TREND ANALYSIS OF TUBERCULOSIS INCIDENCE IN NEPAL DURING 1996 - 2003

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TREND ANALYSIS OF TUBERCULOSIS INCIDENCE IN NEPAL DURING 1996 – 2003.

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ABSTRACT

A descriptive study was conducted to describe the ongoing pattern and trend of TB incidence in Nepal during 1996-2003, regarding person, place, and time. The study was conducted using secondary sources of information obtained from regular TB surveillance data collected during 1996-2003. Compared with the expected incidence rate during this period, the epidemiological situation of tuberculosis in Nepal was a major public health problem. The overall trend of tuberculosis incidence rate in Nepal was decreasing per year by an amount 0.81/100,000.

The sex ratio for the incidence rate of new pulmonary positive TB cases was equal to 2:1. The trend of incidence rate of pulmonary positive TB showed that males had a more steadily increasing rate than females. Sex ratio of age specific incidence rate for the pulmonary positive TB was almost similar to the age group 0-14, with the highest ratio for the age group 55-64 years old. Considering types of TB, the reporting ratio of males and females for extra pulmonary and standard chemotherapy cases were the same, while the highest was found among re-treatment cases. The reported incidence rate of pulmonary and extra pulmonary tuberculosis cases was almost 6.2:1. Different incidence rate was reported in different seasons during this period. The standardized incident rate showed that the highest incidence rate was reported from the regions of CDR followed by MWDR, WDR, EDR and FWDR with ratios equal to 1.6:1.2:1.3:1.4:1 respectively. A high incidence rate was reported from flat (Terai) ecological zones followed by hilly and mountainous ecological zones with ratio equal to 3.1:2.07:1.

The resources should be allocated according to the burden of TB, considering person, place, and time. TB health education priority should be given to females and productive age groups of both sex. The community mobilization of people and the TB patients living in flat and hilly ecological zones should be of higher priority than the people living in a mountainous ecological zone. Awareness for the protective behavior for TB has to be proposed during the summer season followed by rainy and winter seasons, focusing on CDR followed by MWDR, FWDR, WDR and EDR.

KEY WORDS: TREND ANALYSIS, INCIDENCE, TUBERCULOSIS

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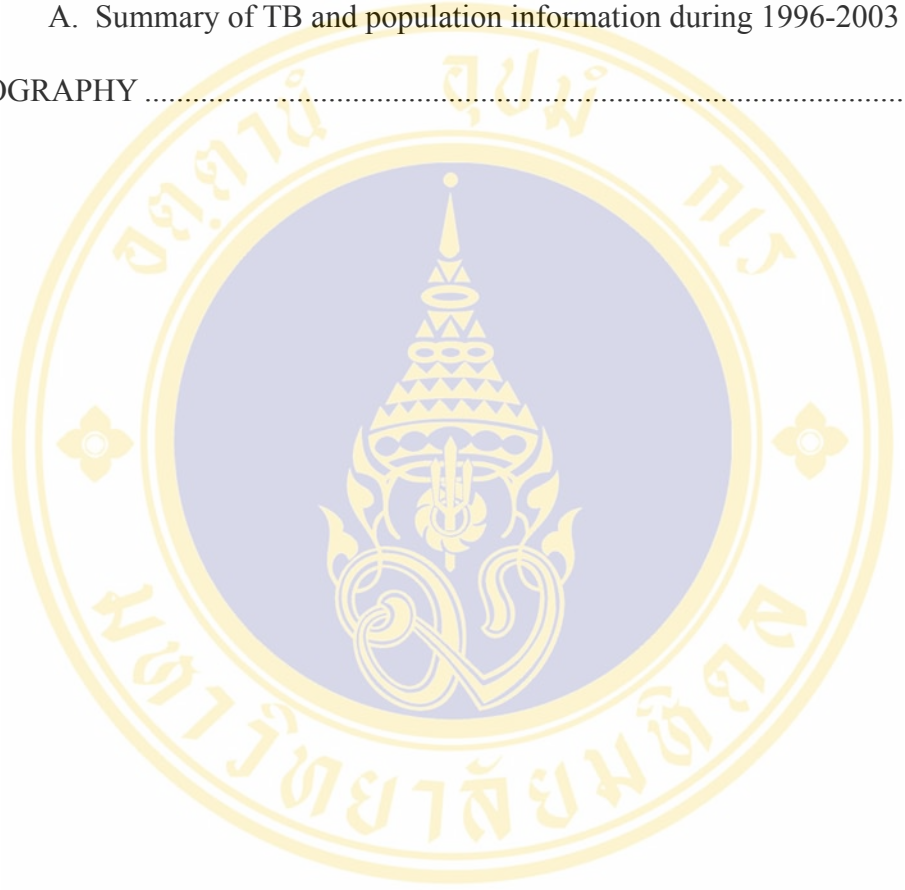

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LIST OF ABBREVIATIONS

TB	:	Tuberculosis
NTC	:	National Tuberculosis Center
NTP	:	National TB control Programme
DOT	:	Directly observed treatment
DOTS	:	Directly observed treatment short course
HIV	:	Human immune deficiency virus
AIDS	:	Acquired immune deficiency syndrome
ARTI	:	Annual risk of TB infection
BCG	:	Bacillus calmette Guerin
AFB	:	Acid fast bacilli
RTC	:	Regional TB center
RHD	:	Regional health directed office
RTLA	:	Regional tuberculosis and leprosy assistant
DTLA	:	District tuberculosis and leprosy assistant
DOHs	:	Department of Heath services
CBS	:	Central Bureau of Statistics
EP	:	Extra pulmonary
NS+ve	:	New smear positive
NS-ve	:	New smear negative
RIT	:	Research institute of Tuberculosis
EDR	:	East Development Region
CDR	:	Central Development Region
WDR	:	West Development Region
MWDR	:	:Mid-West Development Regions
FWDR	:	:Far-West Development Region
IUATLD:		International union against tuberculosis and lungs disease

CHAPTER I
INTRODUCTION

1.1 Rationale and Justification

Tuberculosis (TB) is an infectious disease which spreads through air. When TB patients cough, sneeze and spit, the TB bacilli escapes into the environment. A healthy person inhales those bacilli which are infectious and later develop into TB disease. One untreated TB patient infects 10-15 persons per year. It is an opportunistic disease, which severly infect the people when the immunity is low. Around 60% of HIV/AIDS patients in the world die due to TB. Therefore there is a holy alliance between TB and HIV/AIDS. Tuberculosis is one of the ten leading cause of death in the world (1).

TB is a curable disease and directly observed treatment short courses (DOTS) is the best strategy to treat the patients. DOTS is the most cost effective strategy to cure TB patients since 1993(2). The DOTS ensures the patients to have full course of anti TB drugs under the supervision of health workers, family members and community workers (3).

The severity of TB has been realizing globally. One third of global population i.e. two billion people are infected with mycobacterium tuberculae and are at risk of developing the disease. More than eight million people develop active tuberculosis every year, and about two million die every year (4).

More than 90% of global TB cases and deaths occur in the developing world, where 75% of cases are in the most economically productive age group (15-54 years old). An adult infected with TB loses on average three to four months of work times. The result in the loss of 20-30% of annual household income and, if the patient's dies of TB, an average of 15 years lost of income (5). In addition, to the devastating

economics costs, TB imposes indirect negative consequences-children leave school because of their parents' tuberculosis, and women are abundant by their families as a result of their disease.

Co-infection with the human immune-deficiency virus (HIV) significantly increases the risk of developing TB (6). Countries with a high prevalence of HIV, particularly those in Sub-Saharan Africa, have witnessed a profound increase in the number of TB cases, with reported incidence rate increasing two-to three-folds in the 1990s (7). At the same time, multi-drug resistance TB, which is caused by poorly managed TB treatment, is a growing problem of serious concern in many countries around the world (8).

According to the World Health Organization (WHO), the 22 highest TB burden countries are mostly in Asia and Africa (9). They are Cambodia, Vietnam, Indonesia, Philippine, Thailand, China, India, Bangladesh, Pakistan, and Afghanistan. In most of the TB burden countries, high deviation between estimated cases and notified cases are seen significantly. In the high TB burden countries, the estimated TB incidence (calculated by using Annual Risk of TB Infection) varies from 107/100,000 in China to 572/100,000 in Cambodia whereas the notification rate varies from 8/100,000 in Pakistan to 172/100,000 in Philippines (9). It is estimated that in 2003, Nepal has calculated its estimated incidence 186/100,000 whereas notified rate are 129/ 100,000 per year (10). Table 1 shows the estimated incidence rate, notification incidence rate, case finding, and treatment success rate among the high TB burden countries (6).

The gap between estimated rate and notification rate shows the TB program and management are poor in Asia. To overcome this situation, there must be an effective evaluation and intervention of the TB control program. Thus TB managers in Asia must be serious to combat the existing TB problem in terms of person, place, and time which gives the good information for plan and policy formulation for fighting against the TB jointly in Asia. So it is strongly advisable for high TB burden countries to do trend analysis to find out the real problem in terms of person, place, and time characteristics.

Table 1 Estimation and notification status of high TB burden countries,2000

Country	Population (1000s)	Estimated incidence rate/100,000 per year (all cases)	Notification incidence rate/100,000 per year (all cases)	Nss+ cases detection rate (%)	Treatment success rate (%)
1 India	1,008,937	184	111	42	82
2 China	1,275,133	107	36	36	96
3 Indonesia	212,092	280	32	19	50
4 Nigeria	113,862	305	23	12	75
5 Bangladesh	137,439	242	55	26	81
6 Ethiopia	62,908	397	145	29	76
7 Philippines	75,653	330	170	60	87
8 Pakistan	141,256	175	7.6	3	70
9. South Africa	43,309	526	257	84	60
10 Russia	145,491	132	95	30	65
11 Congo	50,948	320	119	51	69
12 Vietnam	78,137	189	115	80	92
13 Kenya	30,669	484	209	47	78
14 Tanzania	35,119	359	155	45	78
15 Brazil	170,406	68	47	79	11
16 Thailand	62,806	140	54	46	77
17 Uganda	23,300	351	130	50	61
18 Myanmar	47,749	168	65	48	81
19 Mozambique	18,292	433	116	40	71
20 Cambodia	13,104	572	144	44	93
21 Zimbabwe	12,627	584	411	52	73
22 Afghanistan	21,765	321	33	9.2	87
* Nepal	245,546	186	129	70	89

*: Nepal is not under high TB burden countries
Source: World Health Organization, Global Tuberculosis Report, 2002.
Nss+=New smear sputum positive cases

Tuberculosis is a major public health problem in Nepal. In 1993, WHO decided TB as a global emergency. In 1994, His Majesty's Government of Nepal and WHO had evaluated jointly TB Programme and found that case finding rate and treatment success rate were about 40% and 48% which was very low compare to the National target 70% and 85% respectively (10). Then His Majesty's Government of Nepal had decided TB as a national priority program and started a new strategy of TB Directly Observed Treatment Short Course (DOTS). DOTS has been successfully implemented throughout the country since April 2001 two years prior to the planned periods. Now, the DOTS have been implemented as a nationwide programme (10, 11). Table 2 shows the major TB indicators between 1996 and 2003.

