtra India through annual surveys for leprosy.

Of the twentyseven villages the data from one village in Sewagram Leprosy Control Unit for over a period of 40 years is collected on the natural demographic characters such as death, emigration and immigration, birth both for population and cases of leprosy. Same is analysed as a case study in this paper to find out the effect of these natural forces pertaining to population and existing cases on incidence of leprosy with a further view to 1) estimate relationship between increase in population and incidence of leprosy, 2) compare the effect of natural forces on general population and case of leprosy,

3) compare incidence in original population that existed in first survey of 1952 followed up over 40 years and that in subsequently added population.

Both age and sex composition of population is considered to establish effect of these factors also.

EP22

ANALYSIS OF FACTORS AFFECTING LEPROSIS EPIDEMIC WITH STEPWISE REGRESSION MODEL

Li Tianzi¹ and Feng Xuexiang²

¹Affiliated Hospital, Youjiang Medical College for National Minorities and ²Skin Disease Prevention and Treatment Institute of Bose Prefecture, Guangxi, China 533000

The basic data were taken from the records in Bose Prefecture of Guangxi from 1956 to 1992, with leprosy morbidity (y_1) and case rate (y_2) as dependent variables, the per capita gross value of industrial and agricultural production (x_1), per capita national income (x_2), proportion of agricultural population (x_3), proportion of public health personnel (x_4), average annual temperature (x_5) and average annual rainfall (x_6) as independents. Multiple regression model of y_1 and y_2 were built with stepwise regression method, respectively. The simple correlations between each variable and independents in the model were analyzed. It is illustrated that population, economy and air temperature have effects on leprosy epidemic in varied degrees, among which x_1 , x_2 and x_3 have greater effects on y_1 , x_1 and x_3 have more obvious effects on y_2 .

Key words: Multiple regression; stepwise regression; partial regression coefficient; morbidity; case rate.

EP24

THE ANALYSES OF LOGISTIC REGRESSION FOR 593 MB CASES WITH WHO MDT OR MODIFY MDT IN YANGZHOU PREFECTURE, CHINA

YANG Zhong-Min*, LI Wen-Zhong*, YE Gan-Yun*, LUO Xi-Gu**, TAO Ming-Bo**, LUO Jun** and M.F. Lechat***

* Institute of Dermatology, CAMS, P.R.China

** Yangzhou Institute of Dermatology, P.R.China

*** Dept. of Epidemiology, SOPH, UCL, Brussels

Five variables of the AGE at beginning MDT, SEX, delay(DL), treatment regimen(TR) and delay of treatment(DLTR) from detection to beginning MDT are used in the analyses of logistic regression. Ages are divided into 3 levels: ≤ 35 , 35-50 and > 50 , sex with 2 levels: male and female, DL with 2 levels: ≤ 2 and > 2 years, TR with 3 levels: Old MB (treated with DDS before) and New MB (never treated before) with WHO MDT, and MB with Mod MDT (modify MDT: local MDT), DLTR with

3 levels: ≤ 2 , 2-10 and > 10 years. The cured time is a dependent variable which is divided into 2 levels: ≤ 3.6 (median of cured time) and > 3.6 years. The results in single factor show that above 36- age group has high Odds 1.666 in comparison with young age group (Odds = 0.6002), differences between males and females (males Odds=1.188), and delays (≤ 2 year Odds=1.0815) show no significance ($p > 0.05$). Mod MDT has the highest Odds 4.2533 compared with New MB (Odds=0.20) and this indicates the longest time to cure. The cases in group of 2-10 year delay of treatment has an Odds 2.280, but DLTR less than 2 year indicates the lowest treatment efficiency (Odds=0.255). In multiple factors, the male MB with Mod MDT in medial age group has the highest Odds of 3.580. It means that the cases in the group have the shortest cured time in median in contrast to New MB cases in young age group with WHO MDT (Odds=0.3237).

EP25

TREND OF LEPROSY DURING THE MDT ERA

Vijayakumaran P, Jesudasan K, Mani Mozhi N,
& Rao P S S

S L R T C Karigiri, Tamilnadu, India 632 106

The known facts about leprosy are that: 1) the only known source of infection is a case of leprosy; 2) the mode of transmission in leprosy is unclear; and 3) the incubation period is long i.e. 2 to 5 years or more. In the absence of any primary prevention measures, it becomes obvious that the only possible area of intervention is by attacking the known source of infection i.e. a case.

S L R T C Karigiri, in Gudiyattam Taluk, (population 570,000) has been implementing a leprosy control programme, with intensive case finding activities, since 1962, with Dapsone monotherapy; MDT was introduced in 1982. In such a situation, one would expect a reduction in new cases of leprosy in the community. This has reduced the workload considerably, in terms of treatment delivery.

However, Incidence Rates reveal a slow decline over ten years, while the New Case Detection Rates among the various sections of the target population show a minimal reduction. The available data suggest that the quantum of disease transmission in the community has not changed appreciably.

EP23

THE ANALYSES OF STEPWISE REGRESSION AND INDICATORS FOR REFLECTING LEPROSY DECLINE IN YANGZHOU, CHINA

YANG Zhong-Min*, LUO Xi-Gu**, YE Gan-Yun*,
TAO Ming-Bo**, LUO Jun** and M.F. Lechat***
* Institute of Dermatology, CAMS, P.R. China
** Yangzhou Institute of Dermatology, P.R. China
*** Dept. of Epidemiology, SOPH, UCL, Brussels

Total 19478 cases have been detected (1949-1990) in Yangzhou Prefecture located in East of China with 9 200 000 (1990) population. The aims are to explore the relationship between some indicators and leprosy epidemiological trends as well as to identify the most important indicators for monitoring leprosy decline. The methods consist in a stepwise regression using 35 independent variables which are divided into two categories: registered and retrospective variables (the date of onset according to patients' complains), and 4 dependent variables: retrospective incidence rate, retrospective prevalence rate, registered prevalence rate, detection rate. The results show that the most important indicators with high significance (F

test: $p < 0.0001$) are: registered prevalence rate, detection rate, mean age at detection or onset, the proportion of cases at ≤ 14 age in total new cases, the median of delay, cured number in current years, the proportion of MB in registered cases, the proportion of cases with disabilities (II/III) at detection or in registered cases, prevalence rate, incidence rate. In order to calculate these indicators, the following data should be collected: sex, date of birth, date of onset, date of detection, date of beginning MDT, date of completed MDT, date of cured, date of relapsed, type of leprosy, disabilities grade and population in the area.

