TREND OF DETECTION AND PREVALENCE RATES OF LEPROSY IN THE CENTRAL - HIGHLAND REGION, VIETNAM DURING 1996-2005

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Thesis
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TREND OF DETECTION AND PREVALENCE RATES OF LEPROSY IN THE CENTRAL-HIGHLAND REGION, VIETNAM DURING 1996 - 2005

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ABSTRACT

A retrospective study was conducted to assess, describe and predict the epidemiology situation of leprosy (based on annual leprosy reports during 1996-2005 from 11 provinces) in the Central-Highland Region, Vietnam.

Between 1996 and 2005, a total 4,262 leprosy cases were detected in the Central-Highland Region in Vietnam; 60% were males and 40 % were females (male to female ratio = 1.5: 1). The percentage of young age group (< 15years) was 8.5% during this period. For clinical classification, 57.6% were Multi-Bacillary, 42.4% were Pauci-Bacillary. The disabled grade II proportion of leprosy among new cases decreased consistently and continuously from 36.8% (1996) to 19.1% (2005), averaging 25.6%.

Trends of the leprosy detection and prevalence rates decreased significantly, steadily and continuously from 1996. The prevalence was 1.35 per 10,000 population in 1996 and that had decreased by 86% at the end of 2005 (0.19 per 10,000 population). The detection rate was 2.03 per 100,000 population in 2005 and that had decreased by 76% since 1996 (8.34 per 100,000 population). The annual decrease in prevalence and detection rates in the Central-Highland Region during 1996 – 2005 were result of adequate findings of new leprosy cases during 1996 (789 cases) – 2005 (236 cases). The relationship between prevalence and detection rate was highly positively correlated ($r = 0.99$), and was statistically significant ($p < 0.01$). This indicated that the more the detection rate decreased, the more the prevalence rate decreased.

The forecasts for detection rate of leprosy are 1.66, 1.31, and 0.97 per 100,000 population in 2006, 2007 and 2008 (the accuracy of forecasting is quite high as the mean square deviation is only 0.12. The forecasts for the number of new leprosy cases are 209 in 2006, 194 in 2007 and 179 in 2008. However, the accuracy of forecasting is not high.

KEYWORDS: LEPROSY/ TREND/ DETECTION RATE / PREVALENCE RATE

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LIST OF ABBREVIATIONS

LD	:	Leprosy Disease
NCDR	:	New Case Detection Rate
MOH	:	Ministry of Health
NGO	:	Non-Governmental Organization
PMU	:	Project Management Unit
PDU	:	Provincial Dermatology Unit
BCG	:	Bacillus Calmette-Guerin
IEC	:	Information, Education and Communication
MB	:	Multi-Bacillary leprosy
MDT	:	Multi-Drug Therapy
PB	:	Pauci-Bacillary leprosy
WHO	:	World Health Organization
WPRO	:	Western Pacific Region Office
CHR	:	Central-Highland Region
NLP	:	National Leprosy Programme
LCP	:	Leprosy Control Programme
DES	:	Double Exponential Smoothing
MAPE	:	Mean Absolute Percentage Error
MAD	:	Mean Absolute Deviation
MSD	:	Mean Square Deviation

CHAPTER 1
INTRODUCTION

1.1 Rationale and Justification

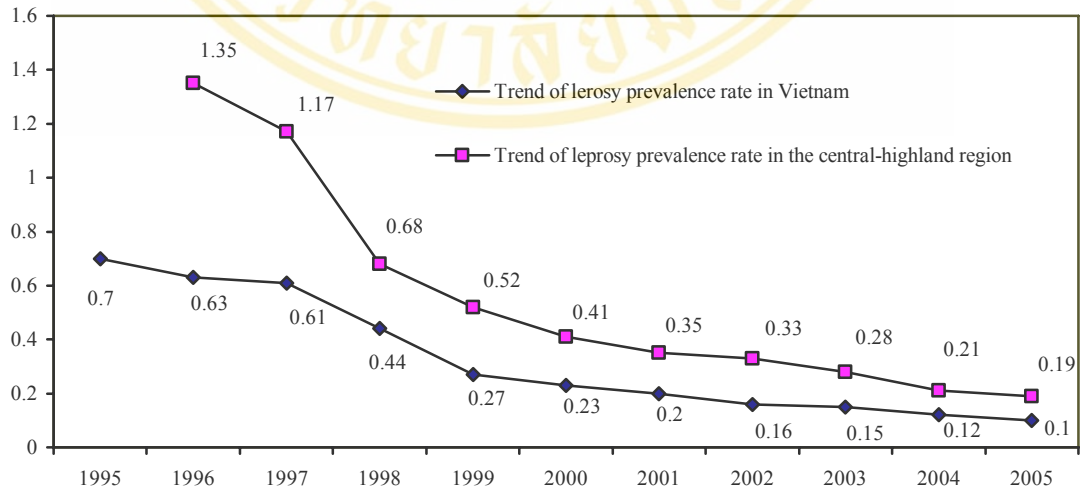
Leprosy is often called "a living death" because of the many horrifying effects on the human body. Without the cure, it can leave people deformed and hopeless for the rest of their lives. Leprosy is a chronic infectious disease caused by *Mycobacterium leprae*. It usual affects the skin and peripheral nerves, but has a wide range of clinical manifestations [1, 2]. The disease is classified as pauci-bacillary or multi-bacillary, depending on the bacillary load. Involvement of certain peripheral nerves may also be noted, sometimes resulting in the characteristic patterns of disability [2]. Among communicable diseases, leprosy is a leading cause of permanent physical disability. Leprosy is one of the leading causes of physical disabilities which contribute to intense social stigma resulting in discrimination of patients and their families in many societies. WHO estimates that between 2 and 3 million individuals are disabled due to leprosy [1, 3]. The mode of transmission of the leprosy bacillus remains uncertain, but most investigators believe that M. leprae is spread from person to person [1, 2]. The two portals of exit of M. leprae that are often described are the skin and mucosa, and the two major portals of entry are the skin and upper respiratory tract [3].

Finding and treating these previously undetected cases is essential to stop the spread of the infection and ultimately eliminate the disease. Early detection of leprosy patients and timely treatment them with WHO recommended multi-drug therapy (MDT) are key elements of the present strategy to halt transmission of the disease and to bring about cure without disabilities [1, 4].

Every year about 700,000 new cases are detected worldwide as the coverage of leprosy services widens. During the past fifteen years over 12 million leprosy patient have been cured with MDT [3].

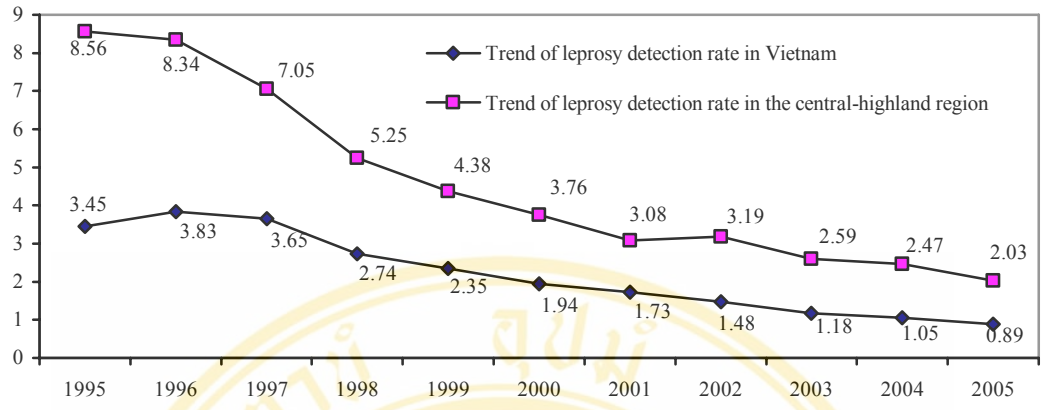
At the beginning of 2005, the global registered prevalence of leprosy was 286, 063 cases. The number of new cases detected globally has fallen by around 107, 000 cases (21% decrease) during 2004 compared with 2003 [4].

WHO has defined "elimination" as a prevalence rate of less than 1 case per 10,000 inhabitants. Leprosy has been eliminated as a public health problem from Vietnam and 106 countries at the end of 2000 [4]. There is an opportunity for this process to build on the gains made by the elimination campaign, such as increased awareness of leprosy, political commitment and the involvement of the general health services. Even though the leprosy burden has been reduced substantially in Vietnam, new cases of leprosy will continue to appear for the near future in some of the currently endemic areas [5, 6, 7 and 8]. The epidemiology of new leprosy cases in the Central-Highland Region is still higher based on the annual detection and prevalence rates (Figures 1, 2)



Source: National Institute of Dermatology, 2006.

Figure 1 Comparison of the trends of leprosy prevalence rate per 10,000 populations between Vietnam and the Central-Highland Region during 1996-2005



Source: National Institute of Dermatology, 2006.

Figure 2 Comparison of the trends of leprosy detection rate per 100,000 population between Vietnam and the Central-Highland Region during 1996-2005

Although leprosy is no longer a big health problem in Vietnam, it continues to affect hundreds of people in provinces of the Central-Highland region. Effective chemotherapeutic treatments are available that have reduced the national disease burden dramatically, but there remain important challenges to fighting and controlling the disease [7, 8].

The basic principles for the national leprosy control program in Vietnam beyond the year 2005 will continue to be based on early detection and treatment of leprosy patients. Health services must continue to provide quality services for leprosy control to these communities over a foreseeable period of time [5].

In view of the need to sustain leprosy services for many years to come, there has to be a shift from a campaign-like elimination approach towards the long-term process of sustaining integrated, high-quality leprosy services that, in addition to case detection and treatment with multi-drug therapy, also include prevention of disability and rehabilitation [9].

Elimination is not eradication, many warn, and it must be clear to everyone that leprosy will continue to exist even in areas where the “elimination goal” has officially been reached. The term elimination itself makes people think the problem is over, the post-2005 leprosy agenda, to make sure that we do not lose the gains achieved to date or miss this unique opportunity to reach complete control of leprosy [10, 11].

The prevalence of leprosy, as measured by the number of cases registered for treatment, and the detection rate are the conventional indicators for monitoring trends in leprosy control and elimination programs [10]. So, the current leprosy situation of the Central-Highland Region in Vietnam needs to assess information-gathering in order to make strategies for detection and treatment, which is much useful as baseline information to plan and set up strategy to control leprosy better.

Understanding of the evolution of the epidemiological trend of leprosy is very important for evaluating and monitoring control strategies. In most countries, reliable epidemiological data on leprosy are difficult to collect for many reasons [11]. However, in Vietnam, where the leprosy programme is well organized, and where medical records of leprosy patients are well documented, computerization of data on leprosy patients registered onwards through the National Leprosy Recording. The Reporting System was initiated under the authority of the Ministry of Health and the National dermatology institute. Reliable data on leprosy over the past 30 years in Vietnam are thus available.

This study described a trend analysis of the number of leprosy patients and the epidemiological evolution over the period. The aims of this study were to assess the epidemiological trends of leprosy in the Central-Highland Region of Vietnam in order to establish a strategy to improve the quality and the effectiveness of leprosy control and to achieve leprosy elimination target in 2008.

1.2 Research Questions

What is the pattern of leprosy detection and prevalence rate of leprosy in the Central – Highland Region in Vietnam by time, geographical areas; gender and age of patients; disabled grades and type of leprosy?

1.3 Research Objectives

1.3.1 General objectives

To identify the trend of the epidemiology situation of leprosy during 1996-2005.

1.3.2 Specific objectives

1.3.2.1 To assess the trends of the leprosy detection and prevalence rate

1.3.2.2 To describe the pattern of detection and prevalence rates by gender and age of patients; disabled grade; types of leprosy; locations and the times.

1.3.2.3 To predict the detection of leprosy in the Central-Highland Region.

1.4 Conceptual Framework

The conceptual framework of this study links among host factors, environment factors and agent factors in detection and prevalence rates (Figure 3). It was described in term of person, place and time [12].

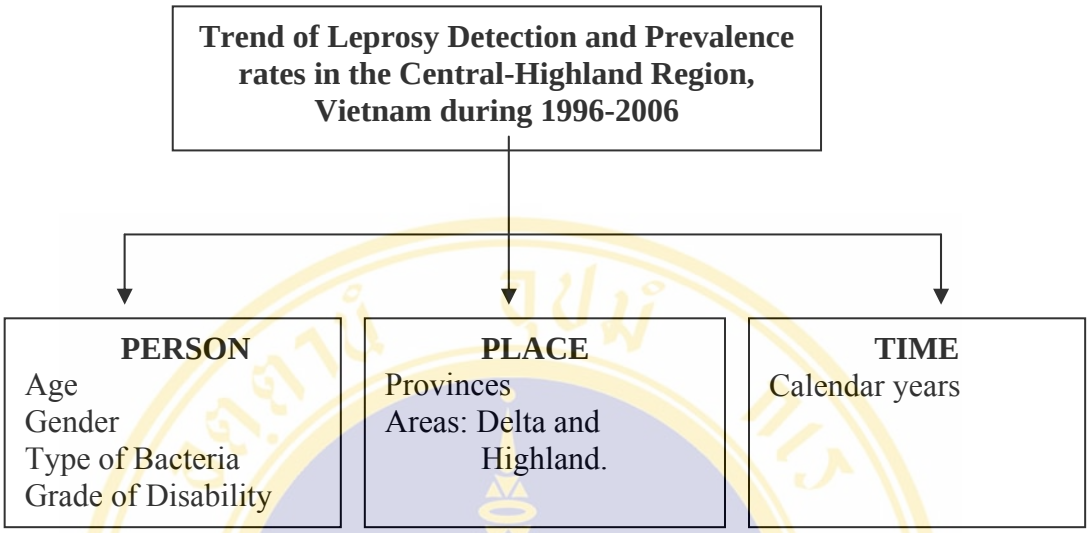


Figure 3 Conceptual Framework

1.5 Operational definition of study factors

1.5.1 Definition of a case of leprosy:

A case of leprosy is a person having one or more of the following features, and who has yet to complete a full course of treatment:

- Hypo-pigmented or reddish skin lesion(s) with definite loss of sensation;
- Involvement of the peripheral nerves, as demonstrated by definite thickening with loss of sensation;
- Skin smears positive for acid-fast bacilli.

The case definition includes retrieved defaulters having signs of active disease as well as relapsed cases that have previously completed a full course of treatment, but does not include cured persons with late reactions or residual disabilities [10].

1.5.2 Classification of Leprosy

The disease is classified as pauci-bacillary or multi-bacillary that can be classified on the basis of clinical manifestations and skin smear results in Table 1 [10].

Table 1 The simple classification of leprosy by WHO.

	Pauci-bacillary (PB)	**Multi-bacillary (MB)**
Clinical	few (up to five) hypo-pigmented, anesthetic skin lesions	multiple (more than five) skin lesions
Laboratory tests (slit skin-smear)	Negative at all sites	Positive at any site

However, in practice, most programs use clinical criteria for classifying and deciding the appropriate treatment regimen for individual patients, particularly in view of the non-availability or non-dependability of the skin-smear services. The clinical system of classification for the purpose of treatment includes the use of number of skin lesions and nerves involved as the basis for grouping leprosy patients into multi-bacillary (MB) and pauci-bacillary (PB) leprosy.

1.5.3 Definitions of disability grades

The disability grades for leprosy have been simplified into three categories of 0, 1 and 2. The proportion of patients in each grade level among newly detected cases can be seen in the following Table 2 [10].

Table 2 Classification of disabled grade of leprosy by WHO.

Grade	Hands and feet	Eyes
Grade 0	No anesthesia, no visible deformity or damage	No eye problems due to leprosy; no evidence of visual loss
Grade 1	Anesthesia but no visible deformity or damage	Eye problem due to leprosy present, but vision not severely affected as a result (vision 6/60 or better; can count fingers at six meters).
Grade 2	Visible deformity or damage present	Severe visual impairment (vision worse than 6/60; inability to count fingers at six meters), lagophthalmos, iridocyclitis and corneal opacities.