Table 2 Comparison of major TB indicators between 1996 and 2003

Indicators	1996	2003
Case finding(%)	46	70
Treatment success rate(%)	48	89
Sputum conversion rate(%)	NA	84
DOTS population coverage(%)	1.7	90
Quality control agreement rate(%)	NA	95
Expected death (Numbers/ year)	150,00-17,000	6,000-8,000
Estimated incidence(/100,000 /year)	214	186
Notified rate(/100,000 /year)	136	129
Total annual TB cases (Number)	28,314	31,637

Sources: Annual report of National Tuberculosis Programme, 2003

According to the TB indicators, Nepal has high achievements during a short period of time comparing between two periods. After achieving the target given by WHO, it is necessary to know the actual impact of those indicators on people as well as TB control program. Therefore, this study focuses on to describe and analyze the trend of TB epidemiological data according to the person, place, and time during the period 1996 to 2003.

Therefore, the incidence of TB is a useful epidemiological index for measuring the magnitude of TB problem in terms of person, place, and time by providing valuable information on the extent of the TB problem and its trend. By this reason, it is expected that this study would be helpful in understanding the ongoing pattern of tuberculosis in Nepal.

Why trend analysis of incidence is necessary?

It is a common customary in public health to have long tradition of monitoring trend in rates of disease of all kinds. The trend analysis is generally used in national data with long period. It gives overall trend of diseases increasing or decreasing pattern whereas it doesn't care the increase or decrease in each year (12).

In trend analysis data are presented in tables and graphs, and comparison will be made by using appropriate statistical tools according to the nature and characteristics of data. Examination of data over time also permits making future frequencies and rate of disease occurrences during this period (12).

The health outcome in a population can be fully understood if their frequency and distribution of a disease is examined regarding person, place, and time. Generally, trend analysis is used for public health surveillance and monitoring, for forecasting disease, for program evaluation, for policy analysis, and for etiological analysis (12). It will also try to find out whole TB situation of the country so that it will help for policy level to plan for effective resource allocation to combat TB appropriately.

It is necessary to know the whole picture of tuberculosis situation of the country regarding person, place, and time. So far, number of TB cases have not yet been declined after achieving the target set by WHO. National tuberculosis control program implemented under DOTS in 1996 covering 1.7% population while in 2003, it was around 90 % (13). Regarding other indicators like case finding rate, sputum conversion rate, treatment success rate, overall quality control agreement rate is respectively 70%, 84%, 89%, 95%. The estimated death rate decreases from 15,000-

17,000 to 6,000-8000 in 2003 (13). The gap between notification and estimation rate is low to compare with other high burden countries from Table 1. But TB cases in Nepal are still increasing year by year. It is necessary to know the whole picture of tuberculosis situation of the country to realize the actual situation of TB in Nepal. The study focuses on person, place, and time characteristics so that in future it would be easy to combat TB in Nepal.

1.2 Research Questions

- What is the pattern of TB incidence rate in Nepal by sex, age groups and types of TB during 1996 to 2003?
- How the TB incidence is distributed in development regions and ecological zones?
- Is their any seasonal influence on TB incidence and change in TB incidence year by year during this period?

1.3 Research objectives

1.3.1 General objective

To describe and analyze the trend of TB epidemiological data according to person, place, and time characteristics.

1.3.2 Specific objectives

1. To describe and compare the TB incidence rate by sex and age-groups and types of TB.
2. To describe and compare the TB incidence rate by development regions and ecological zones.
3. To describe and compare the TB incidence rate by calendar years and seasons.

1.4 Scope of the study

The study considered exploring the TB situation and analyzing in terms of the person, place and time characteristics in Nepal during 1996 to 2003.

1 . This study will help for planning resources allocation.

2 . The study evaluate the overall situation of TB program and at the same time it will also indicate the existing weakness of the TB control programme so that they could be overcome in future.

3 . It will also give the relationship of the TB data among the registration categories.

4 . It will help to identify area for further research.

5 . The result obtained from this study is helpful as a baseline information for program implementation in TB.

1.5 Limitation of the study

The study conducted using regular TB surveillance information and population, which lead to the following limitations.

1. TB information was limited in terms of person, place, and time due to secondary sources of data.

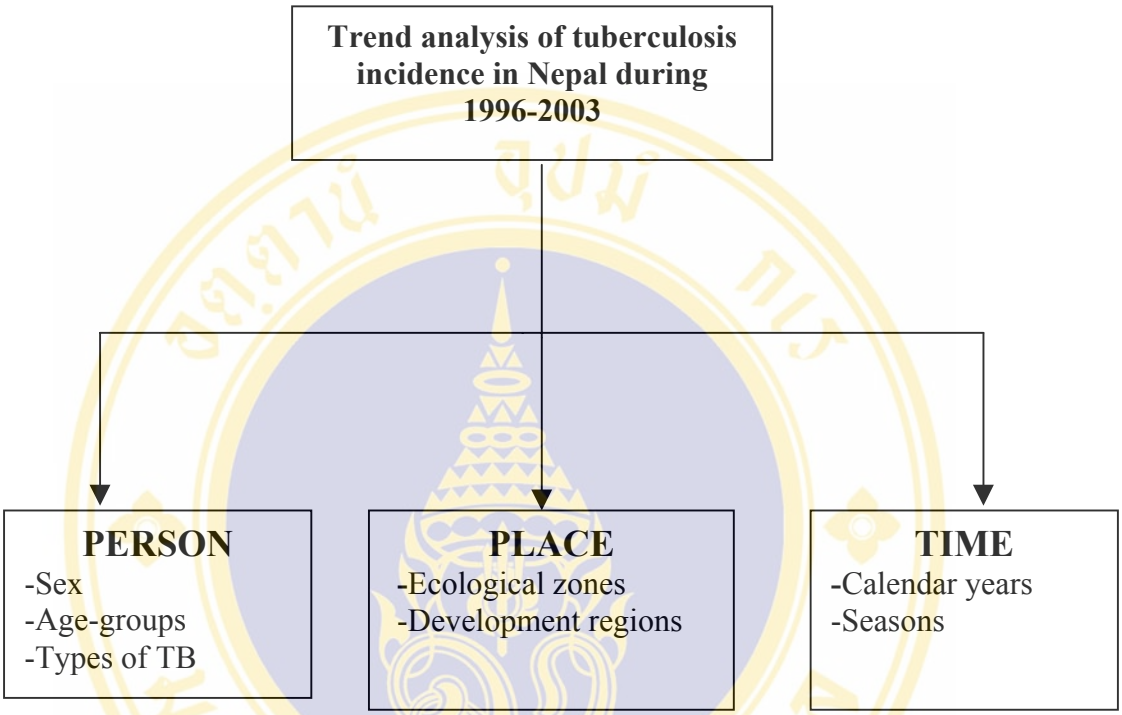
2. The projected populations were taken to calculate incidence rate through out the study, which might be slightly higher than the census population in 2001, this may lead to lower estimation of the incidence rate.

3. For calculating incidence rate by seasons, average year populations were taken as the denominator.

4. It is very difficult to distinct ecological zones, seasonal months.

5. Recording and reporting system are poor in private sector, but patients are being treated which may lead to the underestimation of the incidence rate.

1.6 Conceptual frame work



1.7 Operational definition

Tuberculosis (TB)

Tuberculosis is an infectious disease caused by a type of bacteria. Mycobacterium tuberculosis is the commonest bacteria causing tuberculosis in people. Mycobacterium is also called acid fast bacilli (AFB). Tuberculosis usually affects the lungs, but it can occur in other parts of the body as well.

Pulmonary tuberculosis (PTB)

It is the TB of respiratory system principally of the lungs. Pulmonary tuberculosis can be diagnosed by sputum smear microscopy. Pulmonary TB is also further divided into two categories as a pulmonary positive and a pulmonary negative tuberculosis.

Extra-pulmonary tuberculosis (EPTB)

It refers to tuberculosis of organ other than the lungs, e.g. pleura, lymph node, abdomen, skin, joints and bones, meanings. Diagnosis should be based on one culture positive specimen, or histological or strong clinical evidence consistent with active EPTB, followed by a decision by a clinician to treat with a full course of tuberculosis chemotherapy. The case definition of an extra pulmonary TB case with several sites affected depends on the site representing the most severe form of disease.

Re-treatment tuberculosis cases

Patients previously treated for tuberculosis and now coming for treatment again like relapse (R), return after defaulter (RAD), and treatment failure (F) during treatment (1).

Incident rate

TB incidence rate indicates the number of new cases of TB, which develop within a specific period of time, usually one year. It is usually expressed as a rate per 100,000 general population. Incidence rate shows the notification of TB is increasing or decreasing during specific period of time period.

Incident rate (IR) = No. of new TB cases occurred during a specific period of time/Total population at risk at the same period of time (16).

Trend analysis

The trend analysis gives an overall trend pattern of disease increasing or decreasing whereas it doesn't care the increase or decrease each year. It is generally used in the national data with longitudinal period of study. The trend analysis of TB data are presented in tables or graphs and according to the person, place and time characteristics. Examination of data over time also permits making future frequencies and rate of diseases occurrences in Nepal during 1996 to 2003.

The health outcome in a population can be fully understand if their frequency and distribution is examined in terms of person, place and time. Generally trend analysis is used for public health surveillance.

Age Groups

It refers to the age group of the patients according to the standard classification given by World Health Organization. The age groups are composed of 0-14, 15-24, 25-34, 35-44, 45-54, 55-64, 65 and over years old. The TB cases on respective age groups are recorded accordingly. It will be helpful to find out the risk factors of TB in each age group (10).

Ecological zones

Topographically, Nepal is divided into three distinct ecological zones. They are the mountain, hill, and terai (or plains) ecological zones (14,15).

Mountain ecological zone

The mountain zone ranges in altitude from 4,877 meters to 8,848 meters above sea level and covers a land area of 51,817 square kilometers. Because of the harsh terrain, transportation and communication facilities in this zone are limited and only about 7 percent of the total population live in this zone.

Hill ecological zone

The hill ecological zone, which ranges in altitude from 610 meters to 4,876 meters above sea level, is densely populated. About 44 percent of the total population of Nepal live in the hill ecological zone, which covers an area of 61,345 square kilometers. This zone also includes a number of fertile valleys such as the Kathmandu and Pokhara valleys. The terrain is also rugged in this zone and because of the higher concentration of people, transportation and communication facilities are much more developed there than in the mountains ecological zones.

Terai ecological zone

The terai zone is located in the southern part of the country. It can be regarded

as an extension of the relatively flat Gangetic plains. This area, which covers 34,019 square kilometers, is the most fertile part of the country. Although it constitutes only about 23 percent of the total land area in Nepal, 49 percent of the population lives there. Because of its relatively flat terrain, transportation and communication facilities are much more developed in this zone than in the mountain and hill ecological zones of the country, and this has attracted newly emerging industries.

Development Regions

For administrative purposes, Nepal has been divided into five developmental regions with same geographical setting. They are Eastern Development Regions (EDR), Central Development Region (CDR), Western Development Region (WDR), Mid-Western Development Region (MWDR), and Far-Western Development Region (FWDR).

Seasons

In Nepal, climatic conditions are varied vary substantially by altitude. In the terai , temperature can go up to 44° C in the summer and fall down to 5° C in the winter. In summer, corresponding temperatures for the hill and mountain zones are 41° C and 30° C respectively while the temperatures fall down up to 3° C and far below 0° C in these two areas during winter season. Rainy season starts from 15 of July to 15 of October, 4 months while winter and summer start from 15 of October to 15 of February and 15 of February to 15 of July. The annual mean rainfall in the kingdom is about 1,500mm(17).

CHAPTER II
LITERATURE REVIEW

2.1 Epidemeology of tuberculosis

2.1.1 Definition of tuberculosis (TB)

Tuberculosis (TB) is an infectious disease caused by a type of becteria. Mycobacterium tuberculosis is the commonest bacteria causing tuberculosis in people. Rrobert Koch announced the discovery of tubercle bacillus and published on an article entitled "Etiology of TB". The disease usually infects in the lungs, although in one third of cases other organs are involved, except nail and hair. Poorly manage TB treatment increases multi-drug resistant tuberculosis whereas co-infection with the human immune-defeciency virus significantly increase the risk of developing TB (1).