EP26

STUDY OF LEPROSY IN CHILDREN IN MULTI DRUG THERAPY IN BHARUCH DISTRICT GUJARAT INDIA

N.K. CHOPRA, R.GANAPATI, MRS. M.P. TRIVEDI
Multi-drug therapy project commenced since 1st March 1989 with financial collaboration of Government of India and W.H.O. Total no of patients brought under MDT till December 92 are 11447 (4513 old active area + 6934 new detected cases) No of child below 15 years detected between commencement of MDT and till Dec. 1992 are 1378, (12.01%), of which 187 (13.57%) are M.B. and remaining 1191 are P.B. (86.34%). Amongst P.B. most of the cases were indeterminate and tuberculoid.

Child incidence rate & childhood rate are one of the most vital epidemiological parameters for impact of MDT for leprosy control. These parameters are studied in relation to preparatory, intensive and maintenance phase of MDT. The study showed that child incidence rate which was at commencement of MDT was 21.19% and after 3 years of intensive face in the year 91-92 which increased to 28.9% Childhood rate in the year 1988-89 in preparatory phase was 16.25% and it was increased to 23.89% in the year 91-92.

The other vital epidemiological parameters e.g. the deformity rate, MB rate Bacteriological conversion rate, Age sex and cast factors will be presented.

EP27

AN ANALYSIS OF THE INCIDENCE OF LEPROSY FOR LEPROSY CONTACTS AFTER MDT IN LIANGSHAN AND PANZHIHUA PREFECTURES, SICHUAN PROVINCE

Wu Xinsheng and Ning Yong

Sichuan Provincial Institute of Dermatology and Venereology, Chengdu, China

MDT has been successfully implemented in Liangshan and Panzhuhua Prefectures for 5 years. Two-hundred-twenty-five new leprosy cases were detected among the leprosy contacts from 1987 to 1991; 131 of them were HC of MB 12 were HC of PB, and 94 were non-HC; the ratio for risk for MB HC, PB HC, and non-HC being 13:3:1. The case detection rate gradually reduced annually in the above three kinds of contacts. The annual average declining speeds were 29.9%, 41.1%, and 40.2%, respectively. Both age at onset of disease and proportion of MB among the newly detected cases were obviously increased year by year. The results of the epidemiological analysis indicated that MDT was very effective in interrupting the source of infection and in decreasing the incidence of the disease.

EP28

THE PROTECTIVE ROLE OF BCG IN HANSEN'S DISEASE

Maria C. C. Magalhães

Coordenação Nacional de Dermatologia Sanitária,
Ministério da Saúde, Brasília, Brasil.

All studies carried out to evaluate the effectiveness of BCG on Hansen's Disease have demonstrated a statistically significant protection, in spite of variations among the different populations. Recent studies have confirmed this protection, particularly against the multibacillary forms of the disease.

This paper presents a survey of the past 21 years in the Pernambuco State Central Hansen's Disease Register. Data were grouped by age, sex, and clinical form. Among these, 192 Hansen's Disease patients born since 1971, when ID BCG against tuberculosis was implemented, were examined.

The next phase of the study was the application of a statistical model to the collected data, studying the relationship between vaccine status and age, clinical form, and HD contact.

EP29

THE LEPROSY IN ALGERIA.

OMAR BOUDJENE-STRAMBOULI, ABDELKADER MEHAD-BOUDIA. Department of Dermato-Venerology, University Hospital of Tlemcen (West-Algeria).

Leprosy is not a problem for public health in Algeria. For one century (from 1888 to 1988) a maximum of 250 cases were reported, 75 only of them were Algerians, and 51 caught the disease in Algeria.

In July 1988, a couple from Tlemcen (West Algeria) and living in Mali, came to our service for consultation for the same type of lesions, non pruriginous achromic spots of 0,5 cm of diameter. These lesions reside on the forearms, the legs and the feet. A biopsy of an injury was practised and the histological examination shows the presence on the derm of periannexial and perivascular discreet infiltratis made of histiocytary cells with clear cytoplasm. The aspect is compatible with an indeterminate leprosis. Although the Hansen's disease is not a problem for public health in Algeria, the geographic situation of the country (several neighbouring countries) imposes a continuous surveillance, because of multiple exchanges with the neighbouring countries where there is a high leprosy endemicity.

EP30

THE ACTUAL STATE OF LEPROSY IN THE BALTIC STATES

Attyla Drabik, Anne Sarv, Janis Smits

Heinrich Heine University, History of Medicine, Düsseldorf, Germany

The Baltic States, which until recently were republics of the former USSR, are now independent states.

This fact permitted the possibility to conduct research into the situation of leprosy after the political change.

The actual presence of leprosy will be demonstrated by overhead slide-projection. Of the three Baltic States only Lithuania is free of leprosy at present, while in Latvia as well as in Estonia leprosy is endemic.

Diagnostic as well as therapy of leprosy were influenced by the political and economic situation of the former USSR.

Contacts with leprologists abroad were not possible. The only very limited possibility of continued education, advanced training, and research existed in Astrakhan (in the south of the USSR).

In Estonia a "prophylactic therapy" was executed. The sociological problems of the patients are aggravating. The clinical picture of leprosy with complete statistics will be presented.