In the fact that disability of leprosy has divided into two groups which are grade 2 and other (including grade 0 and grade1).

Proportion of patients with grade 2 disability among newly detected cases that are expressed in a given year as a percentage. This indicator reflects the effectiveness of the programme in terms of early case finding and the level of community awareness of the disease [10].

1.5.4 Prevalence and prevalence rate

Prevalence: The number of cases registered for treatment at a given point of time.

Prevalence rate: The number of cases registered for treatment at given point of time per 10, 000 population (WHO)

$$\text{Prevalence rate} = \frac{\text{No of registered cases for treatment}}{\text{Population in the given area}} \times 10,000$$

This indicator reflects the magnitude of the problem and helps in planning and evaluating control measures [10].

1.5.5 Detection and detection rate.

Detection: The number of cases newly detected during a given year and never treated before.

Detection rate: The number of cases newly detected during a given year per 100,000 populations (WHO).

$$\text{Detection rate} = \frac{\text{Number of new cases}}{\text{Population in the given area}} \times 100,000$$

This indicator is most appropriate for estimating the true incidence of the disease in a given population when analyzed in conjunction with the proportion of patients with grade 2 disability among newly detected cases [10].

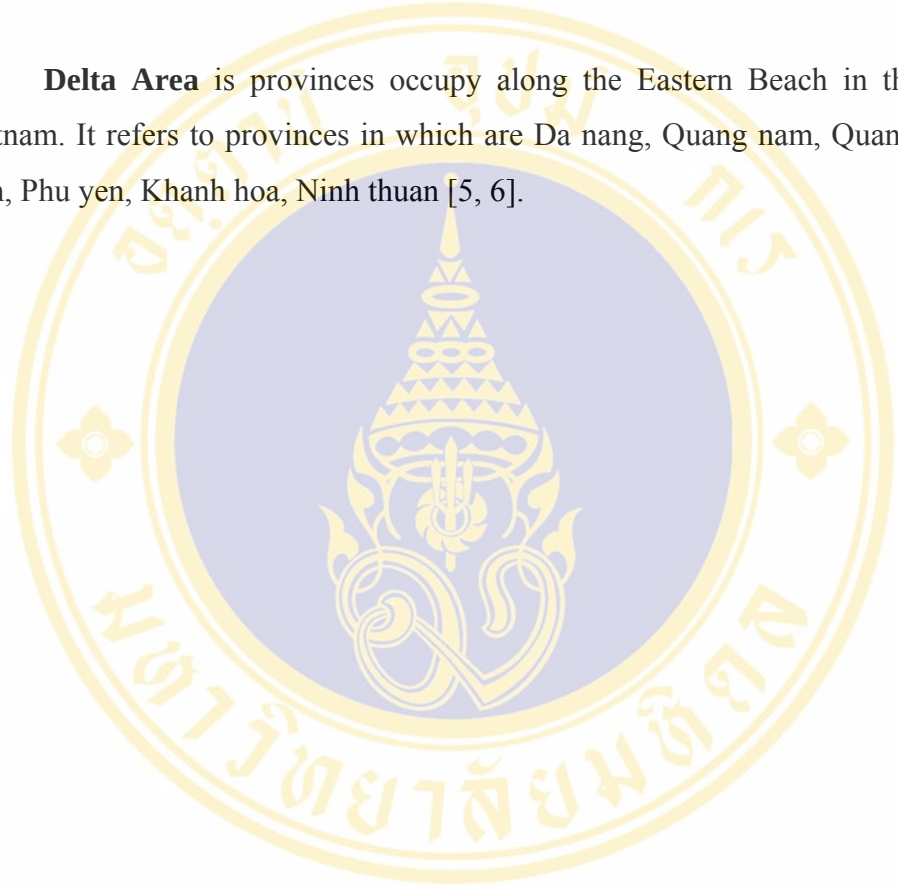
1.5.6 Age groups

The age data in this study is already divided into two groups according to the standard classification given by the World Health Organization. The age-groups are composed of 1 – 14 years old, and ≥ 15 years old. The proportion of newly detected cases aged less than 15 years among the number of newly detected cases. This indicator reflects the level of transmission of the disease over the last few years. The proportion of children among new cases would serve much better to monitor the real disease status [10].

1.5.7 Place

Highland Area is a mountainous or hilly section of a country. In this case it refers to areas in which include Kon tum, Gia lai, Dak lac, and Dak nong provinces in the Centre of Vietnam.

Delta Area is provinces occupy along the Eastern Beach in the Centre of Vietnam. It refers to provinces in which are Da nang, Quang nam, Quang ngai, Binh dinh, Phu yen, Khanh hoa, Ninh thuan [5, 6].



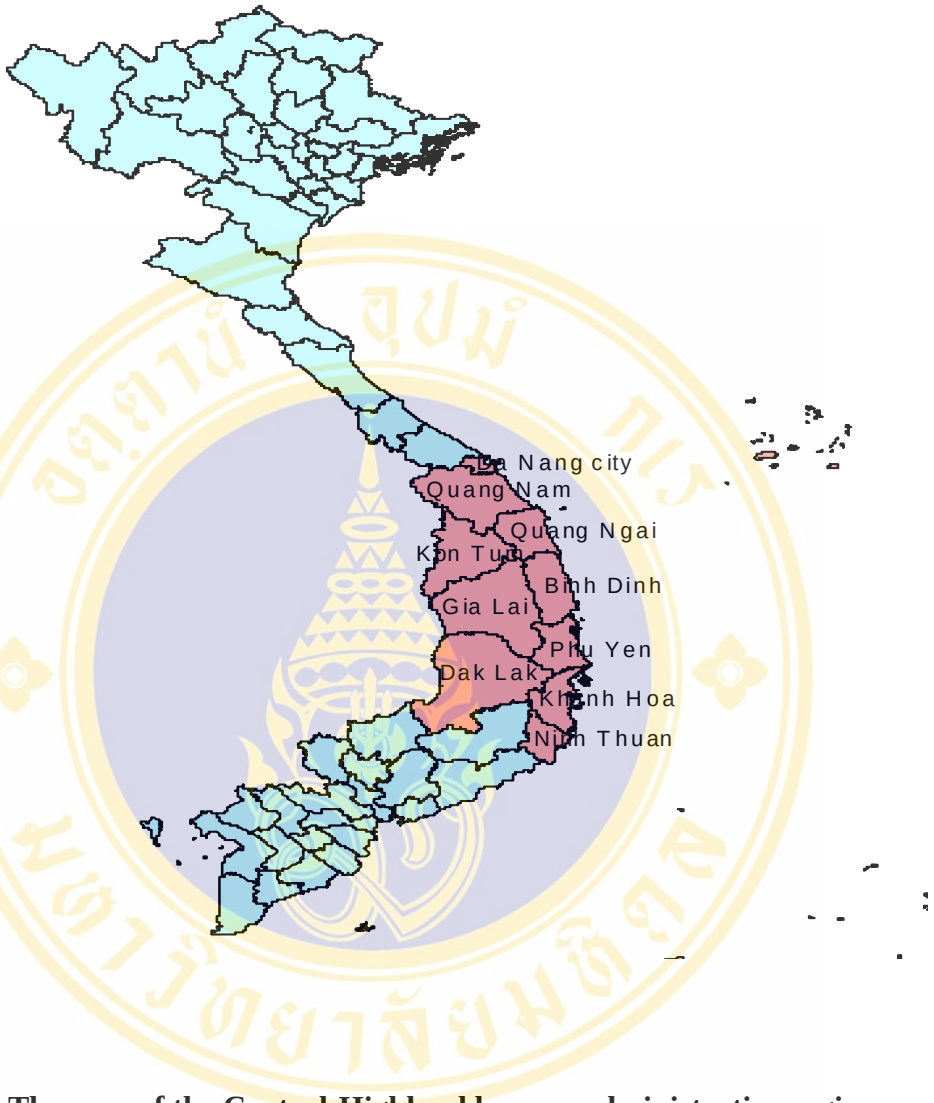


Figure 4: The map of the Central-Highland leprosy administrative region, Vietnam

1.6 Limitation of the study

This study was based on the secondary data from the national leprosy programme so that:

1. Leprosy data were provided by the annual leprosy reports thus no data for education, occupation, minority variables related to the patients;

2. The ages of clients was only divided into two groups (WHO) (1 – 14 years old, and ≥ 15 years old); and
3. The data was under reported so the number of new cases was not updated by month.

CHAPTER 2
LITERATURE REVIEW

2.1 Leprosy Disease (LD)

2.1.1 What is Leprosy

Leprosy is caused by an organism named Mycobacterium Leprae In those days leprosy was thought to be a hereditary disease, a punishment from God affecting in a large majority of the skin, and nerves. It is only mildly infectious and completely curable at any stage. What makes it dreaded is the damage to the nerves giving rise to deformities in the hands, feet, nose and eyes, which promote the awful stigma it does not deserve. These deformities however are preventable and correctable. It has been estimated that, at present, there may be between 2 and 3 million persons with leprosy related impairments and disabilities in the world. There is still no vaccine against this disease [10].

2.1.2 Natural history of Leprosy

Leprosy is one of the oldest diseases of mankind which most probably originated in India. The laws of Manu, stated in the Vedas written as early as 1400 BC in India. 1873, Dr. Armauer Hansen of Norway was the first to see the leprosy germ under a microscope. This was 1873, and Hansen's discovery was revolutionary. The evidence was clear for the entire world: leprosy is caused by a germ (Mycobacterium leprae). It was not hereditary, a curse, or from sin. Because of Dr. Hansen's work, leprosy is also called Hansen's disease [13].

Sources of infection: The infected human being is considered to be the only source of infection. The infective capacity of multi-bacillary leprosy cases is 4–11 times greater than that of patients with pauci-bacillary leprosy [14]. Untreated patients with multi-bacillary leprosy thus constitute the main source of infection. The occurrence or non- occurrence of the disease is closely associated with the cell-

mediated immune response of the host to the challenge by the leprosy bacillus [10, 13].

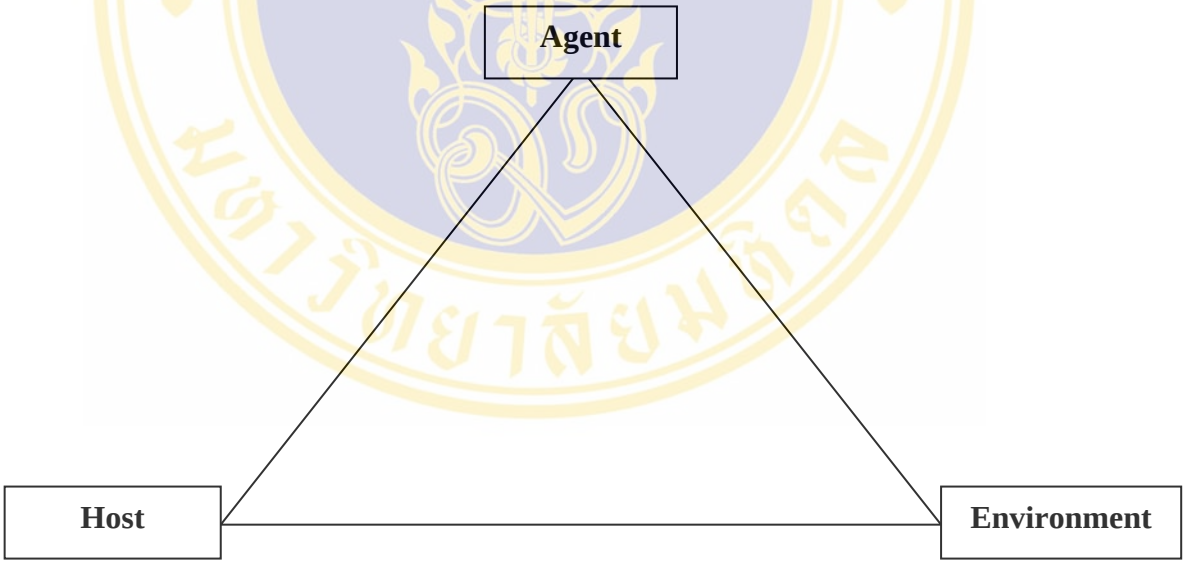
Leprosy is not a hereditary disease. Susceptibility to leprosy infection shows considerable variation, from absolute refractoriness to an apparently complete absence of resistance. Most people in contact with leprosy patients fail to develop the disease, and among the susceptible persons not all are prone to develop the lepromatous form of leprosy.

In general, prolonged and/or close contact is considered to be necessary for its transmission. However, in susceptible persons even a casual or short contact may occasionally cause the disease. An intra-familial contact with a person with multi-bacillary leprosy is more risky than an occasional extra-familial one. The contact need not be “skin to skin” contact as was previously believed, because the nose, and not the skin, is the main portal of exit of bacilli from patients with multi-bacillary leprosy. Leprosy bacilli are rarely found on the intact skin of patients with multi-bacillary leprosy because the highly bacilliferous granuloma located in the dermis is separated from the basal layer of the epidermis by a granuloma-free sub-epidermal clear zone. Therefore, only the ulcerated or abraded skin lesions of patients with multi-bacillary leprosy can be a portal of exit of leprosy bacilli. On the other hand, untreated lepromatous patients may discharge as many as 100 million leprosy bacilli from their nasal secretions every day. Leprosy bacilli may remain alive outside the human body in droplets of nasal secretions for several days. The inhalation of bacilli-laden droplets is at present regarded as the most likely mode of entry of leprosy bacilli into contact persons. Inhaled leprosy bacilli most probably enter the body through the nasal mucosa. Damage to the nasal mucosa, e.g. from the common cold, from picking the nose etc., may be a facilitating factor. The successful transmission of leprosy through nasal mucosa has been reported in nude mice, while experiments to produce the infection in nude mice by introducing leprosy bacilli directly into the lungs through tracheotomy openings were unsuccessful. A scratched, abraded, or insect-bitten skin may facilitate the passage of organisms in droplets deposited on the skin surface, through the epidermis into the dermis. The nasal mucosa and the abraded or damaged skin are the two preferred sites have a temperature which is lower than the normal body temperature of 37°C. Environmental factors, such as overcrowding due to

inadequate housing, lead to more frequent close contact with the source of infection and favor the spread of leprosy. Indonesian studies have shown that children of untreated leprosy patients who slept on the same mat with their parents developed the disease about seven times more frequently than children sleeping on separate mats. The transmission of leprosy depends primarily on the infectiousness of the infected person, the susceptibility of the contact person and the closeness, frequency and duration of the contact [13, 16].

The full sequencing of the M. leprae genome, completed in 2001, has created possibilities for the development of new diagnostic tests and treatments for leprosy [16]

2.1.3 Patterns of occurrence of infectious disease



Source: Medical Epidemiology, Raymond S. Greenberg

Figure 5 Schematic representation of the standard dimensions used to characterize disease occurrence

Disease causation is multi-factorial; that is, disease results from the interaction of many factors related to the agent, transmission, and host. The development of disease reflects the interaction of these factors as they affect a person. Thus, some people exposed to an infectious agent develop disease and others do not.

Infection results from the interaction between an infectious agent and a susceptible host. This interaction - called transmission - occurs by means of contact between the agent and the host. Three interrelated factors - the agent, transmission, and the host -- represent the chain of transmission. The links interrelate in and are affected by the environment; this relation is referred to as the Ecology of Infection, that is, the relation of microorganisms to disease as affected by the factors of their environment. To control infections, an attack on the Chain of Infection at its weakest link is generally the most effective procedure [12].

Host, in this case, refers to human for the infectious agent of Mycobacterium leprae. Several intinsic host factors are influencing exposure, suscepbitility or response of the host to agents like: age-groups, gender, race ethnicity, immunology status, etc.

Environment like sanitation, biological enviroment, culture, occupation, socioecomomic status, survival environment of infectious agents are the improtant determinants for transmission of leprosy.

Agent is only cause of Mycobacterium Leprae that affected in variety of manifestations of leprosy patients like Multi-bacillary or Pauci-bacillary in which some people got grade 2 of disability, etc.

In this study, the distribution of detection and prevalence rates is described in term of person, place and time.