2.1.2 How does tuberculosis spread ?

The bacteria that cause tuberculosis spread from lungs of people with TB when they cough, sneeze or spit. Another person inhales those bacteria, which invade the lungs. Macrophages surround and take up the bacteria. More immunce cells try to kill the becteria and cause an area of local inflammation in the lung. A small proportion (5-10%) of infected patients may develop active clinical illness months to years later when the bacteria begin to replicate and cause symptoms. The bacteria may also spread to hilar lymph glands, causing enlargement. The combination of primary focus and the effeced lymph nodes is called a primary complex. Not everyone who is infected with the becteria gets TB, only 10% of people are infected by the TB. If the infected person has good immunity, disease may never occur. If their immunity is weak (eg in malnutrition, HIV infection) then TB can develop soon after infection (1,18).

2.1.3 Patterns of infectious disease occurrence (19)

The concepts of interaction of agent, host, and environment are the key factors in finding practical and effective prevention and control of tuberculosis.

Host

In an infectious disease epidemiology, it was mainly considering human as a host for the infectious agents. Several intrinsic host factors are influencing exposure, susceptibility or response of the host to agents: like age groups, sex, seasons, geographical areas, race, religions, ethnicity, nutritional status, life style, immunology status, etc.

Environment

Physical environment like crowding, sanitation, seasons, availability of health services, biological environment like population density, socioeconomic environment like occupation, survival environment of infectious agents are the important determinants for transmission of tuberculosis.

Infectious agents

A wide variety of infectious agents can produce disease in man Mycobacterium tuberculosis is notorious for its infectivity but pathogenicity depends upon those factors as descried earlier.

The agent, host and environment factors interrelate in a variety of complex ways to produce disease in humans. Their balance and interactions are different for different diseases.

2.1.4 Clinical signs and symptoms of tuberculosis

Tuberculosis can be diagnosed according to the signs and symptoms as follows:

a. A patient has a chronic cough for more than 2 weeks

b. Blood in the sputum may vary from a few spots to a sudden coughing of a large amount of blood.

c. Breathlessness in tuberculosis is due to extensive disease in the lungs or pleural effusion. The breathless patients frequently appear ill, loose weight and may have fever in the afternoon.

d. Chest pain is a common symptom found in tuberculosis. Sometimes it is just a dull ache or muscle strain from coughing.

e. Occasionally, the patients may seem to develop some acute pneumonia but they could not recover after antibiotic was given (1).

2.1.5 Treatment of tuberculosis

According to the World Health Organisatoin (WHO), the standarised regimens for curing TB patient consists of followings mediciens such as Isoniazide (INH), Rifampin(R), Pyrazinamide (PZA), Ethambutal (E), and Streptomycin (S) with duration of 8 months treatment. Standard regimens for treatment of the TB patients have four categories as follows (1):

Table 3 Recommended treatment regims for each diogonostic category

TB category	TB patients	TB treatment regimes	
		Initial phase	contineous phase
I	New smear positive New smear negative (severe) Severe form of extra pulmonary (EPTB) and severe concomitant HIV disease	2HRZE	6HE (daily)
II	Previously treated sputum smear-positive pulmonary (PTB) : Relapse Treatment after falure Treatment failure (during treatment perood)	2SHRZE/1HRZE	6 H R E (daily)
III	New smear-negative PTB (other than category I) Less severe form of EPTB	2HRZE	6HE (daily)
IV	Chronic and MDR-TB cases (still sputum-positive after supervised re-treatment)	INH alone or others	INH alone or others

Source: Treatment of tuberculosis, Guideline for national programme,WHO:2003

2.1.6 Descriptive epidemiology of tuberculosis

The health outcomes of population is fully understood if the frequency of occurrence and distribution of disease is exmamined in terms of person, place, and time (12).

Person

Epidemiology is concerned with the distribution and determinant of disease frequency in human populations. Infectious disease does not occur at random. In other words, not all persons within population are equally likely to develop diseases. Certain persons are at comparatevely higher risk by virtue of their personal characteristics and environmental charecteristics. Also variations of disease occurrence is mostly with respect to the personal characteristics like age groups, race, gender, etc. Tuberculosis is a disease that is associated with poor socio-economic disadvantage. The combination of crowded housing and poor nutrition contributes to the high risk of tuberculosis among the poor. The distribution of tuberculosis by gender is also different everywhere. The incidence of TB is twice as high among males m as compared to females. The higher occurrence of TB among males probably relate to gender difference in certain high risk behavior. It is found in United State during 1989 that the age group 25 to 44 were the highest risk group for tuberculosis, whereas by gender it was found that incidence of tuberculosis is twice as high among males as compared to females. The higher occurrence of tuberculosis among males probably related to gender differences in certain high-risk behavior (eg, heavy alcohol consumption), as well as predisposing disease (eg, HIV/AIDS (19).

The diagram below shows the schematic representation of the standard dimensions used to characterized disease occurence (19).

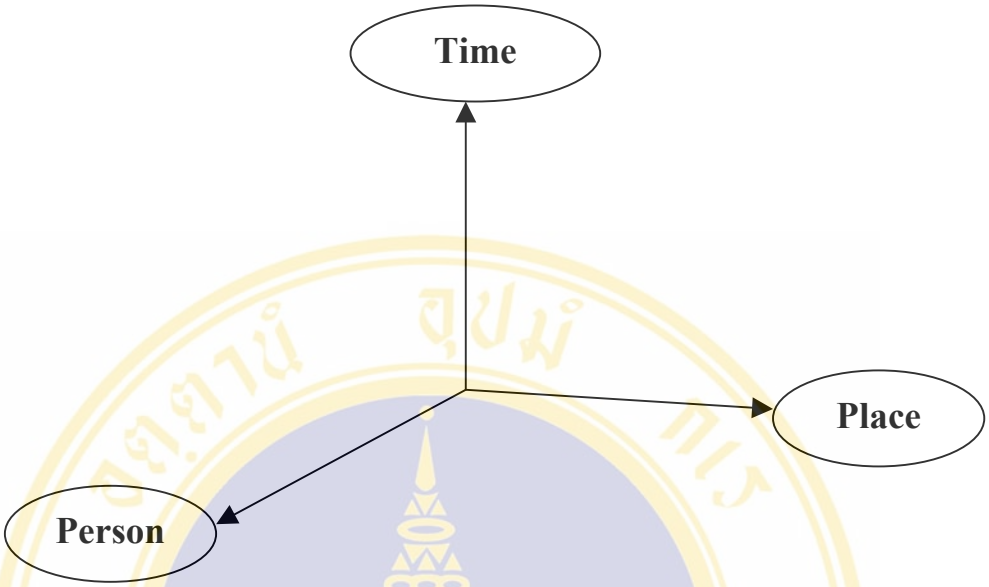


Figure1: Schematic repesenation of the standard dimensions used to characterize disease occurrence
Source: Medical Epidemiology, Raymond S. Greenberg

Place

Variation of places of occurrence of a disease can be occurrence and evaluated at national level (eg, across the countries), at the regional level (eg, across regions) or at local levels (eg, across the comunities). In this study national and regional are selected to explain the pattern of disease occurrence by place. Certain countries, particularly those in the non-industrialized countries have comparatively high rates of tuberculosis. The high rate of tuberculosis in the non-industrialized countries is attributed to poverty and low access to health services. Especially, in Sub-Shaharan Africa, the high prevalence of TB infection was associated with human immune-deficiency virus (HIV).

Due to HIV, even in an industrilized country, tuberculosis cases vary according to the development areas and geographical areas. Also the perdesposing conditions such as intravenous drug and infection with HIV plays greater role for tuberculosis infection even in geographical zones and development areas. In United States, comparatively low rate was found in the West, North, Central and mountain

regions (19) and the highest rate occured in the district of Columbia and New York State (7).

Time

The overall incidence of TB varies between year to year and also for different seasons. It is found in United States that during the first part of the 1980s, a consistant downward trend was observed, continuing a pattern that began many decades earlier. After 1984, however, the incidence of this disease remained fairly constant. Another way to visualize this pattern is to compare the percentage change of incidence between the first and last years of 3 year time interval. Between 1981 and 1983, the incidence of tuberculosis fell by almost 15%. The decrease was less than 9% between 1983 and 1985 and less than 1% between 1985 and 1987. Between 1987 and 1989, the incidence increased by more than two percent.

When percentage changed in all reported cases of tuberculosis, and the number of reported cases fell down during this period except for the age group 25-44 years old. The pattern substantially raised in reported cases in that age groups was due to the HIV infection among that age group.

Several observations to support the speculation that HIV influenced the observed trend in tuberculosis incidence.

1. AIDS emerged at about the same time as the declination of tuberculosis.
2. The age group most affected by AIDS also have experienced an increasing in tuberculosis incidence.
3. The immune dysfunction association with HIV infection facilitiates progression from latent to clinically active tuberculosis.
4. The incidence of both AIDS and tuberculosis has increased considerably among different ethinic groups as well as among the different areas.
5. Clinical studies have revealed that a high proportion of persons infected with HIV have a history of tuberculosis, and conversely, a high proportion of tuberculosis patients in certain population are seropositive for HIV (19).

The actual impact of HIV infection on the trend of tuberculosis morbidity is uncertain, because individual tuberculosis case report forms did not include information on HIV status. However, it appears resonable to conclude that the recent trend in the incidence of tuberculosis has been influenced substainly by HIV.

2.2 Brief history of tuberculosis

Tuberculosis is a communicable disease. It spreads through air. When infected TB patients cough, sneeze, and split it comes into the environment known as TB bacilli and a healthy person inhales those bacilli are to be infected and latter develop diseases called TB. Treatment of TB is the cornerstone of any National Tuberculosis Control Programme. The modern treatment strategy is based on standard short-course chemotherapy regimens. The best prevention of TB is therefore the cure of infectious TB cases. The World Bank recognizes the DOTS strategy as one of the most cost-effective health interventions, and recommends that effective TB treatment be a part of the essential clinical service package available in Primary Health Care (1). Governments are responsible for ensuring the provision of effective TB control through the DOTS strategy. In DOTS strategy, the health system is responsible for facilitating access to treatment and ensuring drug intake.

One untreated pulmonary positive TB patients will infect 10 to 15 persons every year. All infected TB patients not necessarily develop TB as well. If the immune system is weaken, the chance of getting TB infection are very high. Some research study showed TB and HIV/AIDS are holy allies. Lesser the immune system of human body greater will be the chance of developing TB infection. These days this is the serious concern of public health persons where the high prevalence of HIV/AIDS. The trend analysis of TB incidence gives some idea about TB situation and relationship between TB and HIV/AIDS.

Multi drug resistance TB (MDR-TB) is also coming due to poorly managed TB cases is also serious concern for people working in TB Programme. Drug-resistant TB is caused by inconsistent or partial treatment, when patients do not take

all their drugs regularly for required period because they start to feel better. Doctors and health workers prescribe the wrong treatment regimes or the drug supply is unreliable. Particularly dangerous form of drug-resistant TB is the multi drug-resistant TB (MDR-TB), which is defined as the disease due to bacilli resistant to at least Isoniazide and rifampicin the two most powerful anti-TB drugs. Rates of MDR-TB are higher in some countries, especially in the former Soviet Union, and threaten TB control efforts.