EP31

The Relationship between Leprosy Incidence and Economic Development

Dr. Zhao Di, Dr. Zhong Jingzeng, Dr. Nong Yuewen
Dr. Lu Melying & Ms. Hu Ruiying
Guangzhou Dermatologic Institute
3 Hengzhigang Luhu Rd.,
Guangzhou 510060, P.R. CHINA

Abstract

There was a problem puzzled us for a long time when we tried to find out the environmental factors that influence leprosy incidence, why leprosy in Norway was exterminated before any special anti-leprosy drug was found and why high leprosy incidence always occurs only in poor-economic area. In Guangzhou area, leprosy incidence is greatly decreased in past ten-odd years along with steadily economical development. Although multi-drug treatment (MDT) is used in recent years, it is important for curing active patients, but it is not important for influencing leprosy incidence. We took the regression analysis between economy and leprosy incidence on the basis of data from 1981 to 1989, the result is satisfied. The relative coefficient R reaches 0.9429 for the logarithmic model with examining value $p(r=0.9429 > r_{\alpha}=0.788) = 0.01$ (n=9). With this model, we made a prediction, showing that leprosy incidence will decrease to below 0.5/100,000 by 1998 in Guangzhou area according to economic development trend and government plan. Our research maybe also suggest that it was along with economic development in Guangzhou area that leprosy will be exterminated in near future just as a Chinese saying "daybreak will be coming whether cock call it or not".

EP32

MICRO LEVEL ANALYSIS OF LEPROSY IN VADODARA DISTRICT

* Dr Jaysree De and ** Harshit Sinha

Dept. of Geography, M.S. University of Baroda.

Leprosy is a widespread in the rural areas of India with hardly very few districts in the country being free from this disease. With the introduction of MDT in Vadodara district, the prevalence rates show a declining trend. However there are still pockets of high prevalence that form the focus for the spread of the disease. The continuance of the disease in this area is a result of various socio-cultural factors. The present study is an attempt to analyse the behaviour of the disease at the micro level with a view in preparing strategies for the total elimination of this disease.

* Reader, ** Research Scholar, Dept. of Geography, Faculty of Science, M.S. University, Baroda-390 002.

EP33

AN ANALYSIS OF FAMILIAL CLUSTERING OF LEPROSY INFECTION USING THE MODELS OF THEORETICAL PROBABILITY

Chen Xiangsheng Li Wenzhong Ye Ganyun Huang Wenbiao

Liu Fengwu Zhang Shibao Zhang Dacheng Teng Taizhong

Institute of Dermatology, CAMS, Nanjing, China

A total of 1,522 samples from 435 families in two leprosy-endemic counties within Yunnan Province of China were tested for anti-M. leprae antibody based on ELISA using ND-0-BSA as antigen.

For the purpose of the epidemiological analysis, the 95% percentile value of OD (0.14) from the samples of healthy population was defined as the operational breakpoint OD value for leprosy infection. The distribution of leprosy infection in families was analysed using the theoretical models of Poisson, negative binomial and logarithmic distributions, respectively. The results showed: that 1) in the different age groups, the introducing rates had significant difference ($P=0.007$) and the highest rate was 42.22% at 20-30 years of age, which indicated that the family members at this age were most likely to bring the infection into their families; 2) the actual distribution of infection in families was consistent with the negative binomial and logarithmic distributions, but not with the Poisson one, which showed that the leprosy infection was significantly clustered in families. In this paper, the implications of these results for the epidemiology and control of leprosy in population, especially in families, were discussed as well.

EP34

EPIDEMIOLOGICAL SURVEY OF LEPROSY IN YICHUN PREFECTURE OF JIANGXI PROVINCE, CHINA

He Yaozong Zhou Lingfeng

Anti-Schistosomiasis Office of Yichun Prefecture,
Jiangxi Province, China

Based on the related data available about leprosy patients registered in the past 30 years, an epidemiological survey was carried out in 10 counties of Yichun Prefecture, Jiangxi Province in 1990. The results of this survey showed that the prevalence rate was 0.083%. The lepers detected mainly lived in the plain regions along the railways and rivers and in the area around the cities and towns, distributed in clusters. Frequency distribution of lepers in those villages appears Negative Binomial distribution instead of random distribution. Aggregation exponent K was 0.7278. There was a significant difference between prevalence rate and population density ($P < 0.05$) and the linear regression equation was $y=33.3638x-237.04$.

EP35

PROFIL EPIDEMIOLOGIQUE DE LA LEPRE EN HAÏTI

Claude Poin, Silvana Mathelier, Jean Ollivier,
Reol Charlebois, Gary Bien-Aime, M.Élie Norellia,
Fritz Janvier, Klebert Tout-Puissant.

Institut Cardinal Leger, Port-au-Prince, HAÏTI

Les auteurs étudient les différents paramètres épidémiologiques de l'endémie lépreuse au niveau de deux centres de référence en Haïti.

EP36

HANSEN'S DISEASE IN CHILDREN IN THE STATE OF AMAZONAS, BRAZIL, 1980 TO 1990

Silmara Pennini, Paula F. B. Rebello e Maria F. Maroja

Coordenação Nacional de Dermatologia Sanitária,
Ministério da Saúde, Brasília, Brasil.

Amazonas has high rates of detection and prevalence for Hansen's Disease, showing that this condition is a major public health problem in the State.

The authors discuss the disease's epidemiological behaviour in children under 15 years of age, using the historical series of detection rates from 1980 to 1990 and other indicators for this age group.

EP37

THE DWELLING AT THE SITE OF LEPROSY TRANSMISSION.

A.J.G.Araújo, V.L.G.Andrade, P.C.Sabroza, C.P. Motta, S.A.Franco.

Leprosy Control Program Superintendency of Community Health, Rio de Janeiro Secretariat of Health (SES RJ)/SUDS. National School of Public Health-FIOCRUZ-Rio de Janeiro-Brazil.