2.1.4 Symptoms and diagnosis of Leprosy

Symptoms of leprosy:

The early signs include discolored or light patches on the skin of any part of the body with loss of feeling of leprosy, usually lighter than the surrounding skin. When nerve trunks in the arm are affected, part of the hand becomes numb and small muscles become paralyzed, leading to curling of the fingers and thumb. When leprosy attacks nerves in the legs, it interrupts communication of sensation in the feet Therefore you need to confirm if the skin patch is caused by leprosy or not. To confirm the first step is to sit with the patient and ask questions about the skin patch:

Clinical examination requires an examination of the entire body and must be done in private and with proper ethical precautions to identify skin patches, noting their number and locations and testing them for sensation.

Skin sensation testing: Sensation testing means checking if the person can feel if some thing touches the skin patch. Skin patches caused by leprosy have loss of touch sensation. Before starting the skin testing, explain it to the patient. Strength in hands or feet can be a painful. Skin testing for sensation needs to be done properly by asking the patient to be seated. Never say that a person has leprosy just because you have seen a patch on their skin that looks like leprosy without first doing a skin test and proper examination [13].

Skin smear for confirming leprosy: If you have access to a laboratory, it can be possible to do a skin smear test to look for leprosy bacteria. If a laboratory can do sputum smears for TB, they should be able to do the skin smear for leprosy. Skin smear can help to confirm the diagnosis of leprosy in cases where you are not sure about leprosy on clinical examination. Among the online courses, you can learn more about doing skin smears for leprosy. If you do not have access to a laboratory, leprosy can be diagnosed in most cases on clinical examination as explained earlier [13].

The case definition includes retrieved defaulters having signs of active disease as well as relapsed cases that have previously completed a full course of treatment, but does not include cured persons with late reactions or residual disabilities.

The diagnosis of leprosy:

Leprosy is essentially a clinical diagnosis, although a laboratory test (the slit skin smear) is important in some cases. Normally, the diagnosis rests on finding any one of three cardinal signs:

— one or more hypo pigmented, anesthetic skin patches, typical of leprosy;

— one or more thickened peripheral nerves; or

— a positive skin smear.

As with many diseases, the most accurate diagnostic test is a biopsy, with subsequent staining and histopathological examination of the tissues.

One major topic for research at present, is the development of new diagnostic tests, which may allow leprosy to be diagnosed with confidence at a much earlier stage; this would mean that treatment could begin early, resulting in less disability and probably also in less transmission of the disease to contacts [16].

2.1.5 The classification of leprosy cases

Leprosy exhibits quite a wide range of clinical features in different people and this is now thought to be due to differences in the body's immune response to the infection. Most people have an effective response which completely prevents the disease, while others have only a moderate response which allows the disease to appear, but limits it to only a few skin patches. In these patients, the number of leprosy bacilli in the body is quite small (less than a million) and they don't show up on the skin smear test, which is negative; the disease is classified as pauci-bacillary (meaning 'few bacilli'). A very small minority of people, on the other hand, have such a weak immune response to the leprosy bacillus that it can multiply almost without any check and spread to almost all parts of the skin and the peripheral nerves. In these patients the skin smear is positive and the disease is classified as multi-bacillary (meaning 'many bacilli'). For the purposes of treatment, all patients are put into one category or the other (either pauci-bacillary - PB - or multi-bacillary - MB), but this is somewhat arbitrary. The disease should be seen as a more or less continuous spectrum from high to low immunity. It should be pointed out that people who get multi-bacillary leprosy have no other immune deficiencies and have no particular susceptibility to any other disease.

The straightforward classification of leprosy into two treatment groups (PB/MB) is described by WHO. The older, but more detailed, classification of leprosy is known as the Ridley/Jopling classification [13, 16].

2.1.6 Brief history of leprosy treatment

Early 20th century: From the early 1900s through the late 1940s, leprosy doctors in Africa, Asia, the Far East, South America, and elsewhere injected patients with oil from the

chaulmoogra nut. This painful treatment appeared to work for some patients. Long term benefits were questionable, though [13, 16]:

In 1941, Promin for leprosy treatment was introduced to "Carville," the U.S. Public Health Service facility in Louisiana. There was a painful downside to promin: it required too many injections.

Dr. R.G. Cochrane was a pioneer in the use of dapsone pills which became the treatment of choice during the 1950s. Disappointment followed, though, as the leprosy bacilli began developing dapsone resistance. The germs were becoming smarter than the medicine.

During 1970s, treatment was success at last drug trials on the island of Malta in the 1970s led to an effective combination of drugs to treat leprosy.

In 1981, the World Health Organization started recommending multi-drug therapy, or MDT. The three drugs, taken in combination: rifampicin and dapsone for PB leprosy and rifampicin, clofazimine and dapsone for MB leprosy. Treatment takes six months for PB and one year or more for MB.

American Leprosy Missions began using multi-drug therapy in its projects in 1982. MDT has been remarkably successful: there have been very few side effects associated with its use and over 13 million people have been cured of leprosy following its introduction.

All patients were put on WHO multi-drug therapy:

- for multi-bacillary patients (MB MDT), consisting of daily dapsone (100 mg) and clofazimine (50 mg) and monthly supervised rifampicine (600 mg) and clofazimine (300 mg). Patients receive 12 months of MB MDT;
- for pauci-bacillary patients (PB MDT), consisting of daily dapsone (100 mg) and monthly supervised rifampicine (600 mg). Patients receive 6 months of PB MDT.

Early treatment with MDT is the best prevention against nerve damage and deformities. Patients are no longer infectious to others after the first dose of MDT. In other words, transmission of leprosy is interrupted; There are virtually no relapses, i.e. recurrences of the disease after treatment is completed; No resistance of the bacillus to

MDT has been detected; WHO estimates that early detection and treatment with MDT has prevented about four million people from being disabled.

A World Health Organization Study Group recommended multi-drug therapy (MDT) in 1981. MDT consists of three drugs: dapsone, rifampicin, and clofazimine. This drug combination kills the pathogen and cures the patient; MDT is safe, effective, and easily administered under field conditions. MDT is available in convenient monthly calendar blister packs to all patients.

2.2 The elimination of leprosy as a public health problem

The elimination of leprosy as a public health problem means reducing the prevalence of leprosy to below one case per 10 000 population. In 1991 World Health Assembly passed a resolution to eliminate leprosy as a public health problem by the year 2000. Elimination of leprosy as a public health problem is defined as a prevalence rate of less than one case per 10, 000 persons; the target was achieved on time. The widespread use of MDT has reduced the disease burden dramatically; over the past 20 years, more than 14 million leprosy patients have been cured about 4 million since 2000. The prevalence rate of the disease has dropped by 90% – from 21.1 per 10, 000 inhabitants to less than 1 per 10,000 inhabitants in 2000. A dramatic decrease in the global disease burden: from 5.2 million in 1985 to 805, 000 in 1995 to 753, 000 at the end of 1999 to 296.000 cases at the end of 2004. Leprosy has been eliminated from 113 countries out of 122 countries where leprosy was considered as a public health problem in 1985. An additional 13 countries achieved the elimination target since 2000. A 20% annual decrease in new cases detected globally since 2001. Absence of resistance to drugs used in MDT. Efforts currently focus on eliminating leprosy at a national level in the remaining endemic countries and at a sub-national level from the others. The main principles of leprosy control, based on timely detection of new cases and their treatment with effective chemotherapy in the form of multi-drug therapy, will not change over the coming years [16, 17].

2.2.1 The strategy for leprosy elimination:

The following actions are part of the ongoing leprosy elimination campaign: Ensuring accessible and uninterrupted MDT services available to all patients through flexible and patient-friendly drug delivery systems; Ensuring the sustainability of MDT services by integrating leprosy services into the general health services and building the ability of general health workers to treat leprosy; Encouraging self-reporting and early treatment by promoting community awareness and changing the image of leprosy; Monitoring the performance of MDT services, the quality of patients' care and the progress being made towards elimination through national disease surveillance systems. [10, 16]

In recent years, however, there has been a shift in attitudes, whereby leprosy is seen as a disease like any other, which should be treated through the general medical services, just as other diseases are; this is termed integration. As with other diseases, difficult cases could still be referred to specialists, but these would be within, rather than outside the general health services. The process of changing from a vertical program to an integrated program is not simple, but there is general agreement that the advantages of integration (greater sustainability, better coverage, reduced stigma) outweigh the disadvantages (difficulty in maintaining the quality of services at the level of the peripheral clinic). Much discussion at present relates to methods of guaranteeing the quality of services in the field, especially in areas where leprosy is not common.

2.3 Situation of Leprosy

2.3.1 Global Situation

Since 1985 to date, the prevalence of leprosy has been reduced globally by > 90%, with >14 million persons detected and cured; currently almost 100% of registered cases are receiving MDT (Table 2), [18].

— The global leprosy cases reduced from >10 million in 1985 to < 1 million by the year 2000 and to < 0.5 million in 2004;

— 108 of the 122 countries which had a national leprosy prevalence of >1 case per 10,000 population in 1985, achieved the leprosy elimination goal at the national level by the original target date of 2000 and another 5 countries by 2004. Thus, 113 of the 122 countries have achieved elimination.

Table 3: The achieved global elimination from 1985 to 2004

Parameter	1985	2000	2004
Number of Countries with Prevalence Rates of > 1/10,000 population	122	14	9
Global Prevalence	10/10,000	1/10,000	< 1/10,000
Patients on MDT	< 10%	100%	100%
Patients Cured	Accurate Data Not Available	11.2 million	14.2 million

Source: WHO - 2006

Since 14 countries missed the elimination target at the end of 2000, WHO extended the target date to December 2005. At the end of 2004, only 9 major countries, viz., Angola, Brazil, Central African Republic, Democratic Republic of Congo, India, Madagascar, Mozambique, Nepal, and Tanzania are yet to attain the elimination goal [19].

During 2006, statistical reports on the leprosy situation were received from 115 countries and territories. Based on official data from Ministries of Health in endemic countries, global annual detection has shown a declining trend since 2001, and the numberof new cases reported during the year 2005 stood at 296,499. Note that this table excludes the small number of cases reported from Europe. Based on official data from Ministries of Health in endemic countries, global annual detection has

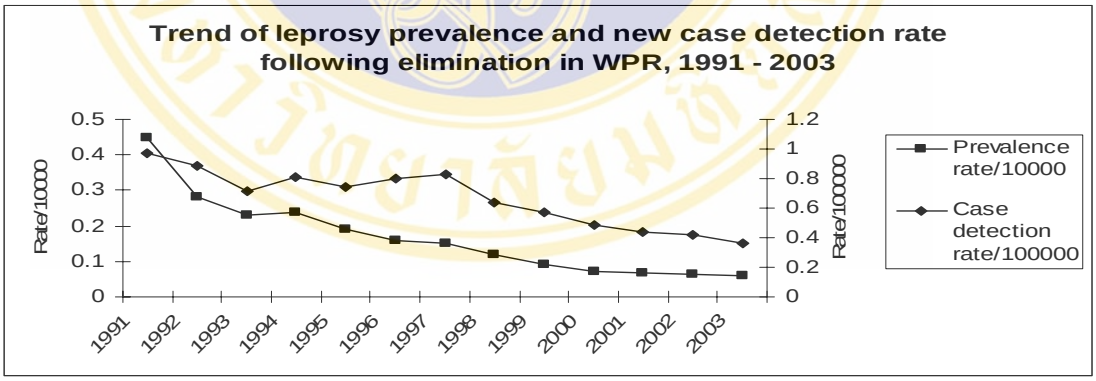
shown a declining trend since 2001, falling by over 110,000 cases (27%) during 2005 compared to the new cases reported during the year 2004 [18, 19, 20] (Table 4).

Table 4 New case detection trend during the period 2001-2005 by WHO region

WHO Region	New case detection during the year				
	2001	2002	2003	2004	2005
Africa	39,612	48,248	47,006	46,918	42,814
Americas	42,830	39,939	52,435	52,662	41,780
South-East Asia	668,658	520,632	405,147	298,603	201,635
Eastern Mediterranean	4,758	4,665	3,940	3,392	3,133
Western Pacific	7,404	7,154	6,190	6,216	7,137
Total:	763,262	620,638	514,718	407,791	296,499

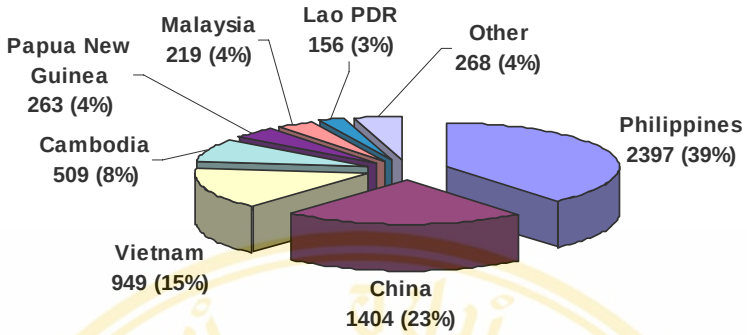
Source: World Health Organization-2006

2.3.2 Situation of Western Pacific Region [21, 22, 23]



Source: WHO-Western Pacific Region, 2005

Figure 5 Situation of Leprosy in Western Pacific Region 1991-2003



Source: WHO-Western Pacific Region-2005

Figure 6: Distribution of new leprosy cases in WPR in 2003

2.3.3 Leprosy Situation in Vietnam

Since 1981, Vietnam carried out leprosy elimination programme. The goal is detection, stop transmission resources in the communities, rehabilitation, and reintegration in the communities. 1983, Vietnam applied MDT regimen to treat all leprosy patients. 1994, Vietnam government pledged to reach leprosy elimination in 2000 in whole country. 1996, leprosy issue has become the national leprosy programme [5].

The programme is vertical and the unit responsible at the central level is the National Dermatology Institute in Hanoi. Activities are integrated into the general health system at the village level. WHO MDT has been gradually used since 1982. The elimination target reached in 1995 and sustained since. Sub-national elimination was achieved in all provinces, except one, by the end of 2000 [5].

The post-elimination activities: A five-year plan has been developed to start from 2001 with the aim of further bringing down prevalence and case detection rates and rehabilitating disabled leprosy patients with specific annual targets; The action was taken in

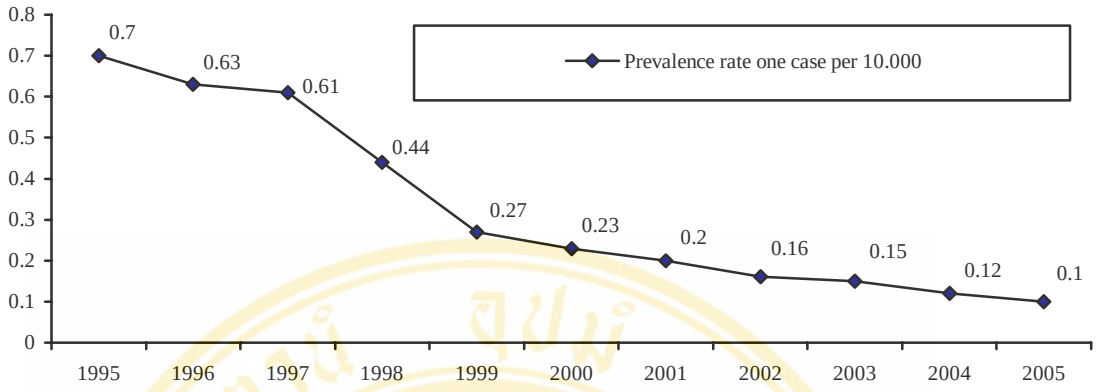
2001 to pilot a post-elimination surveillance system based on the protocol developed in WPRO, in selected provinces; The efforts are being made to detect and treat all cases in endemic pockets at sub-provincial level with intensification of IEC activities to sustain leprosy awareness in the community and among general health staff [5].

The prevalence and case detection rates have declined continuously before and since reaching elimination. The proportion of cases with disability grade 2 was consistently high indicating continued late detection of cases. Detection rate reduced from 3.81 (1995), 1.94 (2000) to 0.89 / 100,000 (2005). Prevalence rate decreased stably 0.7 (1995), 0.23 (2000) to 0.1 / 10,000 [Table 5]

Table 5 The main epidemiological indicators of leprosy from 1995 to 2005 in Vietnam.