From public health perspective, poorly supervised or incomplete treatment of TB is worsening than no treatment at all. When people fail to complete standard treatment regimens, or are given the wrong treatment regimens, they may remain infectious. The bacilli in their lungs may develop resistance to anti-TB drugs. People whom they infect would have the same drug-resistant strain. While drug-resistant TB is treatable, it requires extensive chemotherapy that is often expensive and is also more toxic to patient's (9).

Tuberculosis probably appeared almost at the same time with humanity and recognized as a killer disease since Ice Age. Traces of TB lesions have been found in lungs of 3000 years old Egyptian mummies. In 460 BC, Greek physician Hippocrates "the father of Medicine" described the disease. In the age of Ancient Greece and Roman Empire, tuberculosis began to be recognized by Aristotle and Galen as a disease transmitted from man to animal. Frascatorius (1483-1553) of middle age predicted that TB might be spread in human beings by airborne living particles that he called "conlagium vivium".

Unlike the late half of the 17th century, research after research gradually brought the secret of TB into light. In 1679, exact Patho-anatomical picture of TB lesions was identified by Dutchman F. Sylvivs. He used the term "tubercle" to describe the knobby lesions found in the lungs of the people who died of the wasting diseases. The introduction of Sanitoriom since 1854 by H. Brehmer, a Silesian botanist, was considered as the best way of treatment popular until the early 1960s. It aimed at strengthening the body's self-defense against devastating capacity of the

disease by enforced rest and adequate nutrition. The name Tuberculosis seems first to have been used in 1939,by Johanna Schonlein.

In 1882 a German physician Robert Koch announced the discovery of tubercle bacillus and published on article entitle "Etiology of TB". Within eight years he was able to make an extract of dead bacilli to farm tuberculin, which could then be used as a diagnostic test for tuberculosis infection.

Today, TB is known as infection often of lifelong duration, caused by two species of Mycobacteria, Mycobacterium tuberculosis, and Mycobacterium Bovis. It can result in disease in virtually every organ in the body, most prominently the lungs.

TB was not a major problem, however until the crowded urban living conditions of the early industrial revolution created epidemiology circumstances favoring its spread. In the seventeenth and eighteenth centuries, TB caused one fourth of adult deaths in Europe. Before the availability as anti-microbial drugs, the cornerstone of treatment was rest in the open air in specialized Sanatoria, often in mountain areas.

The important development in TB was contributed by two French scientists Calmettee and Guerin when they abstained a living attenuated bovine tubercle bacilli after a long time of transfer culture in a special medium. This artificially special strain of tubercle bacilli has been named BCG (Bacille de Calmette et Guerin) and now a days is used as the vaccine for the Expanded Programme on Immunization (EPI) to prevent tuberculosis in children.

The modern era of TB began in 1944 with the demonstration of streptomycin followed by anti-TB drugs appeared Ionized in 1952, Rifampicin in 1965. Since then, modern chemotherapy drugs combination started in 1949 to prevent drug resistant. Out patients based ambulatory treatment insisted to start of inpatient based sanitarium treatment 1956, followed by intermittent regimens for daily use.

The latest era of TB control starts from 1977 after the success of SCC trail in Tanzania by Karel Styblo. Since then after SCC with new package TB program known as DOTS is the most effective intervention of TB control in the world.

2.3 Global situation of TB epidemic

Nearly one third of the global population i.e. two billion people is infected with Mycobacterium tuberculosis and at risk of developing disease. More than eight million people develop active tuberculosis (TB) every year, and about two million dies. More than 90% of global TB cases and deaths occur in the developing world, where 75% of cases are in the most economically productive age group (15-54 years old). There, an adult with TB looses on average three to four months of work time. This results in the loss of 20-30% of annual household income and, if the patient dies of TB, an average of 15 years of lost income. In addition to the devastating economy costs, TB imposes indirect negative consequences-children leave school because of their parents' tuberculosis, and women are abandoned by their families as a result of the disease.

Confection with human immunodeficiency virus (HIV) significantly increases the risk of developing TB. Countries with a high prevalence of HIV, particularly in Sub-Saharan African region, have witnessed a profound increase in the number of TB cases, with reported incidence rate increasing two to threefold in the 1990s. At the same time, multi drug resistance, which is caused by poorly managed TB treatment, is a growing problem of serious concern in many countries around the world.

2.4 Epidemiology of TB in Nepal

2.4.1 Tuberculosis situation in Nepal

Tuberculosis is one of the major public health problems in Nepal. About 45% of the total population is infected with TB, out of which 60% are in the productive age group. Every year, 44,000 people develop active TB, of whom 20,000

have infectious pulmonary disease. These 20,000 are able to spread the disease to others. Directly Observed Treatment Short course (DOTS) strategy has been implemented since 1996 and has already reduced the numbers of deaths, however 6,000-7,000 people continue to die every year from this disease. Expansion of this cost effective and highly successful treatment strategy of DOTS, which already has proven its efficacy in Nepal, will have a profound impact on mortality and morbidity. By achieving the global targets of diagnosing 70% of new infectious cases and curing 85% of these patients we will save up to 50,000 deaths over the next five years. High cure rates will reduce the transmission of TB and lead to a decline in the incidence of this disease, which will ultimately help us to achieve our objectives of TB control(10)

DOTS has been successfully implemented throughout the country by April 2001. The NTP has coordinated with the private sector, local government bodies, NGOs, social workers and other sectors of society in order to expand DOTS and sustain the present significant results achieved by NTP. By July 2002 DOTS had been expanded to 273 treatment centres with 909 sub-centres all over the country with 89% of population coverage by DOTS. The treatment success rate in DOTS is now around 89%. Nationally, this year 33,158 TB patients have been registered and are being treated under the NTP (10).

2.4.2 National TB Control Programme

Organization

The National Tuberculosis Programme (NTP) is an integrated approach within the national general health system to control TB. It has policies, plans and activities to achieve good case finding and treatment of tuberculosis patients. The NTP is countrywide, continuous, permanent and integrated with the general health services. It must be relevant to the needs of the population and accessible to the people (22).

The National Tuberculosis Centre (NTC) is the focal point of the NTP. The Director of the NTC manages the NTP. Staff of the NTC provides technical support to

TB control activities at the national, regional, district, health post and sub health post level, as well as running the busy referral clinic and laboratory at the NTC. Technical support in the areas of implementation of DOTS, planning, monitoring, programming, training, supervision, logistics, laboratory services, health information education and communication, and research related to tuberculosis control is provided by the staff of the NTC (10).

At the regional level, all the NTP activities are planned and carried out within the region with the close cooperation and coordination of the Regional Health Services Directorate. The Regional Tuberculosis/Leprosy Assistants (RTLA) supports the Regional Health Services Directorate in managing TB control activities in the region.

The Regional Tuberculosis Centre (RTC) in Pokhara provides technical support to TB control activities in the Western Region under the guidance and close coordination with national tuberculosis center. The NTP activities like planning, supervision, training, monitoring, laboratory services, recording and reporting as well as implementation and expansion of DOTS are conducted by RTC with close cooperation and coordination of RHD in the western region.

At the district level, the district health office/ district public health office is responsible for the planning and implementing of the NTP activities within the district. A tuberculosis/leprosy assistant supports the District Health Officer in the management of TB control activities in the district.

Within the district, the basic unit of management for diagnosis and treatment of patients with tuberculosis is the district hospital and the primary health care center. Diagnostic and treatment services will not usually be provided lower than this level, though health posts may act as sub-center for supervision of patients on DOTS.

National estimates and procurement of anti-tuberculosis drugs continues to be the responsibility of the National Tuberculosis Centre. Drugs are distributed through

the Logistics Management Division of the Department of Health Services, and supporting I/NGOs to the regions and districts.

Several national and international NGOs are involved in TB control activities in Nepal. The Nepal Anti TB Association plays an important role in controlling TB.

Epidemeological survillance system of TB control in Nepal

The survellance system is regular sustem in TB control programme.Recording and reporting ystem is the part of the TB data servallance.The R/R system of the National tuberculosis Control Programme(NTP)is in with the WHO and International Union Tuberculosis and Lungs Diseases(IUATLD)guidelines and recommendations.The forms includes treatment cards,sputum request forms,laboratory registers,TB registers,quarterly reports on case findings and treatment outcomes,programme management and laboratory materials and drug order.There is system of regular assessment of quality control of smear microscopy with aprropriate feed back.

In every quarter(once in four months),DOTS centres and sub centres preapare the case finding,treatment outcome and programme management reports from the treatment cards and TB and laboratory registers and submit to distric during the district DOTS workshop.All the reports are varified in the workshop.

The District Tuberculosis and Leprosy Assistants(DTLA)collects all the information and cubmit to the region during the regional DTLA workshop.A presentation is made during the workshopand cross checking and matching the result of transferred cases by each DTLA of the respective districts.Cohert reports on case finding and treatment outcmes are preapered togathers with Regional tuberculosis and Leprosy Assistants(RTLA).

RTLAs in each regions take part with detail regional report of NTP in the National RTLAs workshop held in National TB centre in Kathmandu.They present the report for discussion in the workshop.Cross checking and matching the result of transferred cases withen the region is done by each RTLA.

The National Tuberculosis Centre collects,compiles, summarizes and analyzes the reports.All the reports are analysed and provedes feedback to regionas folled by districts.NTC submits the reports to Department of Health Services Division(DOHS) ,Ministry of Health(MOH),WHO,IUATLD and JICA.

This is the regular process held in once in every four months.The Reporting system of National Tuberculosis Control Programme are shown below.

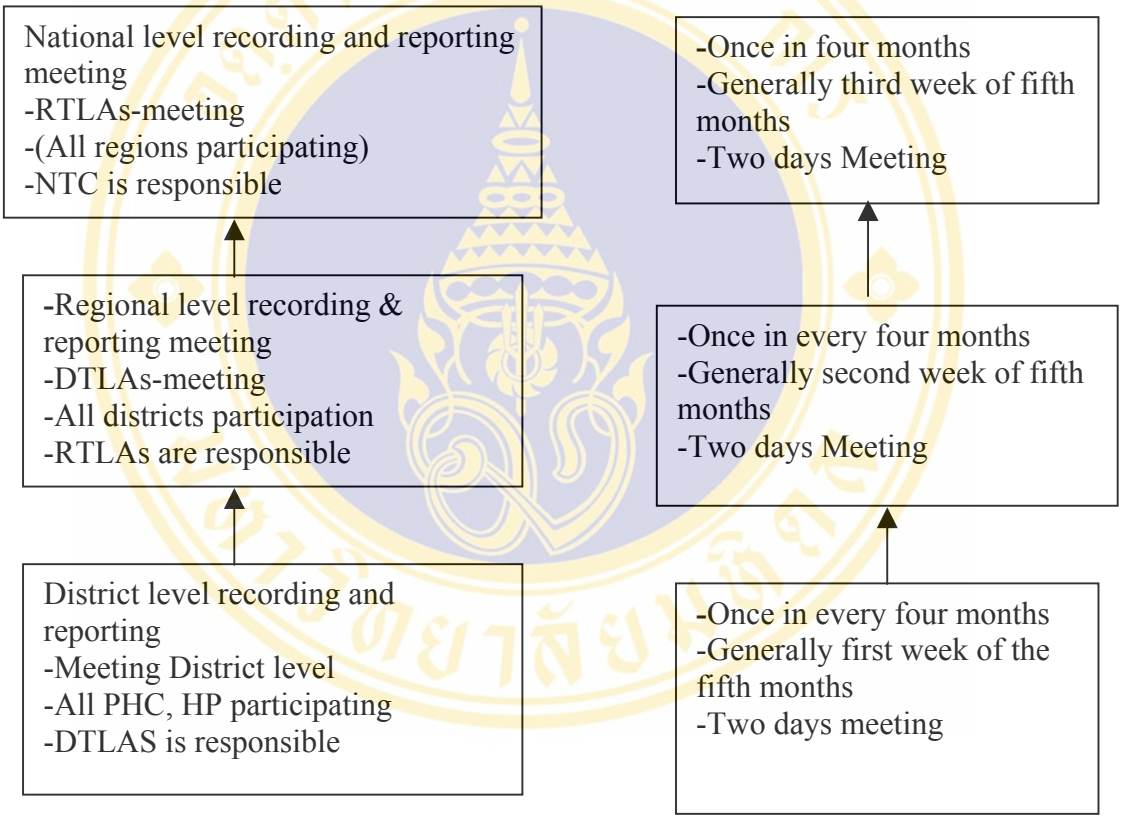


Figure 2: Reporting system of National Tuberculosis Control Programme

CHAPTER III
RESEARCH METHODOLOGY

3.1 Research design

This research was a descriptive study aimed to describe the disease occurrence, distribution, and trend of TB disease in a specified population regarding person, place, and time. The disease was measured and compared by using incidence rate. The frequency of disease occurrence was measured in terms of incidence and it reflects the number of new cases within a given period of time. For comparison of the disease in terms of person, place, and time, incidence rate was taken. The study explored the situation of TB problem, which is much useful as a baseline information to plan and formulate policy to combat TB control in Nepal. The TB data was collected from district TB register according to the person, place, and time to know the whole picture of TB in Nepal during the period 1996 to 2003.