In areas with higher prevalence of leprosy quality of life for the most part of the population is below recommended standards, with inadequate health services and poor sanitary conditions. This paper analyses the contribution of several characteristics of dwellings and households to the definition of leprosy. Dwellings with diagnosed cases of illness are compared with randomly selected dwellings located in the same urban area, in the outskirts of the Metropolitan Area of Rio de Janeiro. The paired analysis of patients with their neighbors revealed an association with age and educational level as a measure of socioeconomic status. In the group of dwellings and households distant from the focus area, age and type of house are the probable differential factors in relation to dwellings and households with diagnosed cases of leprosy. The dwellings is a fundamental unit at ecological and individual levels, while age and educational level are determinants of leprosy morbidity in this area.

EP38

PREVALENCE RATE OF LEPROSY IN KHULNA, SOUTH OF BANGLADESH

Yutaka Ishida (1), A.K.MD.Ahsan Ali (2)

(1): Medical Officer, Dhanjuri Leprosy Project-Khulna Branch (PIME Sisters), Daspara Road, Boro Boyra, Khulna-9,000. (2): Director, TB & Leprosy Project, Shamali, Dhaka, People's Republic of Bangladesh.

Since there was not any leprosy control program in the south of Bangladesh by 1986, the prevalence rate of leprosy in this area still unknown. This report is about the result of a case detecting activity which was done from February to June 1992 both for villagers and for slum dwellers in Khulna municipal area and to give a some idea of the prevalence rate of leprosy in the south of Bangladesh.

Khulna is the biggest city in the south of Bangladesh with 1.2 million population, which has expanded along the west side of the big river, Rupsha. It can be divided into two characteristic area from the point of public health: (1) industrialized or commercial areas in the heart of city and (2) village areas in the peripheral. A case detecting activity was carried out in these different areas parallelly with the same method. The same team member had been involved in this program for 5 month.

The number of total population who were checked from February to June 1992 was 19,032 and 127 cases were found to be leprosy. The overall prevalence rate was 6.67 per thousand population. The numbers of villagers and slum dwellers checked were 15,791 and 3,241 and the members of cases found were 87 and 40 respectively. The prevalence rate in villagers was 5.51 and that of slum dwellers was 12.34, which was extremely high but of the same order of that of the slum in Bombay.

EP39

A STUDY OF PREVALENCE OF CHILD LEPROSY IN ILOCOS NORTE, PHILIPPINES (1986 - 1992)

Ma. Gemma C. Cabanos, M.D., M.P.H.
Skin Clinic Physician

This is a retrospective study of the prevalence rate of child leprosy in Ilocos Norte, one of two pilot provinces in the country that started MDT. The writer did a records review of all the new cases 14 years and below detected during a 7-year period from 1986 to 1992.

MDT was started in Ilocos Norte during the third quarter of 1985. It had a prevalence rate of 34/10000 in 1985. In 1988, it went up to 46/10000. In the last 5 years, the case detection rate has not gone down (average 2.7/10000) and cases of child leprosy have been cropping up through the years.

In the study we noted the age, sex, type or classification and deformity grading on admission. From a total of 82 children diagnosed as leprosy, 3 (3.6%) belonged to the 0-4 age group, 31 (38%) and 48 (58.5%) to the 5-9 and 10-14 age group, respectively. More males were affected than females, 43 (52.4%) versus 39 (47.5%). Forty-eight (58.5%) were MB and 34 (41.4%) were PB. For both sexes, 75 (91.4%) did not have any deformities, 4 (4.8%) had Grade 1 and only 3 (3.6%) had Grade 2 deformity.

The proportion of children to the total new cases detected every year fluctuated. In 1986, 19 out of 145 cases (or 13.1%) were detected. There was a decrease in 1987, 9/119 (7.5%). For 1988, 18/124 (14.5%); 1989, 12/127 (9.4%); 1990, 6/123 (4.8%); 1991, 10/110 (9%) and 1992, 8/106 (7.5%).

The writer would like to investigate further other areas and find out common factors in the circumstances surrounding child infection.

EP40

SAMPLE SURVEY FOR PREVALENCE OF LEPROSY IN THREE SLUMS OF DELHI, INDIA.

K.N. Rao

Coordination Committee for Welfare of Leprosy Patients, C 2/6, Pragati Market, Ashok Vihar-2, Delhi-110052, India.

Union Territory of Delhi has conventionally been treated as a low endemic area for leprosy prevalence. Most of the estimates regarding the prevalence of the disease have been based on old and obsolete surveys or on a few voluntary reportings by patients themselves in an advanced stage of the disease with deformities, mainly, to the urban leprosy centres. The high social stigma against the disease in areas like Delhi, which has a large slum population comes in the way of early diagnosis, treatment and rehabilitation of the afflicted persons. There is no proper estimate of leprosy cases in Delhi since no systematic surveys to detect these cases were carried out in the past. We have conducted a sample survey door-to-door, in three resettlement slum colonies in North Delhi, sponsored by Damien Foundation. The prevalence of leprosy has been 3.13/1000 population examined. Hence it was expected that there may be many leprosy cases in the area and need for surveying larger groups.

EP41

A TEN YEAR FOLLOW UP STUDY ON LEPROSY CONTACT POPULATION BY PGL1 SEROLOGY FOR THE EARLY DIAGNOSIS OF LEPROSY.

Suzanne Chanteau, Philippe Glaziou, Catherine Plichart, Patrick Luquiaud, Régis Plichart, Jean François Faucher, Jean Louis Cartel.

Institut Louis Malardé, Papeete, Tahiti, French Polynesia.