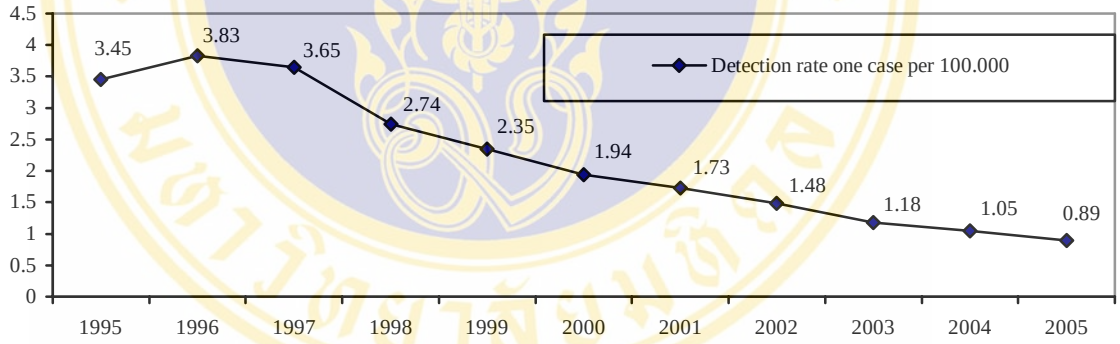
Year	**95**	**96**	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**
New cases	2,591	2,883	2,808	2,162	1,795	1,477	1,336	1,158	940	858	746
Prevalence	0.70	0.63	0.61	0.44	0.27	0.23	0.20	0.16	0.15	0.12	0.10
Detection rate	3.45	3.83	3.65	2.74	2.35	1.94	1.73	1.48	1.18	1.05	0.89

Source: The National Dermatology Institute, Vietnam, 2006



Source: The National Dermatology Institute, Vietnam, 2006.

Figure 8: The trend of prevalence rate of leprosy in Vietnam from 1995 to 2005



Source: The National Dermatology Institute, Vietnam, 2006.

Figure 9: The trend of detection rate of leprosy in Vietnam from 1995 to 2005

2.4 Factors related to Epidemiology of Leprosy.

Leprosy is rare among infants. Although children may run a greater risk of acquiring leprosy, the disease occurs in all age groups. The peak age of onset is between 10 and 20 years. Leprosy affects more males than females. According to Noordeen, in India, the male to female ratio in adults is 2:1.16. This sex difference is greater in adults than in children. Leprosy is not highly communicable [19]

Countries in the all the regions are reporting a wide range of MB proportion among the newly detected cases. In the African Region, it ranges from 23% in Comoros to 92% in Kenya and in the American Region from 36% in Bolivia to 83% in Cuba. The Eastern Mediterranean Region has a range of 58% in Yemen to 92% in Sudan. South-East Asia Region is reporting 38% in Bangladesh to 79% in Indonesia and the Western Pacific Region is reporting 30% in Federated States of Micronesia to 94% in the Philippines [20, 26].

The female proportion among the newly detected cases in the African Region ranges from 21% in Chad to 60% in the Central African Republic. In the American Region, it ranges from 34% in Venezuela to 50% in Dominican Republic, South-East Asia Region from 21% in Timor Leste to 42% in Bangladesh, Eastern Mediterranean Region from 28% in Sudan to 39% in Pakistan and in the Western Pacific Region from 28% in Cambodia to 36% in Federated States of Micronesia.

A wide variation is seen regarding the child proportion among newly detected cases especially in African, American, and Western Pacific Regions. The child proportion in the African Region ranges from 3% in Kenya to 39% in Comoros and in the American Region from 1% in Argentina to 16% in Dominican Republic. In the Western Pacific Region it ranges from 2.1% in China to 32% in the Federated States of Micronesia. However, less variation was observed in the South-East Asia and Eastern Mediterranean Regions with Thailand reporting 5%, Sri Lanka 11%, Pakistan 4% and Yemen 11% [22, 24, 25].

Similarly, the grade 2 disabilities among the newly detected cases show a wide variation in all the Regions. In the African Region, it ranges from 3% in Comoros to 21% in Benin and in the American Region from 2% in Argentina to 11% in Mexico. In the South East Asian Region, it varies from 2% in India to Timor Leste 21%. In the Western Pacific Region, Federated States of Micronesia is reporting 1% grade 2 disabilities among new cases and China 21% [27].

The beginning 2006, WHO reported that the number of new cases detected during 2004 was 407, 791Among them, 47% were multi-bacillary cases, 12% were children, and 4% were
diagnosed with severe disabilities [18].

Nepal is still 4.4 times greater than WHO's target level of less than one case per 10,000 population. Although leprosy affects both the sexes, in most parts of the world males are affected more than females at a ratio of 2:1 [28].

At the end of the 20th Century, leprosy was still endemic in many developing countries, particularly affecting the poorest segments of these societies. The South-East Asia region accounts for 90% of the global leprosy burden; India alone accounts for 55% of the burden, making it the country with the largest number of leprosy cases. The interaction between gender, socioeconomic status, sociocultural factors, and disease is well illustrated by an analysis of leprosy. Across Africa and Asia, it has been noted that there are common exposure problems for all women in the lower socioeconomic groups. These groups tend to have poor housing, inadequate ventilation, low nutritional status, and higher risk of coming into contact with leprosy. Poor nutrition can also compromise immunological status. However, the incidence of leprosy in general and of multi-bacillary leprosy in particular, has been found to be higher in males than females. In most areas of the world, case detection rates are also higher among men, with a ratio for men: women of about 2:1, which raises the question of whether female cases are under-reported. A WHO publication indicated that, in Brazil, case detection of leprosy has been increasing since women started working outside the home, and the ratio is now 1:1 (men: women). New cases of leprosy detected in a study that examined trends over an 18-year period in Bangladesh also showed a decrease in the male to female ratio, from 2.3: 1 to 1.6: 1, with the introduction of active case finding. Again, it remains unclear whether this difference is due to biological or to programme factors [29].

Between 1949 and 1998 a total of 474 774 leprosy cases were detected in China; 75.2% were males and 24.8% were females (male: female = 3:1). The average

age at onset was 29.9 + 13.9 years and the average age at detection was 34.8 + 14.2 years. A total of 24 061 cases aged below 15 years at detection were diagnosed during this period, accounting for 5.1% of all cases. For the clinical classification, 195 468 (41.17%) were MB, 278, 532 (58.67%) were PB, and 772 (0.16%) were patients whose classification was unclear. In 1998, the detection rate was 0.15 per 100 000 population (0.21 per 100,000 for males and 0.09 per 100, 000 for females), with the prevalence being 0.056 per 10,000 population. [38]

In China, from 1985 to 2002, a total of 49,477 new leprosy cases had been detected. Among them, 69.5% were multi-bacillary cases and 25.4% had grade 2 disability. The child cases aged below 15 years accounted for 3.74% of total cases. The grade 2 disability among new patients decreased from 31.4% in 1985 to 23.4% in 2002. The child case detection rate among new cases fluctuated between 2.70%-3.56% from 1999 to 2002 [35].

2.5 Prediction of elimination of leprosy

2.5.1 The previous studies

A study of Xiang-Sheng Chen predicted the elimination of leprosy in leprosy endemic areas of China. The results showed that of 337 provinces where the national goal of basic eradication of leprosy had not been reached and in 40 counties where the WHO goal of leprosy elimination had not been achieved in 1996, the detection rates in calendar years followed exponential models with significant goodness-of-fit. In the 67 counties with downward trends of detection rates, the national goal can be met in terms of detection rate in 6% of counties before the year 2000 or 34.4% before the year 2010, or, in terms of prevalence rate in 31.3% before the year 2010. In the 11 counties with downward trends of the detection rates, the WHO target can be met in eight to ten counties within this century when the duration of disease was determined with the WHO definition. If the MB proportion among new cases increased by 10%, the target would be met one year later. However, at the same MB proportion, the change of fixed treatment schedules from PB six months and MB two years to PB nine months and MB three years will cause achievement of the goal to be postponed by two

to ten years. Leprosy in some endemic areas in China could not be eliminated recently and might be in 10 years [36].

2.5.2 Strategy of elimination of leprosy in Vietnam 2006-2010

A five-year plan has been developed at the end of 2005 to start from 2006 with the aim of further bringing down prevalence and case detection rates and rehabilitating disabled leprosy patients with specific annual targets will be reached at provincial level [5]:

- Prevalence Rate < 0.2 per 10.000 population
- Detection Rate < 1 per 100.000 population
- Grade II of disability of leprosy among new cases is lower 15%

Action was taken in 2001 to pilot a post-elimination surveillance system based on the protocol developed in WPRO, in selected provinces. Efforts are being made to detect and treat all cases in endemic pockets at sub-provincial level with intensification of IEC activities to sustain leprosy awareness in the community and among general health staff.

2.5.3 Strategy of elimination of leprosy in the Central-Highland Region 2006-2010.

Table 6 The targets of elimination of leprosy in the Central-Highland Region 2006-2010 [6]

Indicators	2006	2007	2008	2009	2010
Detection rate	2.05	1.98	1.92	1.71	1.53
Number of new leprosy cases	226	219	211	188	168

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Study Design

This research was a retrospective study is conducted by using the existing data from the national system of leprosy surveillance during 1996 - 2005 in order to

— explore the prevalence and detection rates of leprosy;
— describe and analyze the disease occurrence, distribution, and trend of leprosy disease in the specified population and areas regarding to person, place, and time;
— comparison of the disease in terms of person, place, time, disabled grades and types of leprosy were taken; and
— predict trend of leprosy occurrence in the near future in the central-highland region.

3.2 Study population and study area

3.2.1 Study population

The study populations were the detected leprosy patients living in the Central-Highland Region, Vietnam during 1996-2005.

3.2.2 Study area

In Vietnam, the leprosy national program, provinces divide into 3 administrative regions: Northern Region includes 31 provinces; the Central-Highland Region includes 11 provinces and the Southern region includes 21 provinces.

This study included only the Central-Highland Region of Vietnam. The area is 82,055 square kilometers. It includes 11 provinces (108 districts; 1367 sub-districts). Its population was 11,266,000 and has 44 ethnic minorities. Climate is tropical. The 11 provinces are in two areas as follows:

— Central-Highland Area includes Kontum, Gialai, Daklac, and Daknong provinces.
— Delta Area includes Danang, Quangnam, Quangngai, Binhdinh, Phuyen, Khanhhoa, and Ninhthuan provinces.

3.3 Sample sources

This research was used the secondary data from the annually reports of the national Leprosy Program From:

1. The National Dermatology Institute, Vietnam from 1996 to 2005.
2. The total population data is taken from the Ministry of Population an Environment.
3. Leprosy patient data is taken from 11 provinces belong to the central-highland region, the national leprosy-dermatology hospital and the national of dermatology, Vietnam. The annual leprosy reports on leprosy of Da nang, Quang nam, Quang ngai, Binh dinh, Phu yen, Khanh hoa, Ninh thuan, Kon tum, Gia lai, Dak lac, Dak nong provinces from 1996 to 2005.
4. The total of reported leprosy cases included old and new cases

3.4 Research Instruments

Using summary form to extract the study variables from the annual reports (Table B1 Appendix)

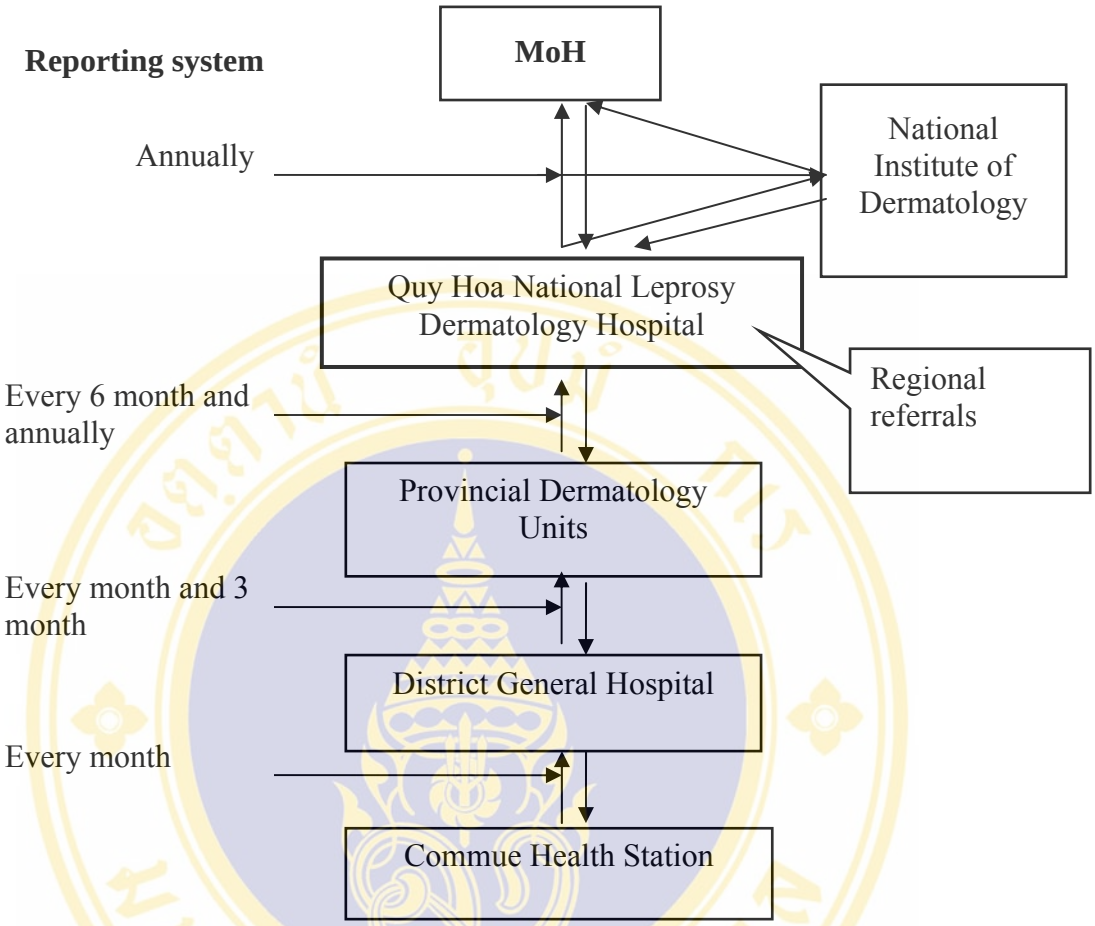
3.5 Data collection processing

All leprosy information was collected from the National Institute of Dermatology, the National Leprosy Dermatology Hospital (as regional leprosy center) and Provincial Health Offices of 11 provinces. The population information during this period was collected from Ministry of Population and Environment (MOPE) in Vietnam.

The data collection was conducted from December 2006 to January 2007 based on forms in Table 15 (Appendix). Supervisors were named and trained to collect leprosy diseases data, and then collected from the National Dermatology Institute and Quyhoa leprosy dermatology hospital, Vietnam. If some data are unclear, researcher and supervisors will go to the provinces to clarify.

The required leprosy and population information were summed up and displayed to describe the leprosy situation in the CHR during 1996-2005 regarding to person, place and time characteristics. Detail data are presented in the Appendix.

According to Figure 10, the reporting information system of leprosy in Vietnam, the original data is sent from communes to district general hospital in every month then sent to provincial dermatology unit (PDU) by every month and quarterly. From PDU sends to regional leprosy hospital in every 6 month. The regional leprosy hospitals send the collecting form of the leprosy data for every 6 month and annually send to the National Institute of Dermatology and Ministry of Health based on Table 16, 17 (Appendix).



Source: Ministry of Health, Vietnam.

Figure 10: The reporting system of leprosy network in the Central-Highland Region

3.6 Data Analysis

In this study, the disease was measured and compared by using detection rate and prevalence rate. The frequency of disease occurrence was measured in terms of detection rate and it reflects the number of new leprosy cases within a given period of time. Comparison of the disease in terms of person, place, and time with detection and prevalence rates was taken.