3.2 Study units

In this study, the study units were different according to the person, place, and time. TB situation classified by person characteristics composed of sex, age groups, and types of TB. Whereas the place characteristics composed of development regions, ecological zones, and the time characteristic seasons and years were taken into account. All the tuberculosis cases registered in the National Tuberculosis Control Program in Nepal during 1996 to 2003 were the study population.

3.3 Study population and study area

The total population and TB cases from 1996 to 2003 were the study population in this study. The population data were taken from the Ministry of Population and Environment and Central Bureau of Statistics (CBS), Thaphthali,

Kathmandu where as TB data were taken from the District and Regional Health Offices as well as the National TB Center, Thimi, Bhaktapur. District tuberculosis and leprosy assistant (DTLA) and regional tuberculosis and leprosy assistant (RTLA) was the key persons for recording and reporting of TB data at the district and region respectively.

Study Place

Nepal has five development regions. The regions are composed of The Eastern Development Region (16 districts), Central Development Region (16 districts), Western Development Region (15 districts), Mid-Western Development Region (15 districts) and Far- Western Development Regions (9 districts) with almost equal geographical setting (15).

Nepal is a landlocked country situated in the foothills of the Himalayas. It shares its northern border with the China (Tibetan) and its eastern, southern, and western borders with India. The highest Himalayan in the world Mount Everest lies in the northern part of Nepal with 8,848 meters (14). Being a birthplace of Lord Gautam Buddha, Nepal is a holy place for Buddhism.

Nepal is rectangular in shape and averages 885 kilometers in length (from east the to west) and 193 kilometers in width (from north to the south). The total land area of the country is 147,181 square kilometers and its population, according to the 2001 Census report, is approximately 23.2 million. Nepal is predominantly rural with only about 14 percent of the population living in urban areas (15)

In Nepal, climatic conditions vary by altitude. In the terai, temperatures can go up to 44° Celsius in the summer and fall to 5° Celsius in the winter. The corresponding temperatures for the hill and mountain areas are 41° Celsius and 30° Celsius, respectively, in the summer, and 3° Celsius and far below 0° Celsius, respectively, in the winter. The annual mean rainfall in the kingdom is about 1,500 millimeters (14,15).

3.4 Research Instrument

TB register was kept at the district and regional level. DTLA and RTLA are responsible for keeping information related to TB. The TB register was the main instrument for keeping the information of patients related to demography, epidemiological and clinical information. TB register had total patients list according to the WHO guidelines where all patients profile were kept from TB treatment cards to the TB registers within their catchment area. TB patients card contains following information like pulmonary positive TB, pulmonary negative, extra pulmonary, and re-treatment TB cases, transfer in, transfer out, date of sputum examination, strength of sputum, category of TB, dose of anti TB drugs, patients profile like name, address, sex, age, geographical areas, development region, seasons, etc.

3.5 Data Collection

The data collection conducted from 26th December 2003 to 19th January 2004. Five supervisors were appointed and train to collect data. TB data was collected from districts, regional health offices. Also the verification of data was done by the Statistical and Epidemiology sections, National TB Center, Nepal. The DTLS and RTLA are responsible for recording and reporting the TB data at the district and region. The populations were collected from CBS and MOPE. Types of information were collected according to all details presented in Table 4.

3.6 Data Analysis

The collected data were displayed in spreadsheet. The final data regarding types of TB, sex, age groups, development regions, ecological zone, seasons and yearly were sum up accordingly. The information was displayed according to the age group of patients like 0-14, 15-24, 25-34, 35-44, 45-54, 55-64, 65 and above years old, male and female, and to the types of TB were also included. Data analysis was done by using excel program, mini-tab program. The data were presented by using number, percentage and incidence rate, and graphical presentation also presented.

TB by person characteristics are presented regarding age-groups, sex and types of TB; TB by place characteristics are presented regarding development regions and ecological zones and TB by time characteristics are presented by seasons and calendar years

Table 4 Types of information needed for study**.**

Types of information	CBS	MOPE	NTC	RHO/DHO
Population at risk				
Population by sex and age groups	„	„		
Population by development regions and ecological zones	„	„		
Population by years	„	„		
TB information				
TB data by sex, age groups and types			„	„
TB data by development regions and ecological zones			„	„
TB data by calendar years and seasons			„	„

Remarks:
RHO : regional health office,
DHO : district health offices,
NTC : national TB center.
MOPE : ministry of population and environment

3.7 Method of standardization

The Standardization are commonly used as a method for analyzing the differences in the occurrence of incidence of disease in terms of both morbidity and mortality, between different groups of population, or over time within the same population. Standardization is the method to allow for difference in age structures when comparing different population according to different places or different time period.

In comparing these rates in two or more groups of population, it is very difficult to ensure that the rates are accurate enough to represent the health status among these populations. When the crud rates are used in assessing health status between these populations, misinterpretation often occurs. In case that the summarize crud rate of one community is higher, we will conclude that health status in this area is poorer than another one, which crud rate is lower, but in a real situation, it may happen in opposite way: such as the higher the crude rate, the better the health status. On the other hand, the lower the crude rates, the worse the health status.

Direct standardization (for age) uses a series of age-specific rates as the standard. The age specific rates in all population groups to be standardized by this method are calculated and applied to the standard population in order to calculate the number of events or cases which would have occurred in the standard population if the rates in the study population occurred. These events (or cases) are then summed and divided by the total population of the standard to obtain the directly age standardized rate. In the analysis of trend over time the most recent census population age structure is usually used as the standard population.

CHAPTER IV
RESULTS

This was a descriptive study carried out to describe on epidemiological study of TB in Nepal during 1996-2003. The study was conducted in January 2004 with regular surveillance data in Nepal during 1996-2003.

The results explained was the general information regarding Tuberculosis Control Programme in Nepal during 1996-2003. The National Tuberculosis Programme is a countrywide programme. More than 90% population covers by the DOTS programme. National Tuberculosis Center is a focal point of the National Tuberculosis Control Programme in Nepal. It provides technical support to TB control activities at the national, regional, district, health post and sub-health post level. The recording and reporting system of Tuberculosis Control Programme is regular in the line with the WHO guidelines and recommendation.

All Tuberculosis information was collected from the National Tuberculosis Center, regional TB center, and five regional health offices for the period of 1996 to 2003. The population information during this period was collected from Ministry of Population and Environment (MOPE) and Center Bureau of Statistics (CBS), Katmandu, Nepal.

The required tuberculosis and population information were summed up and displayed to describe the tuberculosis situation in Nepal during 1996-2003 regarding person, place, and time characteristics. All of these data are presented in table A1 - A13 (Appendix).

The incidence rate of tuberculosis was calculated for comparison. The trend analysis was done by using graphs. Using direct standardization method, the

comparison of TB in different development regions and ecological zones were made. The results of the study are presented into three parts as follows:

PART1: TB situation classified by person characteristics as types of TB, sex, and age groups

PART2: TB situation classified by place characteristics as development regions and ecological zones

PART3: TB situation classified by time characteristics as calendar years and seasons

4.1 TB situation classified by person characteristics as types of TB, sex, and age groups

Table 5 shows the number, percentage and incidence rate of TB by types during 1996 to 2003. Overall 241,078 TB cases of all types were reported in Nepal during 1996 to 2003. Of these, 99,696 (41%) were new pulmonary positive cases, 70,003 (29%) were new pulmonary negative cases, 18,170 (8%) were re-treatment cases, 31,458 (13%) were extra pulmonary cases, and 21,751 (9%) were standard chemotherapy cases. The annual average of notified TB cases in Nepal were 30,134 during 1996 to 2003. Overall increased from a lowest of 28,314 in 1996, total TB cases have steadily increased, with total TB cases for 31,637 in 2003, an increase 3,323 (11.8%).

Table 5 Number, percentage and incidence rate of reported TB in Nepal during 1996-2003 by types of TB

Types of TB	TB cases	IR/100,000/yr
New p. positive	99,696 (41%)	55
Re-treatment	18,170 (8%)	10
New p. negative	70,003 (29%)	39
Extra pulmonary	31,458 (13%)	17
Standard chemotherapy	21,751 (9%)	12
Total	241,078 (100%)	133

The total incidence rate during these period were 133/100,000 per year. Of these, 55/100,000 were the incidence rate of new pulmonary positive cases, 39/100,000 were the incidence rate of new pulmonary negative cases, 10/100,000 were the incidence rate of re-treatment cases, 17/100,000 were the incidence rate of extra pulmonary cases, and 12/100,000 were the incidence rate of standard chemotherapy cases per year during 1996 to 2003. More details were shown in Tables 6.

Table 6 IR of TB by types of TB in Nepal during 1996-2003

Years	IR/100,000 per yr.				
	NPpos	NPneg	Rx-Tret	Ep	STD
1996	50	43	7	11	25
1997	50	39	9	14	21
1998	52	39	9	14	22
1999	55	37	10	16	18
2000	59	35	11	19	10
2001	58	39	11	21	3
2002	57	40	11	22	1
2003	58	38	11	21	0
Total	55	39	10	17	12

Remarks: NPpos: New pulmonary positive, NPneg: new pulmonary negative, Rx-Tret.: re-treatment cases, EP: Extra pulmonary cases, STD: standard chemotherapy

Among the total notified TB cases in Nepal, only new pulmonary TB cases were broken down by age groups and sex. But only in 2002, the total TB cases were broken down by sex, which are presented below for comparison with the new pulmonary positive TB cases.

Between 1996 to 2003, 99,969 new pulmonary positive TB cases were reported with annual average of 12,462. Overall increase from a lowest of 10,348 in 1996, new pulmonary positive TB cases have steadily increased, with 14,348 in 2003, an increase of 4,000 cases (38.7%).