In 1983, a program to follow up the family contacts of leprosy cases has been implemented in French Polynesia, to assess the usefulness and applicability of PGL1 serology in a leprosy control program. A total of 1201 contacts (666 female and 535 male) have been included in the study: 704 of them entered the study between 1983 and 1985, 419 between 1986 and 1989, and 78 between 1990 and 1992. The IgM anti-PGL1 dosage was performed by ELISA test using the natural synthetic trisaccharide NTP. As determined on normal polynesian sera, the specificity was of 98% and the sensitivity of 95% for multibacillary (MB) and 35% for paucibacillary (PB) patients.

The IgM anti-PGL1 seroprevalence determined on the initial sera was of 17%. It was significantly higher among female than male (20% versus 15%, $p=0.02$). The median time of participation was 93 months among the seropositive and 100 months among the seronegative individuals. From 1983 to 1993, 4 out of 209 (2%) seropositive contacts developed the disease (II, IBT, IBL, ILL), as compared to 10 out of 992 (1%) seronegative contacts (4I, 3BT, IBB, 2TT). Of these 10 patients, only 3 (31) converted to seropositivity when leprosy was diagnosed. The risk to develop leprosy was not significantly higher among seropositive than among seronegative groups (2% versus 1%, $p=0.2$). The median time to externalize the disease was longer (but not significantly) among the seronegative than the seropositive patients (27 versus 17 months, $p=0.3$). The total number of leprosy cases detected in the studied population represented only 15% (14/94) of the total new cases detected between 1984 and 1992 in French Polynesia.

In conclusion, this 10 year prospective study clearly shows that IgM anti-PGL1 serology is not effective for the early diagnosis of leprosy among high risk population. Therefore, in most of the endemic countries, this test cannot be recommended for a leprosy control program.

EP42

A LONGITUDINAL STUDY OF THE PREDICTIVE VALUE OF THE LEPROMIN RESPONSE AND ANTI-PGL-1 SEROLOGY IN CHILDREN.

Sharad Naik*, Rekha Vartak*, Shubhada Dandekar**, Damayanti Shah**, and R. Ganapati***.

* Acworth Leprosy Hospital Society for Research, Rehabilitation and Education in Leprosy, Wadala, Bombay-400 031, India.

** Radiation Medicine Centre, BARC, Parel, Bombay - 400 012, India.

*** Bombay Leprosy Project, Sion-Chunabhatti, Bombay - 400 022, India.

One thousand two hundred seventeen children from municipal schools of Bombay (low socio-economic status, age 10-15 years) were clinically examined for leprosy, tested with lepromin and the blood was collected by pin-prick (blood spot) for PGL-1 antibodies determination. All the children were clinically examined every six months for evidence of leprosy for the next 3 years. The children showing either lepromin negative status ($n=116$) or PGL-1 Ab positive status (definite positive $n=64$, borderline $n=94$) or lepromin negative along with PGL-1 Ab positive status (definite positive $n=4$; borderline $n=23$), total $n=301$ were clinically and serologically examined more frequently.

There was no statistical difference in PGL-1 Abs positivity rate in male and female children. Twelve new cases developed during the study period of which 11 were of mono lesions (TT) and only one BT (female). (7 females and 5 males). Statistical evaluation showed that lepromin negativity alone or PGL-1 Abs positivity alone were not useful as predictors for developing clinical leprosy. However when taken together, these two parameters identified a high risk group.

EP43

A SPONSORSHIP PROGRAMME FOR LEPROSY AFFECTED CHILDREN.

Sandip Joshi, Vrushali Kathe, and Sharad Naik.

Acworth Leprosy Hospital Society for Research, Rehabilitation and Education in Leprosy, Wadala, Bombay - 400 031, India.

This study deals with 455 children (below 15 yrs.) who were suffering from polyneuritic or smear positive leprosy and were registered at a leprosy hospital in Bombay during last 13 years. Of these, 122 were registered before MDT and 333 after introduction of MDT. A sponsorship programme in the form of giving help for school fees, books and school uniforms was introduced in 1982 for these children and further supported with initiation of personality development classes in 1987. The inputs of this "social service" has further improved the doctor-patient relationship.

In spite of the reduction due to MDT in the total number of patients on the register, the proportion of children with polyneuritic or smear positive leprosy has not changed (18%) indicating continued infection in Bombay. The sponsorship programme which provided

opportunity for personality development enabled 126 children to complete their education upto secondary school level (55%) and also improved regularity of drug intake and completion of MDT in 78% as compared to 44% in the pre-MDT era. It was necessary to continue the sponsorship and personality development programme for at least 3 years for each student (cost per child \$ 10 per year). This appears to be a cost-effective approach for prevention of debilitation. Such simple "Social service programme" has potential of multiplication in several cities in hyperendemic area.

EP44

DETECTION OF *M. LEPRAE*-SPECIFIC ANTIGEN WITH M-DOT-ELISA IN SERA FROM HOUSEHOLD CONTACTS OF LEPROSY PATIENTS

Cao Yuanhua Shinzo Izumi Wu Qinxue Ye Ganyun
Kunio Kawazu M.D. Amiruddin Mauro F. Mendes Hou Wei

Institute of Dermatology, CAMS, Nanjing, China

The results of detecting *M. leprae*-specific antigen-phenolic glycolipid (PGL-1) with our modified method-M-Dot-ELISA are reported. The sera were from 75 cases of household contacts of leprosy patients (HC), all previously seropositive in Gelatin Particle Agglutination Test (MLPA) and ELISA. Results indicated that: 1) 14/75 (21.3%) were antigen positive, among them, in HC of MB, 14/16 (87.5%) were antigen positive, in HC of PB, 0/16 were antigen positive, in HC of unknown types of leprosy patients, 2/16 (12.5%) were antigen positive, thus the rate of positivity in HC of MB was markedly higher than those in HC of PB. There was significant difference ($P < 0.001$) between them; 2) Positive rates and levels of PGL-1 in HCs were associated with levels of antibody against PGL-1 in sera from HCs. There were significant differences in antigen positive rates and levels between weak and strong antibody positive groups of HC ($P < 0.001$); 3) PGL-1 were all negative in sera from either 40 controls or 10 non-leprosy patients who were previously anti-PGL-1 antibody positive in MLPA and ELISA.