The data will be sorted using Excel spreadsheet regarding type of leprosy, disable grade, gender, age groups, and provinces by the time. Percentage, detection

rate, and prevalence rates will be calculated by Minitab programme. Line charts will be done by Excel to present trends of the leprosy detection and prevalence rates.

The declining rate for detection rate (DR), or prevalence rate (PR) of leprosy during the period of time was calculated as follow:

$$\text{Total declining rate} = \frac{\text{DR (PR) in the first year} - \text{DR (PR) in the last year}}{\text{DR (PR) in the first year}} \times 100$$

The annual declining rate for detection (or prevalence) rate was calculated as:

$$\text{Annual declining rate} = \frac{\text{Total declining rate during the period of time}}{\text{Number of years}} \times 100$$

The relationship between detection rate and prevalence rate will be performed using Pearson correlation analysis. Pearson's correlation coefficient is a measure of linear association. Two variables can be perfectly related, but if the relationship is not linear, Pearson's correlation coefficient is not an appropriate statistic for measuring their association.

In order to determine future trends, forecasting techniques was performed to predict the detection rate of leprosy. The Double Exponential Smoothing (DES) smoothes and provides short-term forecasts if there was trend in the time series. This method displays three measures to help determine the accuracy of the fitted values. The Mean Absolute Percentage Error (MAPE), measures the accuracy of fitted time series values, expresses accuracy as a percentage. The Mean Absolute Deviation (MAD), measures the accuracy of fitted time series values, expresses accuracy in the same units as the average absolute error. The Mean Square Deviation (MSD), it is very similar to MSE, expresses accuracy as the mean squared error. A commonly-used measure of accuracy of fitted time series values. MSD is always computed using

the same denominator, n, regardless of the model, so we can compare MSD values across models. MSE's are computed with different degrees of freedom for different models, so we cannot always compare MSE values across models. For all three measures, the smaller the value, the better the fit of the mode

MAPE = $\{[\Sigma (y_t - \text{forecast}) y_t] / n\}$ x100

MAD = $\{[\Sigma |y_t - \text{forecast}|] / n\}$ x 100

MSD = $\{[\Sigma (y_t - \text{forecast})^2] / n\}$ x 100

(Where y_t equals the actual value, forecast equals the forecast value, and n equals the number of forecaksts.).

CHAPTER 4
RESULTS

The retrospective study was carried out to describe epidemiology of leprosy in the Central-Highland Region in Vietnam during 1996-2005 in term of person, place and time. The secondary data was analyzed in January 2007 by using annual reported data in Vietnam during 1996-2005.

These results explained was the general information regarding the National Leprosy Programme (NLP) in the CHR during 1996-2005. The NLP has been carried out countrywide of Vietnam. It covers 100% of leprosy patients by MDT programme. The NLP has provided technical support to leprosy control activities at any level. The recording and supporting system of the NLP is regular according to WHO guidelines and recommendations.

The epidemiological situation of leprosy during 1996 - 2005 in the CHR was calculated for comparison. The results of the study are presented into four parts as follow:

Part1: The leprosy situation identified by the trends of the leprosy detection and prevalence rates

Part2: Prevalence and detection rates classified by place and time

Part3: Leprosy situation classified by gender and age of patients; grade 2 of disability; types of leprosy; and the time

Part4: Prediction of detection of leprosy in the Central-Highland Region.

4.1 The leprosy situation identified by the trends of the leprosy detection and prevalence rates.

4.1.1 Prevalence Rate.

Table 7 Number of the annual reported leprosy cases in the Central-Highland Region during 1996-2005.

Year	Population	New Leprosy Cases	Detection rate per 100,000 pop.	No of registered cases	Prevalence rate per 10,000 pop.
1996	9,407,000	789	8.3	1,206	1.35
1997	9,495,448	676	7.1	1,045	1.17
1998	9,747,100	512	5.3	345	0.68
1999	10,089,000	431	4.4	415	0.52
2000	10,089,000	396	3.8	303	0.41
2001	10,210,000	330	3.1	259	0.35
2002	10,332,520	341	3.2	274	0.33
2003	10,672,037	279	2.6	254	0.28
2004	11,047,800	272	2.5	259	0.21
2005	11,266,000	236	2.0	194	0.19
Total		**4,262**		**5,554**	

As shown in Table 7 and 8 during 1996 – 2005, a total number of 5,554 cases of leprosy were registered and treated by Multi-therapy (MDT) in the CHR in which included all of characteristics of person, place and time. The number of registered cases of leprosy reported during 1996-2005 has decreased continuously and consistently from 1,206 cases in 1996 to 194 cases in 2005. The latter made the prevalence rate declined 86% from 1.35% per 10,000 populations in 1996 to 0.19 per 10,000 populations in 2005, with the annual declining rate of 8.6%. Meanwhile, the initial fall of prevalence rate during the first

five years (1996-2000) was 69.6% from 1.35 to 0.41 per 10,000 populations, with the annual declining rate of 13,9% during the second five years (2000-2005). The prevalence rate declined 45.7% from 1.35 to 0.19 per 10,000 populations with the annual declining rate of 9.1%. Declining rate in the first five years (1996-2000) was 39.4% higher as compared to such declining rate in the second 5 years (2000-2005).

Table 8 Declining rate of prevalence rate and detection rate of leprosy in the Central- Highland Region during 1996-2005.

Declining Rate	Prevalence rate per 10,000 populations	Detection rate of new leprosy cases per 100,000 populations
Declining rate during first five years (1996-2000)	69.3%	54.2%
Annual declining rate during the first five years (1996-2000)	13.9%	10.8%
Declining rate during second five years (2000-2005)	45.7%	35.5%
Annual declining rate during the second five years (2000-2005)	9.1%	7.1%
Declining rate during the total 10 years (1996-2005)	86.0%	76.0%
Annual declining rate during the total 10 years (1996-2005)	8.6%	7.6%

4.1.2 Detection Rate

As similarly shown in the Table 7 and 8, total number of 4,262 new cases of leprosy was detected in 10 years from 1996 to 2005. Such number decreasing from 789 cases in 1996 to 236 cases in 2005, thus making declining of detection rate of new cases from 8.3 per 100,000 populations to 2.0 in 2005 with the 10 years declining rate of 76% and the annual declining rate of 7.6%. Declining rate of 54.2% was found during the first five years (from 8.3 to 3.8 per 100,000 populations) with the annual

declining rate of 10.8%. Meanwhile, declining rate of 35.5% during the second years from 3.1 per 100,000 populations in 2000 to 2.0 in 2005, with the annual declining rate of 7.1%. The annual declining rate of detection rate of new cases during the first 5 years was 34.6% greater than that found in the second five years.

4.1.3 Relationship between detection and prevalence rates

The detection rate and prevalence rate were diverged in 1996 but subsequently gradually were relatively closer each other in 1996-2000. After the 2000, both of them had equally and consistently declined (Figure 11). These variables are highly positive correlated (r = 0.99), and the correlation was significant at the p< 0.01 level. This indicated that the more the detection rate decreased, the more the prevalence rate decreased.

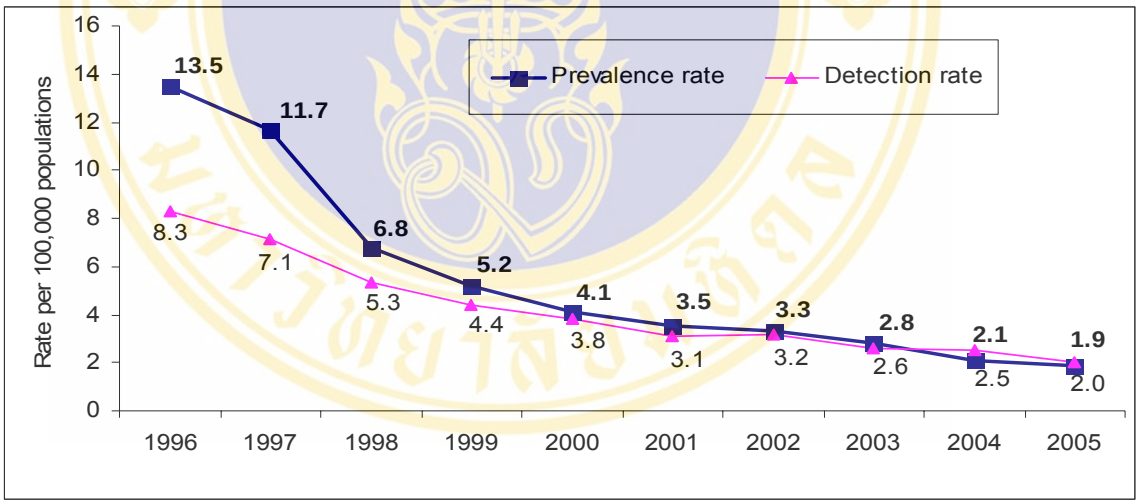


Figure 11 Trends of detection and prevalence rates of leprosy in the Central – Highland Region during 1996-2005

4.2 Prevalence and detection rates classified by place and time

4.2.1 Trend of prevalence rate of leprosy by the place and the time

Figure 12 presents the prevalence rate of leprosy that is compared of the Delta area and Highland area in the CHR during 1996-2005. Generally, the prevalence rates of both areas have decreased during 1996-2005.

For the Highland area, peak prevalence rate was found in 1996 remained at 2.18 per 10,000 populations and quickly decreased to be 0.55 per 10,000 populations in 1998 and gradually reduced onwards. By the end of 2005, the prevalence rate had decreased to 0.25 per 10,000 populations. In the Delta area, peak of prevalence rate was of 1.06 per 10,000 populations and continuously declined onwards in the Delta area. By at the end of 2005, the prevalence rate had decreased to 0.11 per 10,000 populations (Figure 12).

The prevalence rate in the Highland area has generally decreased more stably and faster than the Delta area at first 3 years only.

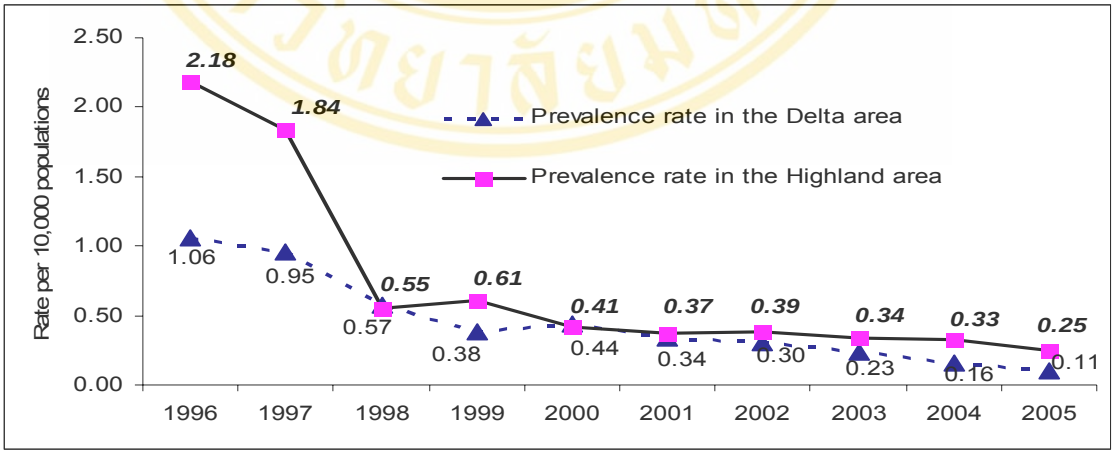


Figure 12 Trend of prevalence rate of leprosy between Delta and Highland areas during 1996-2005

4.2.2. Trend of detection rate of leprosy by the place and the time

Trend of leprosy detection rate in Delta and Highland areas had similarly declined between 1997 and 2003. It seems no change in Highland area, while continuously declined in Delta area after 2003 (Figure 13).

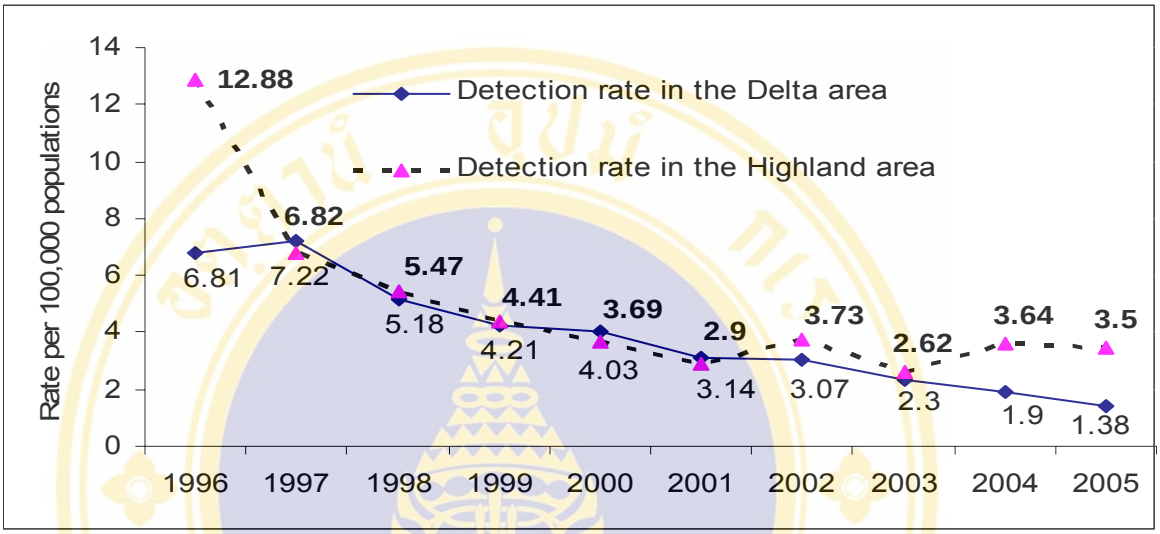


Figure 13 Trend of detection rate of leprosy between Delta and Highland areas during 1996-2005

4.3 Leprosy situation classified by types of leprosy, age of patients, gender, grade of disability, and the time.

4.3.1 Type of leprosy.

The proportion of MB cases among new cases averaged 57.6% and fluctuated from 53.9% to 64.2% between 1996 and 2005, with the peak of 64.2% occurring in 2002. The proportion of PB cases among new leprosy cases averaged 43.4% (Figure14).