Figure 3 represented the trend of TB incidence rate in Nepal during 1996 to 2003 by types of TB. According to the figure, from 1996 to 2003, standard chemotherapy (12-months treatment) incidence rate started to decrease since 1996 to 2001 heavily and almost zero in 2003 while among the new pulmonary positive cases, graphs showed that up to 2000, it was highly increasing then onwards almost constant. For pulmonary negative cases, it was decreasing heavily up to 2000 and slightly increasing then onwards up to 2003. While among the extra pulmonary cases, the incidence rate was increasing in each year compared to the re-treatment cases were increasing was found to be steady during the study period. This was due to the

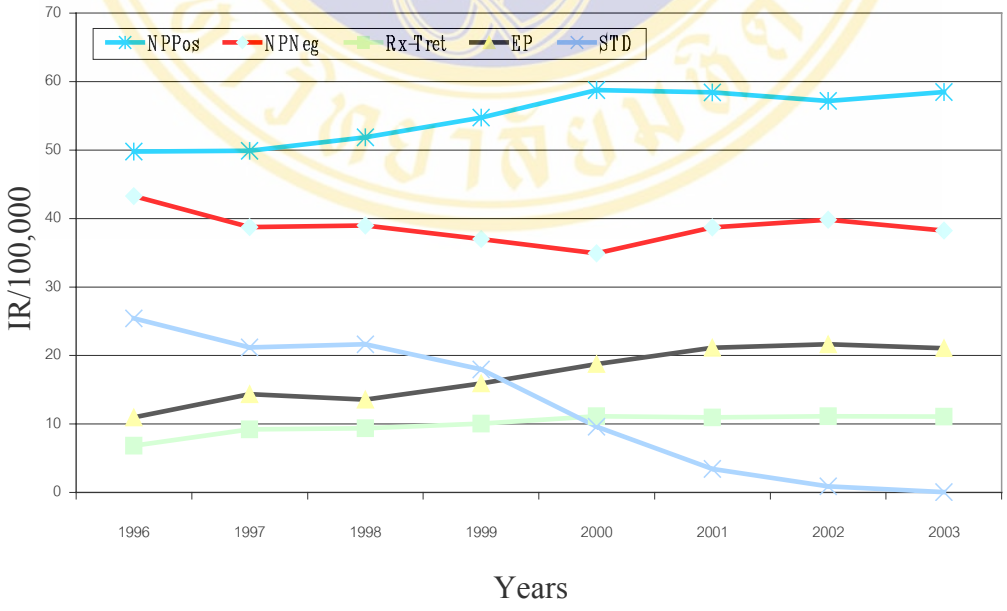


Figure 3 : IR of Types of TB in Nepal during 1996-2003

Remarks: NPPos: New pulmonary positive, NPNeg: new pulmonary negative, Rx-Tret.: re-treatment cases, EP: Extra pulmonary cases, STD: standard chemotherapy DOTS campaign through out the country.

Table 7 showed the sex distribution of total TB cases in Nepal in 2002 by types of TB. Among 31,340 TB cases, 20,265 (64.5%) were males followed by 11,105 (35.5%) females cases with sex ratio equal to 1.8:1, which was lower than new pulmonary positive cases. For male, maximum number of cases were in the new pulmonary positive cases were accounted for 9,304 cases (46%) followed by 6,104 new pulmonary negative cases (30%) and for female, new pulmonary positive were 4,410 cases (40%) followed by new pulmonary negative 3,445 cases (31%). For extra-pulmonary cases, it was found to be nearly double percentage in female and almost similar percentage found among those in standard chemotherapy .

The incidence rate of reported tuberculosis in Nepal in 2002 by types and sex was shown in Table 7. The overall incidence rate was same in extra pulmonary TB group and standard chemotherapy group. Among the pulmonary TB, the incidence rate was much higher in male than female. More detailed were shown in Table 7.

Table 7 Number, percentage and incidence rate (/100,000 population) of reported TB in Nepal during 2002 by types of TB

	Male		Female	
Types of TB	No. (%)	IR/100,000	No. (%)	IR/100,000
New P .positive	9,304 (46%)	78	4,410 (40%)	38
Re-Treatment	2,009 (10%)	17	664 (6%)	6
New P. negative	6,104 (30%)	52	3,445 (31%)	30
Extra-Pulmonary	2,719 (13%)	23	2,474 (22%)	21
Standard Chemotherapy	129 (1%)	1	82 (1%)	1
Total	20,266 (100%)	169	11,075 (100%)	92

Figure 4 showed that the male and female incidence rate of all types of TB cases in Nepal in 2002, which represents the maximum difference was found in new pulmonary positive followed by new pulmonary negative group and re-treatment group of TB cases. But in case of extra-pulmonary and standard TB group, the incidence rate is almost same.

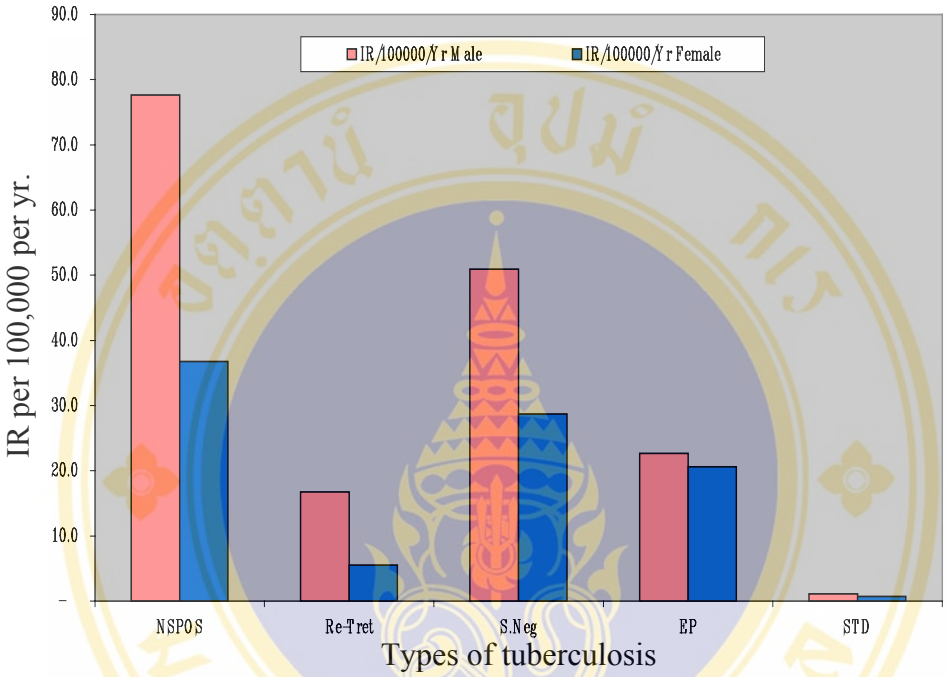


Figure 4: IR of types of TB cases by sex in 2002

The incidence rate of annual pulmonary and extra pulmonary TB were shown in Table 8.

Table 8 Annual incidence rate (/100,000 population) of pulmonary and extra pulmonary TB in Nepal during 1996-2003

Years	IR	
	Pulmonary TB	Extra-pulmonary TB
1996	100	11
1997	98	14
1998	100	14
1999	102	16
2000	105	19
2001	108	21
2002	108	21
2003	108	21
Total	104	17

The total incidence rate of pulmonary TB and extra pulmonary TB were 104/100,000 and 17/100,000 per year with ratio equal to 6:1. More detailed were shown in Table 8.

Figure 5 presented the trends of pulmonary and extra pulmonary TB which was slowly increasing up to 2001 and constant up to 2002 then decreasing up to 2003.

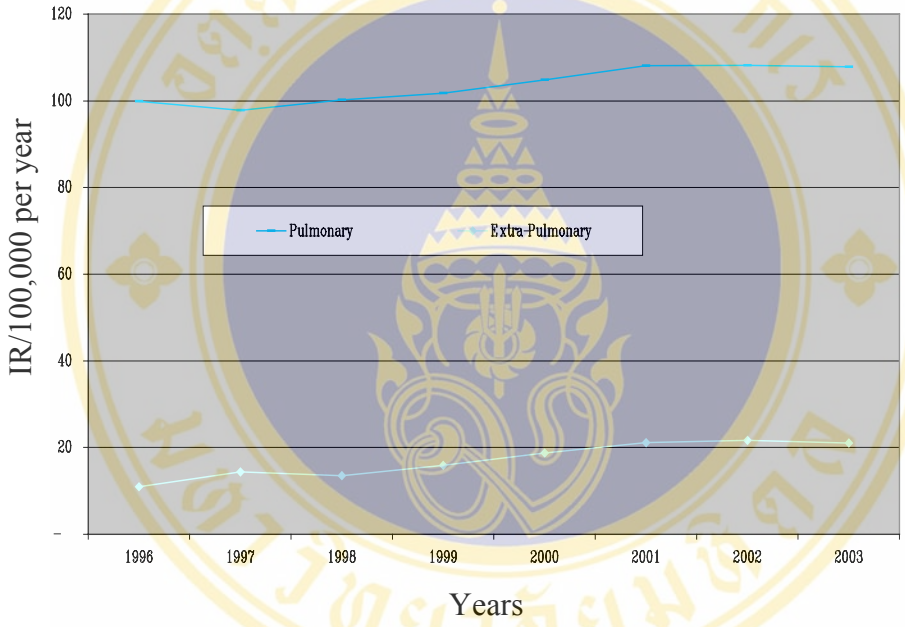


Figure 5: IR of pulmonary and extra pulmonary TB in Nepal during 1996-2003

Table 9 showed that the incidence rate of infectious TB cases and non-infectious TB cases in Nepal during 1996 to 2003. The overall incidence rate of infectious TB cases and non-infectious TB cases were 65/100,000 per year and 68/100,000 per year. The incidence rate of infectious TB cases was dramatically increasing from 56/100,000 per year to 70/100,000 per year during 1996 to 2003 while in non-infectious TB cases, the incidence rate was decreasing from 79/100,000 to 59/100,000 per year during this period. More details were shown in Table 9.

Table 9 Incidence rate of infectious and non-infectious TB in Nepal during 1996-2003

Years	IR/100,000/yr	
	Infectious TB	Non-infectious TB
1996	56	79
1997	59	74
1998	61	74
1999	65	71
2000	70	63
2001	69	63
2002	68	62
2003	70	59
Total	65	68

Between 1996 to 2003, more than two -thirds (67%) of total cases were male cases while the others were female with sex ratio equal to 2:1.

Table 10 Numbers, percentage and IR of new pulmonary positive TB in Nepal during 1996-2003 by sex

Sex	TB cases (%)	IR/100,000 per year
Male	66,558 (67%)	74
Female	33,138 (33%)	37
Total	99,696 (100%)	55

During 1996, 6,772 male tuberculosis were reported, followed by 9,464 cases in 2003, or an increase of 42.7% at the reported cases whereas in female 3,576 were reported in 1996 followed by 4,684 cases in 2003, or an increase of 31% of the reported cases. More details were shown in Table 10 and Table 11.

Table 11 showed annual incidence rate of new pulmonary positive TB cases in Nepal during 1996-2003 by sex.

The total incidence rate for male was 74/100,000 per year, and female, was 37/100,00 per year with sex ratio equal to 2:1. The pattern of sex ratio was found since 1996 to 1999 upward trends then onward almost constant.

The incidence rate of new pulmonary positive TB cases increased from 50/100,000 per year in 1996 to 58/100,000 in 2003, or the increasing percentage are representing 16%. Also, the incidence rate of male cases increased from 65/100,000 in 1996 to 79/100,000 per year in 2003, representing 36% for the increasing percentage during 1996 to 2003. While in female the incidence rate was found to be increased from 34/100,000 in 1996 to 38/100,000 per year in 2003, and representing 12% of the increasing percentage during 1996 to 2003.