EP45

SEROEPIDEMIOLOGICAL ASSESSMENT OF LEPROSY IN CULION, PHILIPPINES

Arturo Cunanan, Jr., Gertrude Chan, Gerald Walsh, Roland Cellona, James Douglas, Ed Gonzaga

Culion Sanitarium, Culion Palawan, Philippines

Culion Sanitarium was once the biggest leprosarium in the Philippines, founded as a segregation colony for Hansenites in 1906. Since then the communities of Hansenites and non-Hansenites have grown and at present the latter outnumber the former.

Although the number of patients coming from different provinces has diminished significantly, there was an increasing incidence among the endogenous population as shown by the 7.5/1000 rate in 1987 following a survey done prior to the start of the MDT program in Culion. This is a reflection of an active transmission going on in the resulting intermingled populace. The extent of transmission and infection going on before 1987 was a big question, however treatment of active cases, which are potential reservoirs of infection have been addressed by the MDT program with a resulting decline in incidence and prevalence after 5 years, although new cases are still arising from the community.

This study monitors the efficacy of MDT, determines relapse rates and measures PGL-1 antibody and antigen level of the general population allowing early diagnosis and treatment using ELISA technology in support of the goal of eradicating leprosy in Culion Island.

Household enumeration, numbering, mapping of target population ages 5 years and above are considered Culion residents (6 months residency) were included in the study. Population were classified as index case and contacts (household and community).

7567 baseline serum (90% target population) were examined. 13% of community contact (CCC) and 11% of household contacts (HHC) were ELISA (+). Negative contacts are followed-up annually while positive contacts are examined bi-annually for 4 consecutive years.

Through this cohort study, high risk contacts will be identified and new knowledge in leprosy epidemiology may be generated.

EP46

A PROSPECTIVE IMMUNOEPIDEMIOLOGIC STUDY USING MISA AND ELISA FOR ANTIBODIES AGAINST PGL1

P. Krishna murthy, P.S. Rao,
M. Subramanian, B. Sekar

Central Leprosy Teaching & Research Institute,
Chengalpattu, Tamilnadu, India - 603 001

About 11,000 individuals selected through cluster sampling in the field area of C.L.T.R.I and investigated for skin response to MISA and antibodies against PGL1 by ELISA were followed for periods varying from 2 to 3 years for occurrence of leprosy. A total of 104 cases were detected (90TT, 7BT, 5Pn, 2BL). Risk ratio for factors like age, sex, contact status, ELISA for anti-PGL1 positivity, MISA positivity and combinations of ELISA and MISA were calculated. Contact status, MISA & ELISA (both -ve) and MISA -ve were found to be significant risk factors for disease (RR 2.74, 1.64 and 1.58 respectively). Eventhough the follow up period is not sufficiently long to make conclusive remarks it appears that response to MISA and ELISA for anti-PGL1 antibodies may not be of much use as predictors of clinical disease, at least not as much as the easily identifiable factor of contact status, in high endemic population.

EP47

The role of anti-*Mycobacterium leprae* PGL-1 antibodies in assessing the contacts of leprosy patients in a low endemic area.

Soares D.J., Failbus S., Chalish Y & Kathet B.
Anandaban Leprosy Hospital, The Leprosy Mission, PO Box 151,
Kathmandu, Nepal.

The role of anti-*M. leprae* phenolic glycolipid (PGL-1) antibodies in the serodiagnosis of leprosy is still uncertain. Although some studies suggest that seropositive contacts of leprosy patients have an increased risk of developing leprosy, the situation is less clear in community studies. In high endemic regions seropositivity is higher in 5-15 year olds and is not associated with the subsequent development of leprosy. This suggests that seropositivity is a marker of subclinical infection rather than clinical leprosy. We have studied the value of screening with anti-PGL-1 antibodies in contacts of leprosy patients in a low endemic region. The leprosy control program in the Lalitpur District of Central Nepal has been active since 1962 and multi-drug therapy (MDT) was introduced in 1983. Between 1986 and 1990 a mass intensive survey detected 234 new cases (case detection rate 2.2/10,000/year). In 1991-1992 past patients were re-examined and finger prick samples collected from the 159 index cases and 403 of their healthy contacts. Anti-PGL-1 IgM antibodies were measured by ELISA. Of the index cases, 55 had received MB-MDT, 93 PB-MDT and 11 DDS monotherapy alone. Twenty percent (8/39) of those who were receiving or who had stopped treatment in the last 3 years were seropositive while 2.5% (3/120) of those released from treatment earlier were seropositive. Of the 503 contacts, 93 were <15 years. There were no new cases of leprosy found in the contacts and only 4 (0.8%) were seropositive. On review 6 months later these 4 contacts had no evidence of leprosy and had become seronegative. The index cases of the antibody positive contacts had been released from therapy 1-8 years before and were seronegative. The low seropositivity rate in the contacts may be related both to the inactivity of the index cases and to the effective control program in the district which had reduced the background rate of subclinical infection in the community. These data indicate that the role of the anti-PGL-1 antibody assay for screening contacts in a low endemic area is very limited.

EP48

USE OF PGL-1 IMMUNOASSAYS IN SEROEPIDEMIOLOGICAL STUDIES OF *MYCOBACTERIUM LEPRAE* INFECTION IN MALAYSIA

Gan Seng Chiew¹ and Tsuyoshi Fujiwara²

Division of Immunology, Institute for Medical Research, 50588
Kuala Lumpur, Malaysia,¹ and Institute for Natural Science,
Nara University, Nara, Japan.²

Results from a three year national seroepidemiological study involving about 40,000 individuals selected by stratified sampling showed that PGL-1 immunoassay can be used as a

screening tool in a leprosy control programs. Seropositivity to PGL I antigens correlated with the prevalence rate of a defined population. The use of *M. leprae* specific antigens, such as PGL I, in immunoassays could thus be used as an indicator of exposure to *M. leprae*. Individuals with subclinical infection had higher antibody titers and could be identified from those who had been exposed and became immune. High antibody titers, especially of the IgM class, were found in higher frequencies among individuals staying in high prevalence communities and in leprosy patients. IgG antibodies were found in significant quantities in individuals staying in low prevalence communities and in leprosy patients treated over a long period of time. A gelatin particle agglutination test (MLPA) which detects IgM-anti-NT-BSA was used as a field test in the seroepidemiological studies in Malaysia and was shown to have very good concordance with the reference ELISA test.