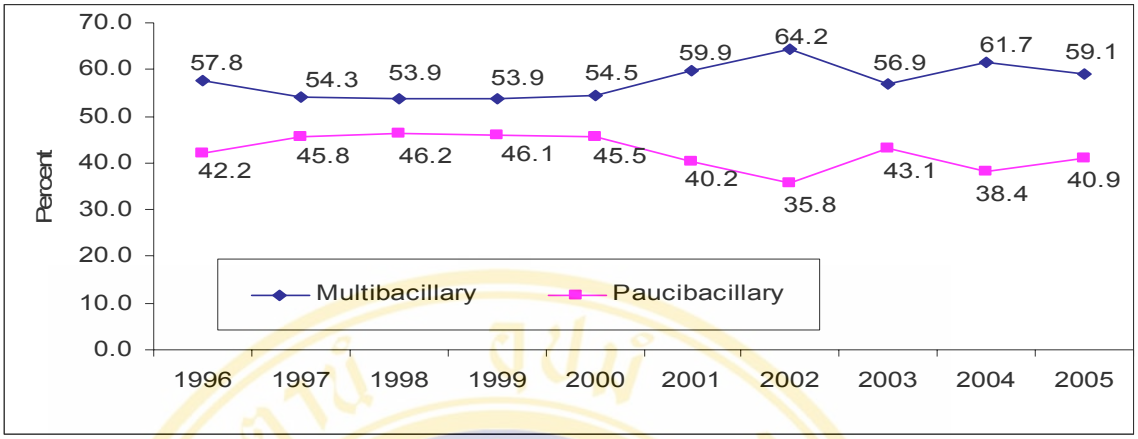


Figure 14 Trend of type of leprosy during 1996-2005 in the Central-Highland Region

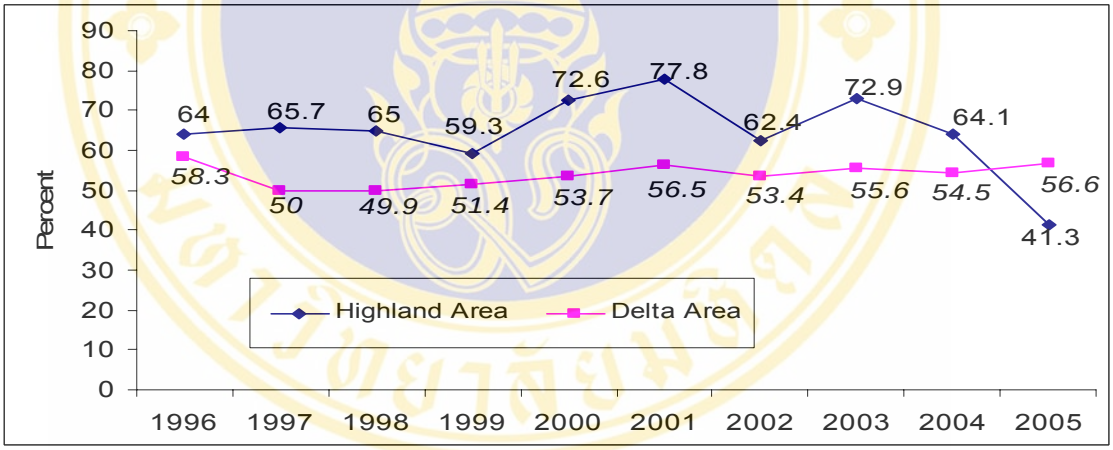


Figure 15 Trend of Multi-bacillary leprosy between the Highland area and the Delta area during 1996-2005

Proportion MB type of leprosy averaged 54% fluctuated from 50% to 58.3 % in Delta area, but averaged 64.5% and strongly changed from 41.3% to 77.8% in the Highland area. This proportion, from 1996 to 2004, Delta area was less than Highland area. But at the end of 2005, Delta are was higher than Highland area (Figure 15),

4.3.2 Age-groups.

The percentage of new cases among children aged less than 15 years averaged 8.5% and ranged between 5.2% and 12.2% during 1996-2005. The percentage of leprosy patients aged are more than or equal to 15 years averaged 91.5 %, and the peak of 94.9% occurring in 2002 (Figure 16).

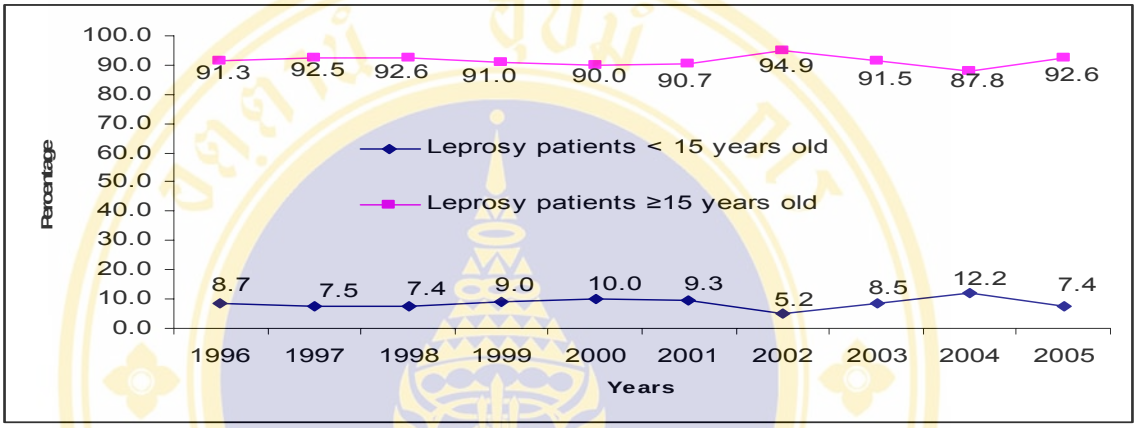


Figure 16 Trend of age-groups of leprosy patients during 1996-2005 in the Central-Highland Region

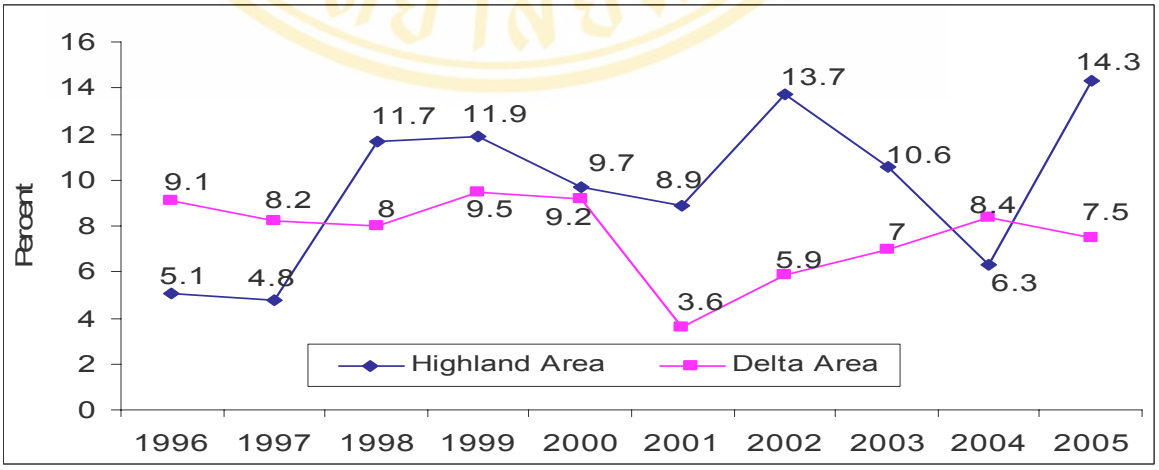


Figure 17 Trend of children < 15 years affected by leprosy between the Highland area and the Delta area during 1996-2005

Proportion of new cases among children < 15 years averaged 9.7% and strongly fluctuated from 4.8% to 14.3% in the Highland area. In the Delta area, this proportion averaged 7.6% and less fluctuated than that in the Highland area (Figure 17)

4.3.3 Disability

Among new cases, visible disability, expressed as grade 2, averaged 25.6%. It has slowly steadily reduced, with peak of 36.8% in 1996 and reduction in 2005 (19.1%). The proportion of disabled grade II has continuously declined in the CHR since 1996 by 48% (Figure 18).

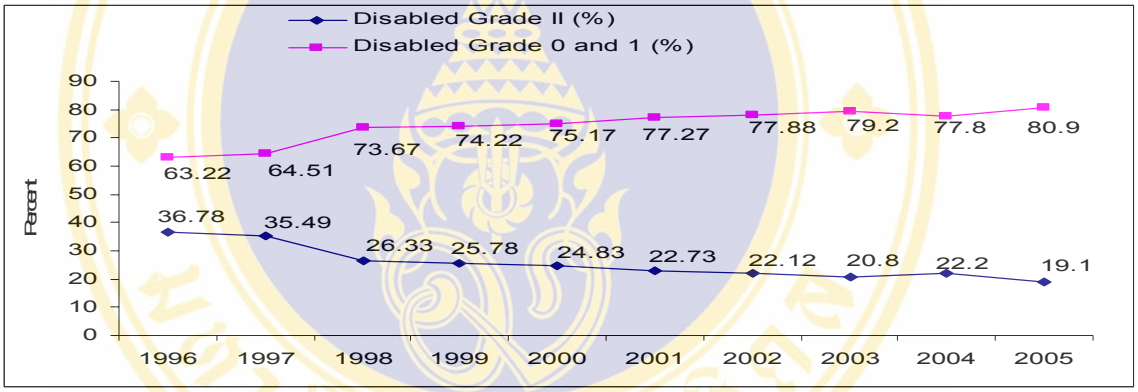


Figure 18 Trend of disabled grade II of leprosy patients during 1996-2005 in the Central-Highland Region

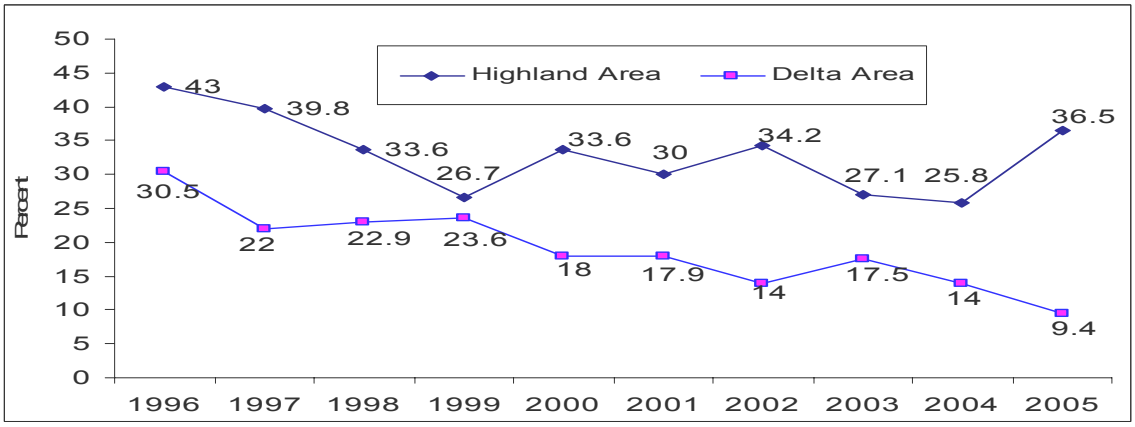


Figure 19 Trend of disabled grade II of leprosy patients between the Highland area and the Delta area during 1996-2005

Figure 19 showed that the proportion of grade II of disabled leprosy among new leprosy cases averaged 19% and had continuously decreased from 30.5% to 9.4% in the Delta area. In the Highland area, this proportion averaged 33.0%, strongly fluctuated and was still high at the end of 2005 (36.5%. every year this proportion in Highland area was always higher than Delta area (Figure 19).

4.3.4 Gender

Among new leprosy cases, percentage of male patients averaged 59.3% and the highest peak in 2002 (62.1%), while proportion of female averaged 40.7% and the peak of 45.16% occurring in 2003. Males got leprosy more than females (Figure 20). The average ratio of males to females is 1.5:1 (3:2).

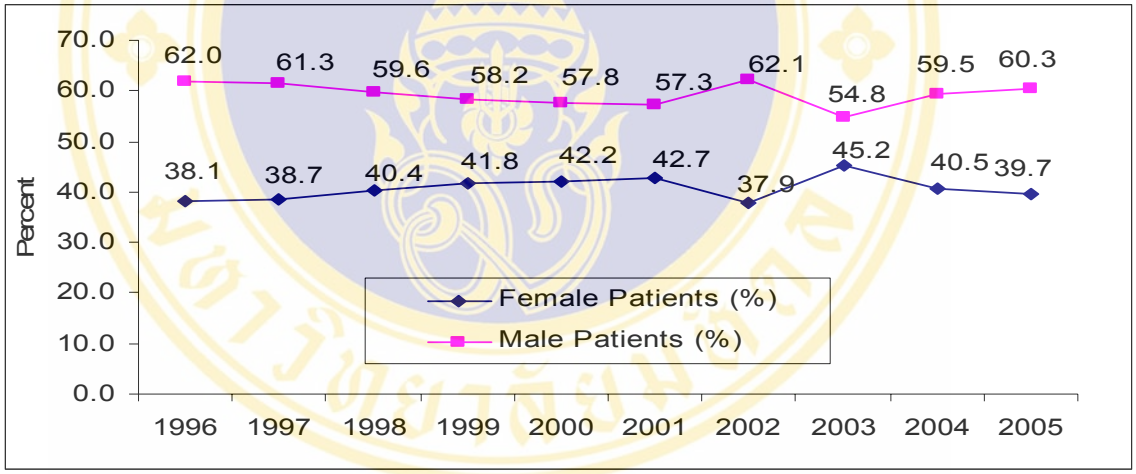


Figure 20 Trend of gender affected by leprosy during 1996-2005 in the Central-Highland Region.

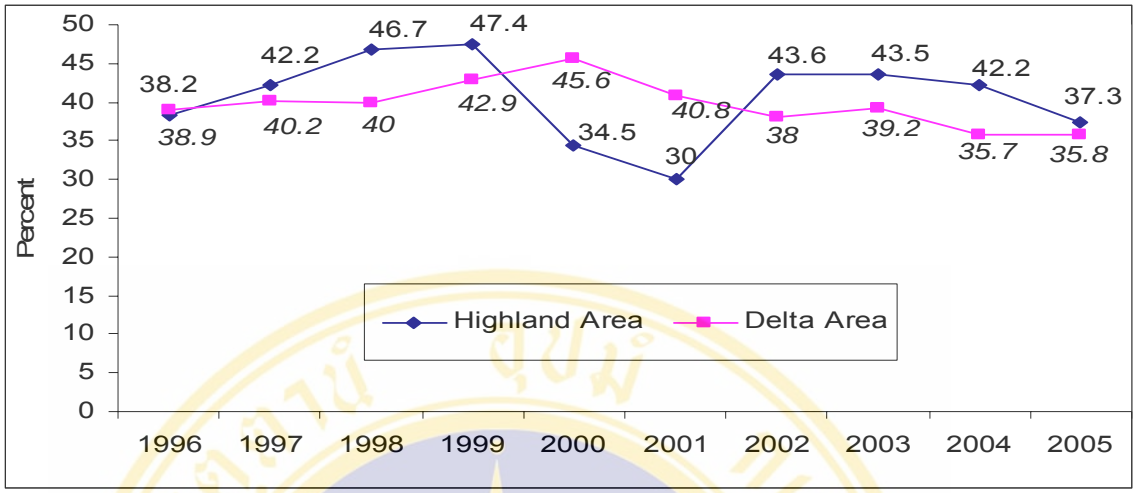


Figure 21 Trend of females affected by leprosy between the Highland area and the Delta area during 1996-2005

Proportion of the female leprosy patients averaged 40.6% and strongly changed from 30% to 47.4% in the Highland Area. While in the Delta area this proportion averaged 39.7% and slightly fluctuated from 35.8% to 45.6% (Figure 21).

Table 10 Comparison of characteristics of leprosy by person aspect between Delta and Highland areas in the Central-Highland Region during 1996-2005.

Characteristics of leprosy	Highland area	Delta area
Multi-Bacillary	Higher in 1996, 2005	Higher only in 2005
Children <15 years old	Higher for 7 years	Higher in 1996, 1997, 2004
Grade II of disability	Higher for 10 years	----------
Female patient	Higher for 7 years	Higher in 1996, 2000 2001

As shown in Table 10, characteristics of new cases of leprosy in the Highland area were more complex than that in the Delta area. The proportion of disabled grade II was higher for 10 years in Highland as compared to Delta area. The proportion of

children case aged < 15 years appeared 7 years in Highland, meanwhile only 3 years in Delta. The female proportion in the Highland was 5 years higher than that in Delta area. The proportion of MB patients was higher for 2 years in Highland, while was higher only 1 year in Delta area.

4.4 Prediction of detection of leprosy in the Central-Highland Region

The distribution of the detection rates and new leprosy cases during 1996-2005 in the CHR followed exponential models with significant goodness-of-fit. The Double Exponential Smoothing Technique was used as there was trend with no seasonal effect.

Based on the Double Exponential Smoothing Technique, the predicted detection rates were 1.66, 1.31, and 0.97 per 100,000 populations in 2006, 2007 and 2008 (Figure 22). The accuracy of forecasting is quite high, it provides a good fit for this time series (MAPE = 7.59; MAD = 0.29; MSD = 0.12).