Table 11 Incidence rate of new pulmonary positive TB in Nepal during 1996-2003 by sex

Years	IR/100,000/Yr		M/F ratio Sex ratio (M : F)
	Male	Female	
1996	65	34	1.91 : 1
1997	66	34	1.94 : 1
1998	67	37	1.81 : 1
1999	75	35	2.14 : 1
2000	79	38	2.07 : 1
2001	78	39	2.00 : 1
2002	78	37	2.10 : 1
2003	79	38	2.07 : 1
Total	74	37	2 : 1

Figure 6 showed that the trend of tuberculosis incidence rate of new pulmonary positive TB cases in Nepal during 1996-2003 by age groups. The incidence rate of

pulmonary positive TB increased regularly as the age group increases. The age group 0-14, the deviation of male and female incidence rate had almost equal and the incidence rate increased when the age groups increased and maximum deviation was found in the age group 55-64 years old.

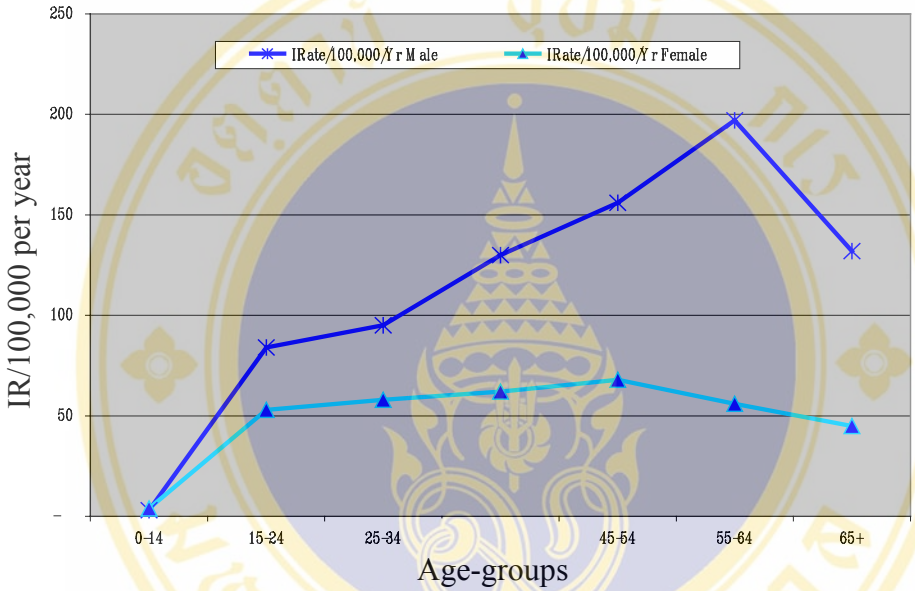


Figure 6 : Trend of new pulmonary positive TB cases in Nepal during 1996-2003 by age-groups

Table 12 showed that age specific incidence numbers, percentage and incidence rate by sex. The percentage and the numbers in age group 15-24 years old was the highest and declined thereafter while age was increasing for both male and female. But the incidence cases in age group 0-14 in both male and female were almost same.

Though the incidence rate of both male and female ware the same in the age group 0-14 years old and difference was much higher as age groups increased from 15-24, 25-34, 35-44, and the highest was found among the age group 55-64 years old while the rapid decreasing was found in the age group 65 + years old. The deviation of male and female rate was found to be the highest in the age group 55-64 years old, and 65 years old and above. More details were shown in Table 12 and Table 13.

Table 12 Age-specific number, percentage and IR of total new pulmonary positive TB in Nepal during 1996-2003

Age groups	Male		Female	
	Number (%)	IR/100,000/yr	Number (%)	IR/100,000/yr
0-14	1,119 (2%)	3	1,339 (4%)	4
15-24	14,496 (22%)	84	8,942 (27%)	53
25-34	12,680 (19%)	99	8,002 (24%)	58
35-44	12,539 (19%)	130	5,938 (18%)	62
45-54	11,070 (17%)	156	4,729 (14%)	68
55-64	9,393 (14%)	202	2,599 (8%)	56
65+	5,261 (8%)	156	1,589 (5%)	45
All age groups	67,988 (100%)	71	31,708 (100%)	36

Table 13 IR of reported TB in Nepal during 1996-2003 by age groups

Age groups	IR/100,000 per year							
	1996	1997	1998	1999	2000	2001	2002	2003
0-14	3	3	4	4	4	3	4	4
15-24	60	67	64	64	71	72	69	70
25-34	76	76	72	80	91	84	81	84
35-44	92	91	91	95	102	105	99	100
45-54	101	98	132	121	125	119	120	122
55-64	115	102	110	129	130	148	159	164
65+	74	72	69	101	104	101	95	98
All age groups	50	50	52	55	59	59	58	59

Figure 7 represented the trend of incidence rate according to the age groups. The trend was found to be steadily in the age group 0-14 years old during 1996 to

2003 and maximum trend had been in age group 55- 64 years old during 1996 to 2003. The change was slightly same among the age groups 35-44 and 15-24 years old whereas in the age groups 25-34, 45-54 and 65 and above years old, the trends had nearly steady. More detail was shown in graphs 7.

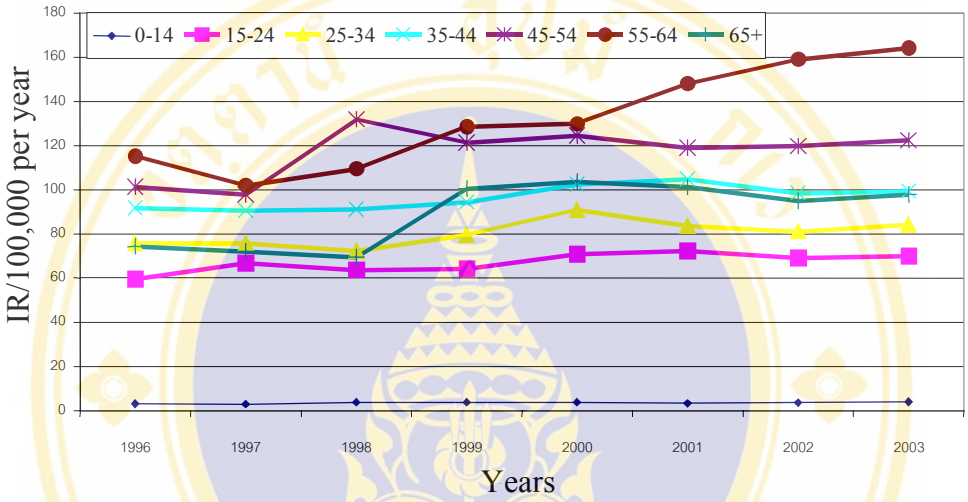


Figure 7 : Trend of IR of new pulmonary Positive TB in Nepal during 1996-2003

4.2 TB situation classified by characteristics of place as development regions and ecological zones

Table 14 showed that reporting situation of tuberculosis cases in Nepal during 1996-2003 by development regions. A total of 241,078 cases of all types, representing 50,504 (21%) from Eastern Development Region (EDR), 97,205 (40%) from Central Development Region (CDR), 45,428 (19%) from Western Development Region (WDR), 31,503 (13%) from Mid-West Development Region (MWDR) and 16,438 (7%) from Far-West Region (FWDR) were reported during 1996 to 2003. The ratios of reporting percentage among these regions were of CDE: EDR: WDR: MWDR: and FWDR were equal to 5.7:3:2.7:1.8:1.

Also the variation of percentage changed between years since 1996 to 2003 was very low in each development regions but a few more cases were reported in

2003 from Mid Western Development Region and Central Development Region. More details were presented in Table 14.

Table 14 Number, percentage and incidence rate of TB in Nepal during 1996-2003 by development regions

Development regions	TB cases	IR/100,000 per year
EDR	50,504 (21%)	117
CDR	29,205 (40%)	160
WDR	45,428 (19%)	124
MWDR	31,503 (13%)	135
FWDR	16,438 (7%)	99
Total	241,078 (100%)	133

Table: 15 showed that reporting incidence rate of Tuberculosis in Nepal during 1996-2003 by development regions. For EDR, the reported incidence was equal to 117/100,00 per year, while 160/100,000 per year were found in CDE, 124/00,000 per year were found in WDR, 134/100,000 per year were in MWDR and 99/100,000 per year were found in FWDR. If compared the incident rate among the different regions, the incident rate in EDR was almost decreasing since 1996. For CDR, it was also almost the same, decreasing deviation was less in WDR while in MWDR and FWDR were heavily increasing since 1996 to 2003. The ratio of reporting percentage of CDE: EDR: WDR: MWDR: and FWDR was 160:117:124:134:99 (1.6:1.2:1.3:1.4:1). More details were presented in Table 15.

Table 15 IR of TB in Nepal during 1996-2003 by development regions

	IR/100,000 per year				
Years	EDR	CDR	WDR	MWDR	FWDR
1996	114	181	122	114	89
1997	99	180	132	113	86
1998	124	173	126	111	86
1999	135	154	132	126	100
2000	123	153	128	137	104
2001	118	148	124	149	107
2002	117	145	117	154	108
2003	108	149	113	158	106
Total	117	160	124	134	99

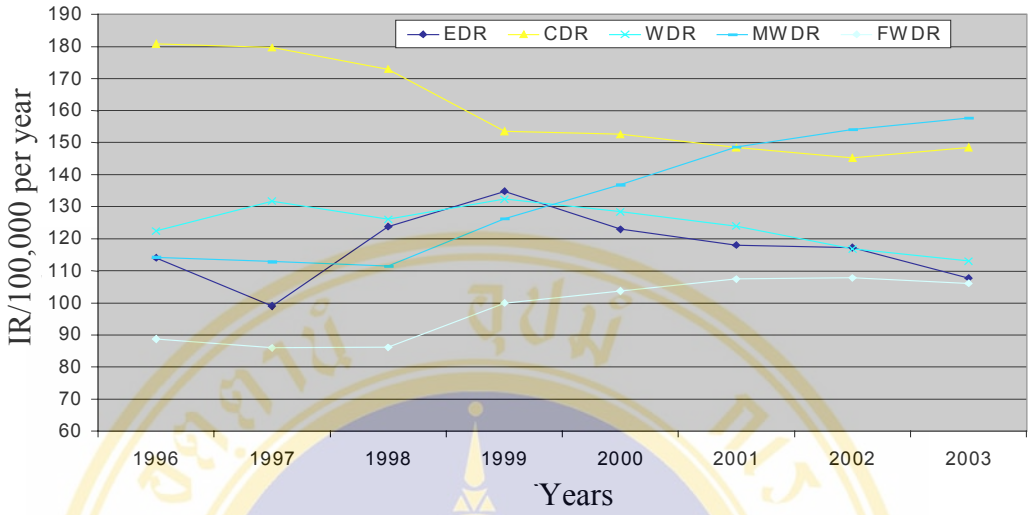


Figure 8 : IR of TB cases in Nepal during 1996-2003 by development regions

Figure 8 showed that the trend of TB incidence by development regions. Low reporting from Far-Western Region from 1996 to 1998 and increased slowly up to 2003. But from Central Development Region, incidence rate was high in 1996 and sharply decreased in 1999 and then continuing to decrease until 2003.Whereas in Western Development Region, constant up to 1998 and increasing trend up to 2003. In summary, Far-Western Region and Mid-Western Region both of them the trend increasing but in Centre Development Region, Eastern Development Region, and Western Development Region, the decreasing trends were observed.

Table 16 showed that reported TB cases according to the ecological zones in Nepal during 1996 to 2003. Mountain ecological zones contributed 7,390 (3%), hilly ecological zones contributed 90,532 (38%), and flat (Terai) ecological zones contributed 143,156 (59%).