EP49

A NATURAL ECOSYSTEM FOR LEPROSY RELATED CHEMOAUTOTROPHIC MYCARDIOPHILIC BACTERIA; TRANSMISSION OF LEPROSY BACILLUS TO HUMANS FROM FOSSIL FUEL RICH SOIL:

Dastidar, Sujata G. & Chakrabarty A.N.

Division of Microbiology, Deptt of Pharmaceutical Technology, Jadavpur University, Calcutta-700 032 and Deptt of Medical Microbiology & Parasitology, Calcutta University College of Medicine, Calcutta-700 020, India.

Global maps were prepared for the incidence of leprosy and distribution of fossil fuels in different countries. This allowed comparison of these two parameters. A correlation has been found to exist between the prevalence of leprosy and distribution of fossil fuels (FF) and their surface soil seepages at global, regional as well as individual country levels. This could be accounted for by the occurrence of FF metabolising soil-bacteria which were indistinguishable from those isolated from human leprosy cases. The factors which appeared to determine the final outcome of the endemicity of leprosy, could be: a man-to-man, and soil-to-man infections. These in turn, seemed to depend on overcrowding, consanguinity and clustering of populations, quality of living standards and hygiene, and mode of tilling of lands assessed on the basis of comprehensive information. The origin of leprosy in the world, as well as, that of indigenous leprosy cases in the "leprosy-free" countries like USA and Russia, can be considered to be due to a soil-to-man infection. The possibility of indigenous origin of leprosy in different FF rich countries of the New World, independent of being imported from outside, explains the numerous findings of leprosy-like faces and figures in various paintings, and engravings on metals and stones, and pottery works etc. in the pre-Columbian Maya and Inca civilisations and the Aztec empire in the Americas. These had been accurately recorded by early Jesuit missionaries as frequent occurrences of florid leprosy among the Mayan and Incan Indians who must have had this infection long before Columbian era.

EP50

ASSOCIATION OF GEOGRAPHIC FACTORS WITH LEPROSY INCIDENCE RATES IN KARONGA DISTRICT, NORTHERN MALAWI

Jonathan AC Sterne¹, Jorg M Ponnighaus², Paul EM Fine¹, and Lyn Bliss¹

¹Communicable Disease Epidemiology Unit, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK; ²Karonga Prevention Study, Chilumba, Malawi.

Within an area of high leprosy incidence, geographic variation in incidence rates may be associated with socioeconomic factors, or with environmental factors which influence either transmission of *M. leprae* or the acquisition of protective immunity. We studied the association between leprosy incidence (adjusted for age, sex,

prior BCG vaccination, ecological zone, house construction and duration of schooling) and location of residence at the start of the study in more than 80000 individuals in Karonga District, Northern Malawi. Average follow-up was five years. Leprosy incidence was not associated with proximity to rivers, but there was some evidence of lower rates among individuals living within 1 km of the shore of Lake Malawi (rate ratio=0.66, p=0.075). There was strong evidence for higher incidence rates with increasing distance from the main roads in the district; at least some of this effect appeared to be socioeconomic. Although incidence rates were lower in the vicinity of the district "capital", there was no significant association with proximity to smaller "towns". The relation of these results to geographic variation in naturally acquired DTH to *M. leprae* antigens, which is strongly associated with protection against leprosy, will be discussed.

EP51

LEPROSY IN ISFAHAN
A PROVINCE OF IRAN

Ali Asilian - Ali Momeni - M. Meghdadi - Shariati and Sh. Enshaie

Leprosy is a chronic tropical disease that frequently involve skin, peripheral nerve and nasal mucosa.

According to WHO estimation there are about 15 Millions leprosy patients all over the world and about 60% of them are living in Asia.

In Iran there have been cases of leprosy in several provinces however, in Isfahan, Native dermatologists and pediatricists of infectious diseases believe that leprosy specialists is not present in Isfahan, area. We began an investigation either to approve or roll out this idea.

We searched the records about all of the registered patients in leprosy registered center were 21. 14 of whom were Afghan, one was Iraqi, and the remainder were Iranian who were infected in other provinces and then migrated to Isfahan.

The analysis the results proved that.

There are not any cases of leprosy in Isfahan residential areas at the present time.

EP52

THE IMPLICATIONS OF DELAYED-TYPE HYPERSENSITIVITY TO *M. leprae* SOLUBLE ANTIGENS AND TO TUBERCULIN FOR NATURAL AND VACCINE-DERIVED IMMUNITY TO LEPROSY

Paul EM Fine¹, Jonathan AC Sterne¹, Jorg M Ponnighaus², Lyn Bliss¹, and Richard JW Rees³

¹Communicable Disease Epidemiology Unit, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK; ²Karonga Prevention Study, Chilumba, Malawi; ³National Institutes of Medical Research, Mill Hill, London, UK.