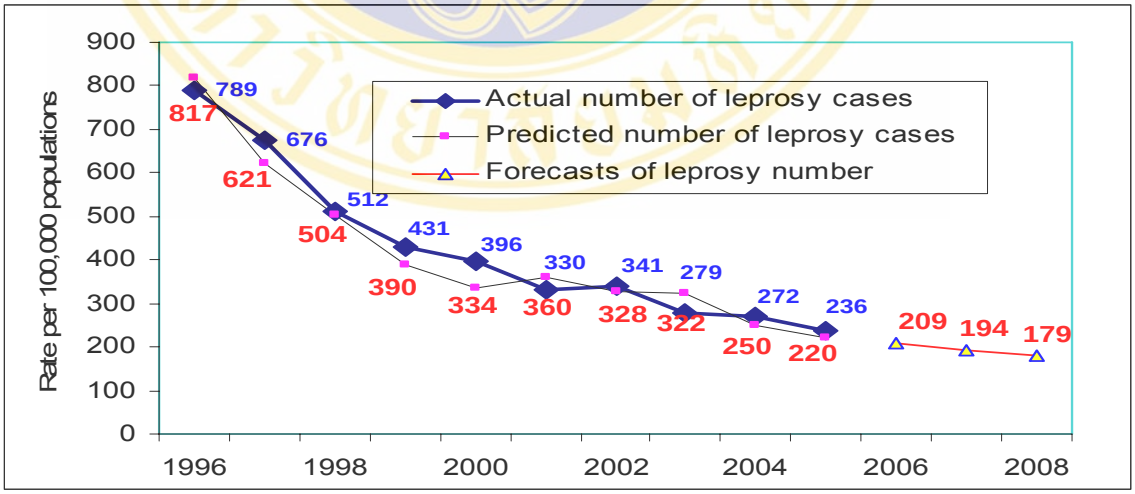


Figure 22 Prediction of the trend of detection rate of leprosy in the Central-Highland Region during 2006-2008.

In another hand, we can also predict the number of new leprosy cases in the near period of 2006, 2007 and 2008 by using Double Exponential Smoothing Technique.

Based on the Double Exponential Smoothing Technique, the predicted detection rates were 209, 194, and 179 in 2006, 2007 and 2008 (Figure 23). The accuracy of forecasting is not high (MAPE = 8.17; MAD = 31.83; MSD = 1307.37).

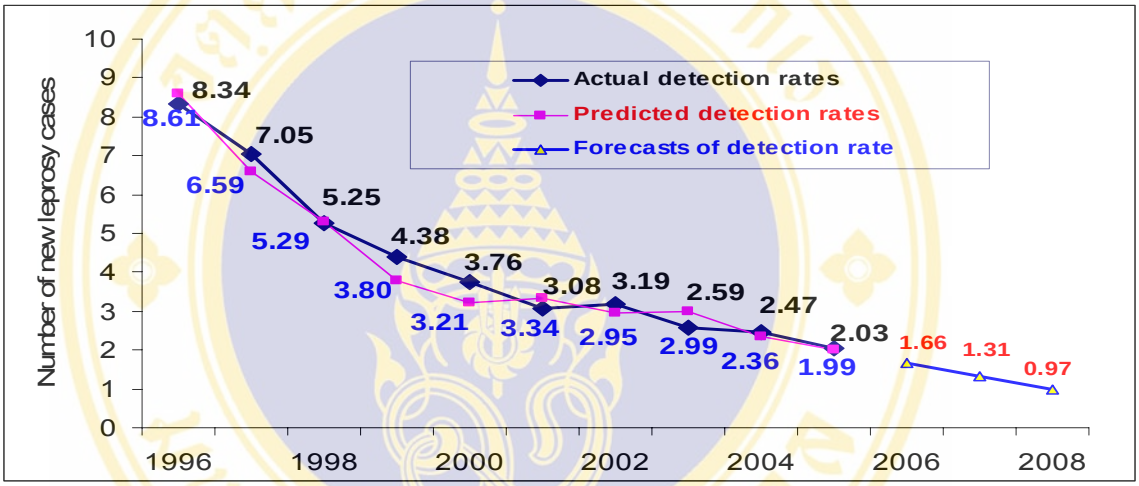


Figure 23 Prediction of the number of new cases of leprosy in the Central-Highland Region during 2006-2008.

CHAPTER 5
DISCUSSION

The epidemiology of leprosy is one of the most important ways of controlling the disease. The present study is based on 10 years of the annual reported data from the Leprosy Control Programme (LCP) in the Central-Highland Region (CHR), which aimed to reflect the current situation of leprosy in the CHR during 1996-2005 and predict the detection of the leprosy disease in the near future. This study was to describe the situation of leprosy in the CHR regarding to person, place and time characteristics. Over the study period, the Multi-Therapy (MDT) coverage has increased significantly to 100% since 1995.

During 1996-2005, in the CHR, the total number of leprosy detected was 4,262 cases among 11,266,000 populations, while the national level was detected 16,136 cases among 84,000,000 populations (Table 9; 11, Appendix), that means the number of leprosy per 1,000,000 populations in the CHR is 2 times (0.19 : 0.38) higher than those in the whole country of Vietnam. The number of the new cases in the CHR has decreased continuously and consistently since 1996 by 71% and peak of 789 new leprosy cases in 1996, and 236 at the end of 2005. In generally, prevalence rate and detection rate have stably and continuously decreased during 1996-2005.

Prevalence and detection rates

During 1996 – 2005, the prevalence rate was fallen from 1.35 per 10,000 populations in 1996 to 0.19 per 10,000 populations in 2005, with decreased by 86% during 10 years. The annual decreased in prevalence in the CHR during 1996 - 2005 is a result of adequate findings of new cases. It also justified the treatment of leprosy that was well and timely managed to every new leprosy patient. Although the National Leprosy Programme in the CHR has reached elimination of leprosy since 1996 (0.66 per 10,000 populations), but it was still 2 times than the national level [6] and was

significantly higher than the average level in the Western Pacific Region (0.05 per 10,000) [22]. That means the CHR where is still high endemic of leprosy. The detection rate was peak of 8.34 per 100,000 populations in 1996 and continuously decreased at 2.03 per 100,000 in 2005; it has steadily and continuously declined by 76% since 1996.

Detection rate may not be representing the current incidence and the degree of transmission of infection of leprosy in the community, because that depends on the operational sociological factors. In another hand, the absence of robust criteria or method diagnoses early leprosy disease. That means incidence rate of leprosy always higher than detection rate. However, the data from 1996 to 2005 revealed a significant declining trend in the new case detection rate. This might lead to interruption of transmission and freedom from leprosy in the long run.

The prevalence rates decreased faster than the detection rate, with the peak ratio of prevalence rate to detection rate is 1.6: 1 in 1996 and relatively closer and faster decreased at 0.95: 1 in 2005 (Figure 11). Because during 1996-1998, some of leprosy patients were treated with the old regimen of MDT that lasted 24 months for MB leprosy patients, but from 1998 to up to now all MB patients have been treated with 12 regimen of MDT recommended by WHO because of side-effectives of rifampicine and dapsone drugs. Another hand, PB leprosy patients were treated with 6 month regimen of MDT [2], most of them completed treatment before at the end of year.

Comparison between two areas the prevalence and detection rates in the Highland area has decreased less than those in the Delta area during 2002 to 2005. By at the end of 2005, the prevalence and detection rates in the Highland area were also 2 times higher than those of Delta area (Figures 12, 13). It may be caused by geography is more complicated in the Highland area; by culture that has still been underdeveloped, environmental status was not so clean, and lower educational level, etc. Because leprosy is an infectious and social disease.

As the relationship between detection rates and prevalence rates is concerned, it should be noted that diverged in period of time from 1996-1999 because of applying regimen of 24 months for MB in some cases at somewhere, and the prevalence rate in 2000–2005 was parallel in the detection rate because of great impact of applying regimen of only 12 months for MB started in 1998. The relationship between prevalence and detection rate highly positive correlated ($r = 0.99$), and the correlation is significant at the $p < 0.01$ level. That means the more detection rate decreased per year, the more prevalence rate the accordance's decreased.

Type of leprosy

In the absence of precise tools to measure M. leprae infection and of an effective method to monitor the endemic trend of leprosy at present, estimates of the leprosy endemic status mainly depend on the evaluation of prevalence and detection rates However, the prevalence is not only influenced by the detection rate, but is also associated with the disease's duration, MB: PB type ratio, as well as the criteria for declaring a clinical cure [27].

During 1996-2005 in the CHR, the proportion of MB leprosy patients detected was averaged at 57.6%; it is lower than the national level (61.8%) [Table A1, Appendix] and similar to leprosy in China (58.7%) [38], but higher than India (35.28) [25]. The proportion of MB leprosy patients detected in Highland Area was averaged at 64.5% is higher than that of the Delta Area (54%). The MB type of leprosy is mainly of sources for transmission of leprosy. That means the CHR is still rich transmission source of leprosy. Even though, the mode of transmission of leprosy is now unclear, but economics, environment and sociological conditions contribute noticeably as risk factors of leprosy disease.

The present study showed the tendency of MB proportion that had started higher onwards in 2000. Initially 1996, the proportion was high because more MB patients were detected. Later, as case detection improves, the MB proportion will

increase at a low level. Finally, as the number of new infections and patients become fewer and fewer, more MB patients with longer incubation periods will be diagnosed.

Age-groups

The proportion of newly detected cases aged less than 15 years compared with the total number of newly detected cases is expressed in a given year and as a percentage.

Over the last 10 years, both of the detection rates of leprosy (2.0–8.3 per 100,000 populations) and the proportion of child leprosy cases (5.2–12.2%, averaged 8.5%) in the CHR were higher than the national level (5.5 – 7.5%; averaged 6.3%) [Table A1, Appendix]; and the detection rates of child leprosy less than 15 years in the Highland area (8.9%) remained at a slight higher level than that in the Delta area (7.9%) [Table A4; 5, Appendix]. Comparison with China, the child cases aged below 15 year accounted for 3.7% of total that is significant low level [37]; and very high in India (14.9%); in Africa region (10.5%) and in Western Pacific Region (8.3%) [22]. That means the leprosy epidemiology in the CHR is still high endemic area which is compared of the whole country of Vietnam – particularly in the Highland area. Because the people, less than 15 years, were affected by leprosy that reflects the level of transmission of the disease over the last year [10]. It also reflects the people aged less than 15 years were locally affected by leprosy in area they are living. This is an important epidemiology indicator; even through the proportion could also be influenced by operational factors, such as active campaigns among sub-group of populations such as school survey for example. As transmission of M. Lepae decrease in populations, the proportion of children among newly detected cases may also be expected to decrease. However, this is a slow process. Therefore, it should be informative to monitor age specific detection rate or mean age at detection; this should increase in the situation of decline incidence.

Leprosy is an infectious and also social disease that explains why the adult people affected by M. leprae are more than children aged less than 15 years. Because

the adult people were more time at risk sources of leprosy and have longer lifetime than children aged less than 15; furthermore the incubation period of leprosy has not still identified yet – some cases were reported until 40 years later.

Grade of disability

This indicator reflects the effectiveness of the programme in terms of early case finding and the level of community awareness of the disease (WHO). The disabled grade II newly detected cases has decreased over 10 the years, averaged 25.6%. Because the leprosy control programme has well operated, early diagnosis of leprosy with minimum of disability was implemented. It also reflects reduction of stigma in the communities. But this proportion is still highly relevant indicator. The proportion of newly detected patients with disabilities has been shown to be related to delay before detection. A large proportion of patients with deformity among new detected patients indicated that these include old cases where as a small and stable proportion of new patients with impairment among the newly detected cases is a signs that the delay between onset of the disease and its diagnosis.

Although the grade II of disability of leprosy in the CHR has steadily decreased, with peak of 36.8% in 1996 and reduction in 2005 (19.1%), but it is still higher than national level (averaged 22.8%, with 16.2% at the end of 2005 [Table 9, Appendix]. Especially in the Highland area were always higher than the Delta are. The detection rate of are lower than the CHR: average disabled grade II of new cases in WPRO is of 15.5% [21] and in India is very low level (1.8%) [25], except China 25.4% [38]. It means that there are still many patients who are detected only after they present visible disabilities in the Central-Highland Region. The epidemiology of the disease itself is still a problem because, to date, there is no effective way to measure the level of infection and the incidence of the disease in the community. This is complicated by the process of self-healing of many single lesions as well as the tendency for the patients to hide the disease because of the social stigma.

Gender

The number of leprosy was detected 4262 cases in the CHR in which there were 1,715 female leprosy patients [Table A3, Appendix] and was not different ratio of female leprosy patients detected in the Highland area (40.6%) and the Delta area (40.2%) [Table 12, 13; Appendix], but in the Highland area were still higher for 7 years than Delta area. The proportion of female leprosy patients has fluctuated around 37.9% to 45.1% and averaged 40% among new leprosy cases detected during 1996-2005. It was less than that of males. Maybe male people in developing countries work outside more than females that explains males has more time to contact with leprosy patients. In most areas of the world, case detection rates are also higher among men, with a ratio for men to women of about 2: 1 [29]. The average ratio of male to female in the CHR is 1.5: 1. This ratio is lower than India 2:1 [17] and Nepal 2:1 [28] and China 3:1 [38], which raises the question of whether female cases under-reported. A WHO publication indicated that, in Brazil, case detection rate has been increasing since women started working outside the home, and the ratio is now 1:1 [27]. Another study in Bangladesh during 18 year period also showed a decrease trend in the male to female ratio, from 2.3: 1 to 1.4: 1 [26]

The epidemiological trends of leprosy in the Central-Highland Region from 1996 to 2005 show significant changes, but the distribution of the disease is still uneven between different areas of the region. WHO’s target for elimination of leprosy as a public health problem was reached in the CHR at the regional level in 1997, at the provincial level in 2000. According to the criterion for leprosy elimination in Vietnam [5], the prevalence rate of leprosy was < 0.2 per 10,000 populations at the end of 2005 in the Central-Highland Region but there were still 4 of provinces where this target had not been achieved at the end of 2005: Binh dinh (0.20); Ninh thuan (0.26); Kon tum (0.95) and Gia lai (0.49) [Table A6, Appendix]. Special attention must therefore be given to eliminate and finally eradicate leprosy in these provinces of the Central-Highland Region.

Prediction of trend of detection of leprosy in the CHR

The epidemiological trends of detection of leprosy in the Central-Highland Region from 1996 to 2005 showed significant changes. It had also decreased consistently and continuously since 1996. If the Leprosy Control Programme (LCP) will keep continuing well operations, the trends of detection of leprosy will continuously decrease at 209 new leprosy cases with detection rate of 1.66 per 100,000 populations in 2006, at 194 cases with detection rate of 1.31 per 100,000 populations in 2007, and at 179 cases with detection rate of 0.97 per 100,000 populations in 2008. So the Central-Highland Region may be reached criteria of leprosy elimination (detection rate < 1 per 100,000 populations) of Vietnam in 2008 [5].

According to the annual leprosy report 2006, the number of 192 new leprosy cases was detected and detection rate was 1.75 per 100,000 populations [39]. Comparison of forecasts that are lower 17 cases and higher 0.09 per 100,000 populations in forecasts of detection rate of 1.66 per 100,000 populations (95%). That means the effectiveness of the leprosy control program in the CHR that operated 95% perfectly in 2006.

CHAPTER 6
CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The research was performed on the secondary data of leprosy during 1996-2005 in the Central-Highland Region, Vietnam. This study presents a trend analysis of the number of leprosy patients and the epidemiological evolution over the period of 10 years. The aim of this study is to assess the epidemiological trends of leprosy in the Central-Highland Region of Vietnam in order to establish a strategy to improve the quality and effectiveness of leprosy control for this region. The conceptual framework of this study links among host factors, environment factors and agent factors in detection and prevalence rates. It was described in term of person, place and time.

A retrospective study was conducted to assess, describe and predict the epidemiology situation of leprosy in the CHR. The study populations were the detected leprosy patients living in the Central-Highland Region, Vietnam during 1996-2005. This research was used the secondary data from the annually reports of the national Leprosy Program From

The data of 4,262 leprosy patients was detected in 10 years in the CHR including 2,562 males and 1,700 females who had come from 11 provinces in the CHR. Trends of the leprosy detection and prevalence rates had decreased significantly, steadily and continuously since 1996. The prevalence was 1.35 per 10,000 populations in 1996 that had decreased by 86% at the end of 2005 (0.19 per 10,000 populations). The percentage of young age group (< 15years) was 8.5% during this period. For clinical classification, 57.6% were Multi-Bacillary, 42.4% were Pauci-Bacillary. The disabled grade II 36.8% proportion of leprosy among new cases had decreased consistently and continuous from 36.7 % (1996) to 19.1% (2005), averaged 25.6%.

The forecasts for detection rate of leprosy were 1.66, 1.31, and 0.97 per 100,000 populations in 2006, 2007 and 2008 (the accuracy of forecasting was quite high as the mean square deviation was only 0.12). The forecasts for the number of new leprosy cases were 209 in 2006, 194 in 2007 and 179 in 2008. However, the accuracy of forecasting is not high.

The data were analyzed by Excel, Minitab and SPSS programmes. The results are useful to inform people who are working in leprosy control programme.

6.1.1 Trends of the leprosy detection and prevalence rates

This study shows that leprosy was well controlled in the Central-Highland Region. The epidemiological trends of leprosy in the CHR during 1996-2005 show significant changes on most of indicators. Trends of the leprosy detection and prevalence rates had decreased steadily and continuously since 1996.

The prevalence was 1.35 per 10,000 populations in 1996 that had decreased by 86% at the end of 2005 (0.19 per 10,000 populations) with the annual declining rate of 8.6%. Declining rate in the first five years (1996-2000) was 39.4% higher as compared to such declining rate in the second 5 years (2000-2005).

The detection rate was 2.03 per 100,000 populations in 2005 that had decreased by 76% since 1996 (8.34 per 100,000 populations) with the annual declining rate of 7.6%. The annual declining rate of detection rate of new cases during the first 5 years was 34.6% greater than that found in the second five years.

The annual decrease in prevalence and detection rates in the CHR during 1996 – 2005 are results of adequate finding of new leprosy cases during 1996 (789 cases) – 2005 (236 cases).

According to WHO’s target for elimination of leprosy as a public health problem was reached in the CHR at regional level in 1998 (0.68 per 10,000 populations)

Although in generally, the detection and prevalence rates in the CHR had always been 2 times higher than those in the whole country of Vietnam

Comparison between two areas the prevalence and detection rates in the Highland area has decreased less than those in the Delta area during 2002 to 2005. By at the end of 2005, the prevalence and detection rates in the Highland area were also 2 times higher than those of Delta area

6.1.2 The situation of leprosy classified by the related indicators

In the absence of precise tools to measure Mycobacterium Leprae infection and of an effective method to monitor the trend of leprosy at present. Evaluation of the leprosy status mainly depends on prevalence and detection of leprosy:

Type of leprosy

During 1996 – 2005, there were 1,912 Pauci-bacillary leprosy patients and 2,350 Multi-bacillary leprosy patients detected. The proportion of MB leprosy patients was averaged at 57% is higher than that of PB leprosy patients (43%). The proportion of MB leprosy patients detected in Highland Area was averaged at 63.8% is higher than that of the Delta Area (53.5%). The MB leprosy patients are mainly of sources of transmission.

Agegroups

The detection rate of leprosy in children (less than 15 years) in the CHR during 1996 – 2005 was much less than that in adults. The proportion of child leprosy cases (5.2–12.2%, averaged 8.5%) in the CHR was significantly higher than the national level (5.5 – 7.5%; averaged 6.3%). This indicator reflects the level of transmission of the disease over the last few years. The new-case detection and the proportion of children among new cases would serve much better to monitor the real disease status. It also reflects the people aged less than 15 years were locally affected by leprosy in

area they are living that also means the endemic sources of leprosy till remaining in the Central-Highland Region.

Grade of disability

This indicator reflects the effectiveness of the programme in terms of early case finding and the level of community awareness of the disease (WHO). The disabled grade 2 of newly detected cases has decreased over 10 the years, averaged 25.6%. Although it has steadily decreased, with peak of 36.8% in 1996 and reduction in 2005 (19.1%), but It is still higher than national level. The average grade II of disability of leprosy in 10 years in the Highland Area (34.7 %) was higher than that in the Delta Area (21.2%). It should be considered by prejudice in communities and also stigma of people they were affected by leprosy who tried to hide their leprosy disease.

Gender

The proportion of female among leprosy patients detected in the CHR during 1996 - 2005 has insignificantly fluctuated around 37.9% to 45.1%, averaged 40%. The average ratio of males to females is 1.5:1. It remains unclear whether this difference is due to biological or to programme factors. The study also showed that, the total number of new female leprosy cases detected, this trend is not reflected in age-groups, and type of deformities seen in leprosy differs according to sex.

6.1.3 Prediction of the detection of leprosy in the Central-Highland Region during 2006-2008.

The epidemiological trends of leprosy in the Central-Highland Region from 1996 to 2005 show significant changes, but the distribution of the disease is still uneven between different areas of the CHR. Special attention must therefore be given to eliminate and finally eradicate leprosy in these provinces of the Central-Highland Region.

Regarding to the present study that the Leprosy Control Programme (LCP) in the Central-Highland Region has been ongoing well so the LCP will keep continuing well operations the trends of detection of leprosy will continuously decrease at 209 new leprosy cases with detection rate of 1.66 per 100,000 populations in 2006, at 194 cases with detection rate of 1.31 per 100,000 populations, and 179 cases with detection rate of 0.97 per 100,000 populations. According to criteria of the National Leprosy Programme that the CHR will be reached in 2008 that means earlier 2 years [5]

6.2 Recommendations

6.2.1 Recommendations for the leprosy control programme

Following the findings from this study, there are some recommendations should be made for improving of the operating and reporting system of the Leprosy Control Programme in the Central-Highland Region, particularly in Highland area, that can be summarized as follows:

To further reduce leprosy cases and sustain quality leprosy services including rehabilitation. The main principles of leprosy control, based on timely detection of new cases and their treatment with effective chemotherapy in the form of multi-drug therapy, will not change over the coming years. The emphasis will remain on providing quality patient care that is equitably distributed, affordable and easily accessible. At the moment, there are no new technical tools or information that warrants any drastic changes in the strategy for leprosy control. However, there is an urgent need to make decisive changes in the organization of leprosy control, in the attitude of health care providers and beneficiaries, and in the working arrangements among all partners

— Early new case detection and timely treatment with multi-drug therapy (MDT) for all in order to reduce grade II of disability less than 15%, children less than 5%. That is good actions to interrupt the transmissive sources. Especially, in Highland area should carry out multi-survey as contact survey, photo-survey, mass survey;

— Propaganda of basic information of leprosy in the communities, especially in schools should be maintained and strengthened in the CHR, particularly more focussing in the Highland area that aims at minimizing decrease of stigma of people who are affected by leprosy and prejudice of the communities to the leprosy patients.

6.2.2 Recommendations for further research

The present study did not cover all the aspect of person, place, and time characteristics such as ethnicities, urban, rural, other age-groups, occupation, and onset time of leprosy patients, detail of gender association in type of leprosy and in age-groups. These issues should be studied in further research to contribute in setting up the priorities of the Leprosy Control Programme that is the most suitable to each area, and contribute in clearer understanding of the transmissive mechanism of leprosy.

We also need to get information of patient satisfactory to the leprosy services in order to know the reasons of the delay detection, and to explain more clearly about grade II of disability of leprosy.

Further study on molecular biology of Mycobacterium Leprae will be answered why males were always getting leprosy more than females, and some people getting Multi-bacillary but others only getting Pauci-bacillary, and also understanding of disability due to leprosy.

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APPENDIX

APPENDIX A

1. Prevention and Reporting System of the National Leprosy Programme in Vietnam

The programme is vertical and the unit responsible at the central level is the National Institute of Dermatology in Hanoi. Activities are integrated into the general health system at the village level. The disease is unevenly distributed: Twelve provinces in mountainous areas and four provinces on the high plateau have been considered as highly endemic. Case detection is mainly carried out through mass contact and group screening. WHO' MDT has been gradually used since 1982.

Elimination target: Reached in 1995 and sustained since. Sub-national elimination was achieved in all provinces, except one, by the end of 2000.

Post-elimination activities during 2001-2005

— A five-year plan has been developed to start from 2001 with the aim of further bringing down prevalence and case detection rates and rehabilitating disabled leprosy patients with specific annual targets.

— Action was taken in 2001 to pilot a post-elimination surveillance system based on the protocol developed in WPRO, in selected provinces.

— Efforts are being made to detect and treat all cases in endemic pockets at sub-provincial level with intensification of IEC activities to sustain leprosy awareness in the community and among general health staff.

2. The epidemiology of Leprosy in Vietnam during 1996 - 2005.

Table 9 The situation of new leprosy cases in Vietnam during 1996-2005.

Year	Populations (1.000)	Total No of new leprosy cases	Characteristics of new leprosy cases			
			MB (%)	Disabled grade 2 (%)	Female (%)	Child <14 (%)
1996	75, 310	2,883	62.68	31.53	35.48	7.32
1997	76, 900	2,808	63.70	30.40	36.40	5.66
1998	78, 858	2,162	59.11	28.95	25.32	7.49
1999	76, 325	1,795	59.67	25.07	37.66	6.91
2000	76, 325	1,477	61.27	20.92	38.66	7.11
2001	77, 244	1,336	62.00	19.99	37.00	6.00
2002	78, 144	1,158	61.74	19.43	37.74	5.61
2003	80, 727	940	62.17	18.86	35.72	5.48
2004	81, 701	858		16.90	37.53	5.48
2005	83, 118	746	65.27	16.22	36.06	6.30
		Total: 16,163	Mean 61.8	Mean 22.8	Mean 35.8	Mean 6.3

Source: The National Institute of Dermatology, Vietnam, 2006.

Table 10 The leprosy prevalence and detection rates of leprosy in Vietnam during 1996-2005.

Year	Prevalence rate (per 10,000 populations)	Detection rate (per 100,000 populations)
1996	0.63	3.83
1997	0.61	3.65
1998	0.44	2.74
1999	0.27	2.35
2000	0.23	1.94
2001	0.20	1.73
2002	0.16	1.48
2003	0.15	1.18
2004	0.12	1.05
2005	0.10	0.89
Mean	0.29	2.08

Source: The National Institute of Dermatology, Vietnam, 2006.

3. Leprosy information in the Central-Highland Region during 1996-2005

Table 11 Characteristics of the New Leprosy Cases (NLC) in the Central-Highland Region (CHR) during 1996-2005.

Year	Population	Total No of new leprosy patients	Characteristics of leprosy patients			
			No of MB patients	Grade II of disability	Number female patients	Children aged < 15
1996	9,407,000	789	428	280	305	59
1997	9,495,448	676	364	178	275	50
1998	9,747,100	512	276	132	214	46
1999	10,089,000	431	232	106	191	43
2000	10,089,000	396	234	89	168	37
2001	10,210,000	330	196	67	118	16
2002	10,332,520	341	191	71	135	29
2003	10,672,037	279	157	53	104	21
2004	11,047,800	272	160	53	105	20
2005	11,266,000	236	112	28	85	26
Total		4,262	2,350	1,057	1,700	347

Source: The Quyhoa National Leprosy Dermatology Hospital, Vietnam, 2006.

Table 12 The new leprosy cases in Highland Area during 1996-2005

Year	Population	Total No of leprosy patients	Characteristics of leprosy patients			
			No of MB leprosy patients	Grade II of disability	Number female patients	Children aged < 15
1996	2,437,000	314	201	135	120	16
1997	2,434,900	166	109	66	70	8
1998	2,505,300	137	89	46	64	16
1999	3,061,000	135	80	36	64	16
2000	3,061,000	113	82	38	39	11
2001	3,099,000	90	70	27	27	8
2002	3,136,188	117	73	40	51	16
2003	3,238,630	85	62	23	37	9
2004	3,518,600	128	82	33	54	8
2005	3,597,000	126	52	46	47	18
Total		1,411	900 (63.8%)	490 (34.7%)	573 (40.6%)	126 (8.9%)

Source: The Quyhoa National Leprosy Dermatology Hospital, Vietnam, 2006

Table 13 The new leprosy cases in Delta Area during 1996-2005

Year	Population	Total No of leprosy patients	Characteristics of leprosy patients			
			No of MB patients	Grade II of disability	No of female pats	Children aged < 15
1996	6,970,000	475	277	145	185	43
1997	7,060,548	510	255	112	205	42
1998	7,241,800	375	187	86	150	30
1999	7,028,000	296	152	70	127	28
2000	7,028,000	283	152	51	129	26
2001	7,111,000	223	126	40	91	8
2002	7,196,332	221	118	31	84	13
2003	7,433,407	171	95	30	67	12
2004	7,529,200	143	78	20	51	12
2005	7,669,000	106	60	10	38	8
Total		2,803	1,500 (53.5%)	595 (21.2%)	1,127 (40.2%)	222 (7.9%)

Source: The Quyhoa National Leprosy Dermatology Hospital, Vietnam, 2006.

Table 14 The achieved indicators of elimination of leprosy in provincial level at the end of 2005 in the CHR

Provinces	Indicators of elimination of leprosy		
	Prevalence rate (per 10,000 populations)	Detection rate (per 100,000 populations)	Grade II of disability (%)
Da nang	0.05	0.53	0.0
Quang nam	0.06	0.48	14.3
Quang ngai	0.10	1.43	16.7
Binh dinh	0.20	1.89	3.4
Phu yen	0.07	1.07	11.1
Khanh hoa	0.13	1.64	14.3
Ninh thuan	0.26	3.84	12.8
Kon tum	0.95	10.91	14.7
Gia lai	0.49	7.25	40.0
Dac lac	0.03	0.29	100.0
Dac nong	0.10	0.99	0.0
The Highland Area	*0.25*	*3.50*	*36.5*
The Delta Area	*0.11*	*1.38*	*9.4*
Total of the CHR	*0.19*	*2.03*	*19.10*

Source: The Quyhoa National Leprosy Dermatology Hospital, Vietnam, 2006.

APPENDIX B

COLLECTING FORMS

Table 15 The patient information form needed for the study

THE NAME OF PROVINCE:

Indicators	The number of patients of years									
	96	97	98	99	00	01	02	03	04	05
Population										
Delta area										
Highland area										
Age of patients										
<15 years old										
≥15 years old										
Genders										
Male										
Female										
Place										
Delta area										
Highland area										
Type of Bacteria										
Multi-bacillary										
Pauci-bacillary										
Grade of disabilities										
Grade 2										
Grade 0 and 1										

Table B16 Reporting form of new leprosy patients [M2]

			PB	MB	Total	Populations suggested	Populations already examined
1. Method of examination	A	Came self-patients					
	B	Introduced					
	C	Mass survey					
	D	Contact survey					
	E	Group survey					
	F	Unknown					
2.		Total No of new leprosy cases					
3. Gender	A	Males					
	B	Females					
4. Age	A	0-14					
	B	15+					
5. Bacilli	A	Positive					
	B	Negative					
	C	Didn't do					
6. Disability	A	Grade 0					
	B	Grade I					
	C	Grade II					
7. Re-treatment	A	Relapse after MDT					
	B	Relapse after DDS					
	C	Reregistered					
	D	Moved away					
Total		Total increased (column2 + column 7)					

Table B17 Management form of leprosy patients [M3]

	1	2	3. Completion				4	5. treatment during this year								6. Management in this year						7. Situation at the end of this year					
			A	B	C	D		5.1	5.2 Gender		5.3 Age		5.4 treating			6.1 Disability				6.2 Reaction		A	B	C	D	E	F
									A	B	A	B	A	B	C	A	B	C	D	A	B						
	No of leprosy managed at the end of last year	No of leprosy increased this year	Completed surveillance	Death	Gave up treatment	Transferred to other place	No of leprosy patients reported at the end of this year	No of leprosy are treating	Males	females	0-14	15+	Usually	Unusually	Unknown	Grade 0	Grade I	Grade II	Needed care of disability	Leprosy reaction II	Leprosy reaction I	Continue treating	Completed MDT	Continue surveillance	Relapse in surveillance	Disability after surveillance	Unknown
PB																											
MB																											
Total																											

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