We report incidence rates of leprosy among 58,618 individuals in Northern Malawi as a function of age, sex, prior BCG status and prior delayed-type-hypersensitivity (DTH) to several different *M. leprae* soluble antigens (MLSA) and to tuberculin (RT23, 2 IU). Though no relationship was evident with prior DTH to MLSA antigens produced by the initial protocols, a strong negative relationship with leprosy risk was evident with prior DTH to MLSA antigens which had been prepared with a later protocol including centrifugation at 105,000 g. The

association was restricted to individuals without prior BCG scar. Leprosy risk was also negatively correlated with prior DTH to tuberculin in unvaccinated but not in vaccinated individuals. Age/sex/BCG scar-adjusted prevalence of DTH to the MSLA antigens was inversely related to prevalence of leprosy within different ecological areas. Naturally-acquired DTH to mycobacterial antigens may be a stronger correlate of protective immunity to leprosy than is DTH induced by BCG vaccination.

EP53

INTRAFAMILIAL TRANSMISSION OF LEPROSY IN VELLORE TOWN, INDIA

Renu George, Rao PSS, Rachel Mathai, Mary Jacob
Christian Medical College & Hospital, Vellore.

Intrafamilial risks in leprosy reported mostly from rural areas are likely to be different in urban setting due to several socio-demographic and environmental factors. Urban sample surveys are expensive and frustrating due to problems of stability, cooperation and logistics. In this paper we describe a hospital based study done from 1968 to 1991 to determine risks and extent of intrafamilial transmission in relation to characteristics of index cases and contacts in urban areas. Families were examined annually by doctors. Person-years of followup were used for calculation of incidence rates.

Of the 120 index cases 44% were MB, 410 contacts were registered and followed up. 14 contacts developed leprosy of whom 12 were under 15 years of age. 83% were detected during the first 5 years. The incidence rate (IR) per 1000 was 5.1 with no gender bias. The IR was 7.3 and 2.8 among contacts of MB and PB leprosy ($P < 0.05$). Importance of active surveillance

by hospital based survey is emphasized and may be designed to focus on persons below 15 years, with intensive followup for first 5 years. This model is feasible and can be integrated into general health service of any hospital.

EP54

DETECTION OF *MYCOBACTERIUM LEPRAE* NASAL CARRIAGE IN A LEPROSY ENDEMIC POPULATION.

Paul R. Klatser¹, Baedah Madjid², Stella van Beers² and Madeleine Y.L. de Wit¹.

¹ Royal Tropical Institute, Meibergdreef 39, 1105 AZ Amsterdam, The Netherlands.
² Dept. of Microbiology, Hasanuddin University, Ujung Pandang, South Sulawesi, Indonesia.

In order to better understand the role of *M. leprae* nasal carriage in the maintenance of infection reservoirs and transmission of leprosy, we applied a polymerase chain reaction (PCR) detecting a 531 bp fragment of the *pra*-gene of *M. leprae* on nasal swab specimens collected through a total population survey from individuals living in an area endemic for leprosy. False-positive reactions were controlled by the application of dUTP/UNG. False-negative reaction were monitored using a modified control. A total of 1228 nasal swabs specimens were analysed; 7.8% were found positive. No clear age-related pattern could be revealed. It was found that only 3.1% of the households was associated with 27% of all PCR-positive individuals. The results of this study further add to the already available evidence that infections occur readily throughout the endemic population. Assuming that the specific and sensitive detection of *M. leprae* DNA through PCR indeed reflects the presence of bacilli, this is to our knowledge the first time that *M. leprae* nasal carriage has been specifically detected at the population level.

EXPERIMENTAL

EX1

EARLY IMMUNOLOGICAL RESULTS OF EXPERIMENTAL *M. LEPRAE* CHALLENGE OF MONKEYS AFTER ATTEMPTED IMMUNIZATION WITH LIVE BCG OR BCG + HEAT-KILLED *M. LEPRAE*.

Bobby J. Gormus, Keyu Xu, Wayne M. Meyers, Gerald P. Walsh, Rudolph P. Bohm, Jr., Gary B. Baskin, Susumu Ohkawa, Marion S. Ratteeree, Pamela A. Mack and James L. Blanchard

Tulane Primate Research Center, Covington, LA; AFIP, Washington, DC and Leonard Wood Memorial, Rockville, MD, USA.

Groups of 10 rhesus monkeys (RM) and 7 sooty mangabeys (SM) were immunized and boosted with either live BCG alone or BCG + low dose heat-killed *M. leprae* (LD HKML) or BCG + high dose (HD) HKML. These plus an unvaccinated group were challenged with live ML and studied immunologically and clinically at intervals before and after vaccination.

Blastogenic responses of blood mononuclear cells (MNC) to lepromin (lep) and Rees soluble protein antigen (Ag) were initially baseline, but increased in BCG + HKML groups after vaccination. Lep skin tests of BCG + HKML groups of RM 2 months postvaccination were strongly positive in all 20 RM.

Changes were observed in the following blood MNC subsets by flow cytometry after monoclonal antibody (Ab) staining: CD4, CD8, CD4/4B4, CD4/2H4 and CD16.

Ab profiles to ML-specific phenolic glycolipid-I (PGL-I) Ag by ELISA showed elevated IgG and little IgM in groups receiving BCG + HKML compared to others. We previously reported that this pattern is present in leprosy-resistant monkeys.

These results together with histopathology suggest that BCG + HKML or BCG alone have a protective anti-leprosy effect. Long term follow-up is in progress to determine if this will result in protection against progressive, disseminated leprosy.

EX2

LEPROSY IN PHILIPPINE CYNOMOLGUS MONKEYS [MACACA FASCICULARIS]

Eduardo C. Dela Cruz, Rodolfo M. Abalos, Tranquillino T. Fajardo, Jr., Laarni G. Villahermosa, Roland V. Cellona, Wayne M. Meyers, Bobby J. Gormus, Ranillo G. Resuello, Jerome B. Nazareno and Gerald P. Walsh
Leonard Wood Memorial, Cebu, Philippines, Armed Forces Institute of Pathology, Washington, D.C., Tulane Primate Center, Covington, LA and SICONBREC, Manila, Philippines

Nonhuman primate models of leprosy provide valuable information on the pathogenesis of leprosy in humans.