Table 16 Number , percentage and incidence rate of reported TB in Nepal during 1996 to 2003 by ecological zones

Ecological zones	Numbers	IR./100,000 per yr.
Mountain Zone	7390 (3%)	54
Hilly Zone	90,532 (38%)	112
Flat Zone	143,156 (59%)	166
Total	241,078 (100%)	133

According to yearly reporting status, mountain ecological zone contributed 3% in each year since 1996. But the reporting percentage of hilly ecological zone in each year since 1996 to 1999 was around 38% and from 1999 to 2001, it was found to be around 36% and found to be around 40 % between 2002 to 2003. Also in flat ecological zone, from 1996 to 1997, it was found 59% and from 1998 to 2002 it was around 60% and from 2002 to 2003 was around 57%. More details were presented in Table 16.

Table: 17 showed that reported incidence rate of TB cases according to the ecological zones in Nepal during 1996 to 2003. The mountain ecological zone had overall incidence rate 54/100,000 per year, while the hilly ecological zone and flat ecological zone had 112/100,000 per year and 166/100,000 per year respectively. The incidence rate of hilly ecological zone and mountain ecological zone was almost same since 1996 to 2003 whereas in the flat ecological zone. Among the flat ecological zone the incidence rate was slightly decreasing during 1996 to 2003. The ratios of the incidence rate of flat, hilly, and mountain were 166:112:54 (3.1:2.1:1)

Table 17 IR of TB in Nepal during 1996-2003 by ecological zones

Years	IR/100,000 per yr		
	Mountain	Hilly	Flat
1996	46	115	170
1997	50	113	166
1998	48	113	171
1999	71	110	172
2000	56	107	172
2001	55	105	170
2002	55	117	155
2003	54	114	154
Total	54	112	166

Figure 9 represents the trend of TB incidence rate by ecological zones. The hilly ecological zones, the incidence rate was found almost similar since 1996 to 2001 then onwards slightly increasing whereas among the mountain ecological zones, the rate were decreasing slightly and the flat ecological zones also almost constant during this period .

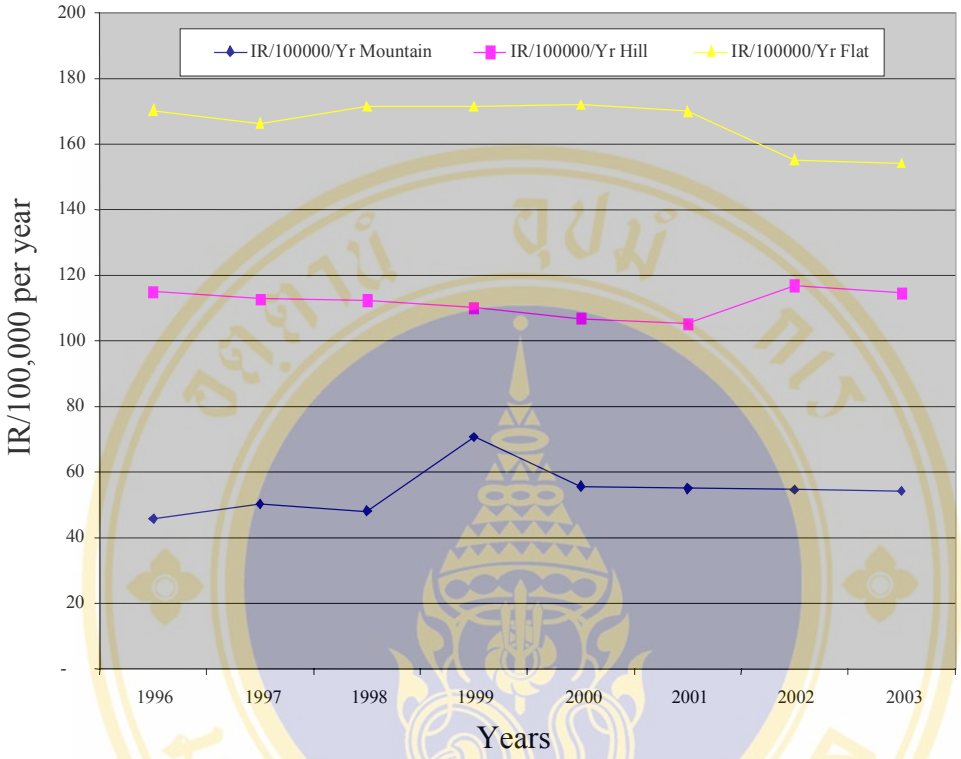


Figure 9: Trend of IR TB in Nepal during 1996-2003 by ecological

(a) By using methods of direct standardization

The incidence rate (IR) of all population groups to be standardized by this method are calculated and applied to the standard population in order to calculate the number of events of cases which would have occurred in the standard population if the rates in the study population occurred. These cases were then summed and divided by the total standard population to obtain as the direct standardized rate for comparison.

Table 18 Method of direct standardization of TB cases in Nepal during 1996-2003 by development regions

Years	Std. Population *	Expected Cases				
		EDR	CDR	WDR	MWDR	FWDR
1996	20,831,643	23,765	37,661	25,515	23,813	18,472
1997	21,290,069	21,075	38,262	28,049	24,016	18,310
1998	21,748,592	26,922	37,610	27,397	24,224	18,730
1999	22,237,434	29,985	34,146	29428	28,062	22,224
2000	22,726,822	27,943	34,671	29164	31,091	23,587
2001	23,453,019	27,686	34,806	29,084	34,852	25,186
2002	24,014,239	28,164	34,880	28,050	36,977	25,887
2003	24,542,724	26,435	36,448	27,738	38,698	26,044
Total	180,844,542	21,1987	288,458	224,453	241,734	178,551

Sources: Sources: Population projection for Nepal 1996-2016,Volume I, Ministry of Population and Environment Nepal

*Standard population: Yearly projected population

Direct Adjusted Incidence (DIR)=Total expected cases/Total standard population

Comparative Incidence Index (CII) is calculated after calculating DIR for each region, which are displayed in Table 19.

Table 19 Summary of the comparative incidence index of each development regions

	EDR	CDR	WDR	MWDR	FWDR
DIR (/100,000)	117.2	159.5	124.1	133.7	98.7
CII for EDR to	1	1.37:1	1.06:1	1.15:1	1.19:1
CII for CDR to	1.37:1	1	1.28:1	1.20:1	1.62:1
CII for WDR to	1.06:1	1.28:1	1	1.08:1	1.26:1
CII for MWDR to	1.15:1	1.20:1	1.08:1	1	1.36:1
CII for FWDR to	1.19:1	1.62:1	1.26:1	1.36:1	1

Remarks: EDR: East Development Region, CDR: Central Development Region, WDR: West Development Region, MWDR: Mid-West Development Regions, FWD: Far-West Development Region

By comparing standardized incidence rate of development regions, different number of tuberculosis cases were reported from different regions in Nepal during 1996 to 2003.

Table 20 Method of direct standardization of TB cases in Nepal during 1996-2003 by ecological zones

Years	Std. Population	Expected cases		
		Mountain	Hill	Flat
1996	20,831,644	9,553	23,938	35,493
1997	21,291,624	10,703	23,991	35,422
1998	21,761,653	10,498	24,497	37,301
1999	22,242,115	15,690	24,469	38,150
2000	22,733,242	12,666	24,303	39,089
2001	23,453,024	12,884	24,720	39,837
2002	23,971,142	13,126	28,057	37,214
2003	24,500,768	13,330	28,045	37,790
Total	180,785,212	98,424	202,022	300,250

Table 21 Summary of the comparative incidence index of each ecological zone

	Flat zone	Hilly zone	Mountain zone
DIR (/100,000)	166.1	111.7	54.4
CII for flat area to	1	1.5:1	3.1:1
CII for hilly area to	1.5:1	1	2.1:1
CII for mountain area to	3.1:1	2.1:1	1

The results from standardized incidence for ecological zones showed that the different numbers of tuberculosis cases were reported from various ecological zones. The flat zone and hilly zone were the high burden for tuberculosis compared to the mountain ecological zone in Nepal during 1996 to 2003.

4.3 TB situation classified by time characteristics as calendar years and seasons

The total number of reported tuberculosis cases during 1996 to 2003 is 241,078. During 1996, 28,312 cases were reported and 31,631 were reported in 2003. The overall changed in total number of cases was 3,323 (11.7%). More details were presented in Table 22.

Table 22 Number and percentage change of reported cases of TB in Nepal during 1996-2003

Years	TB cases	Percentage of changes (%)
1996	28,314	0
1997	28,403	0.3
1998	29,519	3.9
1999	30,315	2.7
2000	30,473	0.5
2001	31,077	2.0
2002	31,340	0.8
2003	31,637	0.9

The incidence rate during 1996 was 136/100,000 and 129/100,000 was in 2003 and the overall decreased in incidence rate was found to be 7/100,000 (5.2%) during these periods.

While from 1996 to 2003, the expected incidence (calculated by annual risk of TB infection) decreased from 241/100,000 to 186/100,000 per year or accounted for the percentage of decreasing as equal 22% during these periods.

Table 23 Incidence rate of notified and expected cases of TB in Nepal during 1996-2003

Years	IR. /100,000/yr.	
	Notified Incidence	*Expected Incidence
1996	136	214
1997	133	210
1998	135	206
1999	136	202
2000	133	199
2001	133	194
2002	131	191
2003	129	186
Total	133	200

Source: Tuberculosis control in Nepal 2055-2060(198-2003), long term plan, 1998

*Expected incidence: Calculated by using annual risk of TB infection using Karl Stablo formula

By comparing, the notified incidence rate with expected incidence rate (given in Table 16) in Nepal during 1996-2003 showed that the tuberculosis is still in problem.

It was found the incidence rate during 1996-2003 period was negatively correlated with time period. The overall tuberculosis in Nepal showed each additional year since 1996 to 2003, the incidence rate of TB had declined by approximately 0.81 cases per 100,000 per year

Table 24: Showed that reported tuberculosis cases in Nepal during 1996-2003 by three different seasons. In rainy season, the reported cases were 76,327 (32%), 66,812 (28%) cases were found in winter, and 98,029 cases (41%) were found in summer. The ratio of incidence rate to the summer, to the rainy and to the winter was equal to 41:31:28 (1.5:1.2: 1).

Table 24 Number, percentage and incidence rate of reported TB cases in Nepal during 1996-2003 by seasons

Seasons	TB cases	IR/100,000 per year
Rainy	76,237 (32%)	126
Winter	66,812 (28%)	111
Summer	98,029 (41%)	162
Total	241,078 (100%)	133

Table 25 shows the reported incidence rate of tuberculosis cases in Nepal during 1996-2003 by three different seasons. In rainy season, the reported incidence rate was almost around 126/100,000 per year whereas in winter and summer are respectively 111/100,000 and 162/100,000 per year. The ratio of incidence rate in summer, rainy and winter was equal to 162:126:111(1.5:1.2:1). More details were presented in Table 26.

Table 25 Incidence rate of reported cases of TB in Nepal during 1996-2003 by seasons

	IR./100,000/Yr.		
Years	Rainy	Winter	Summer
1996	129	112	167
1997	110	125	165
1998	132	112	161
1999	134	110	163
2000	134	95	170
2001	123	111	164
2002	127	110	155
2003	121	110	155
Total	126	111	162

Figure 10 showed the seasonal trend of TB incidence in Nepal during 1996-2003 by seasons. According to the figure, since 1996 to 1998, and 2001 onwards deviation of reporting status was low whereas in 1999-2001,the reporting status had much gap between each other.

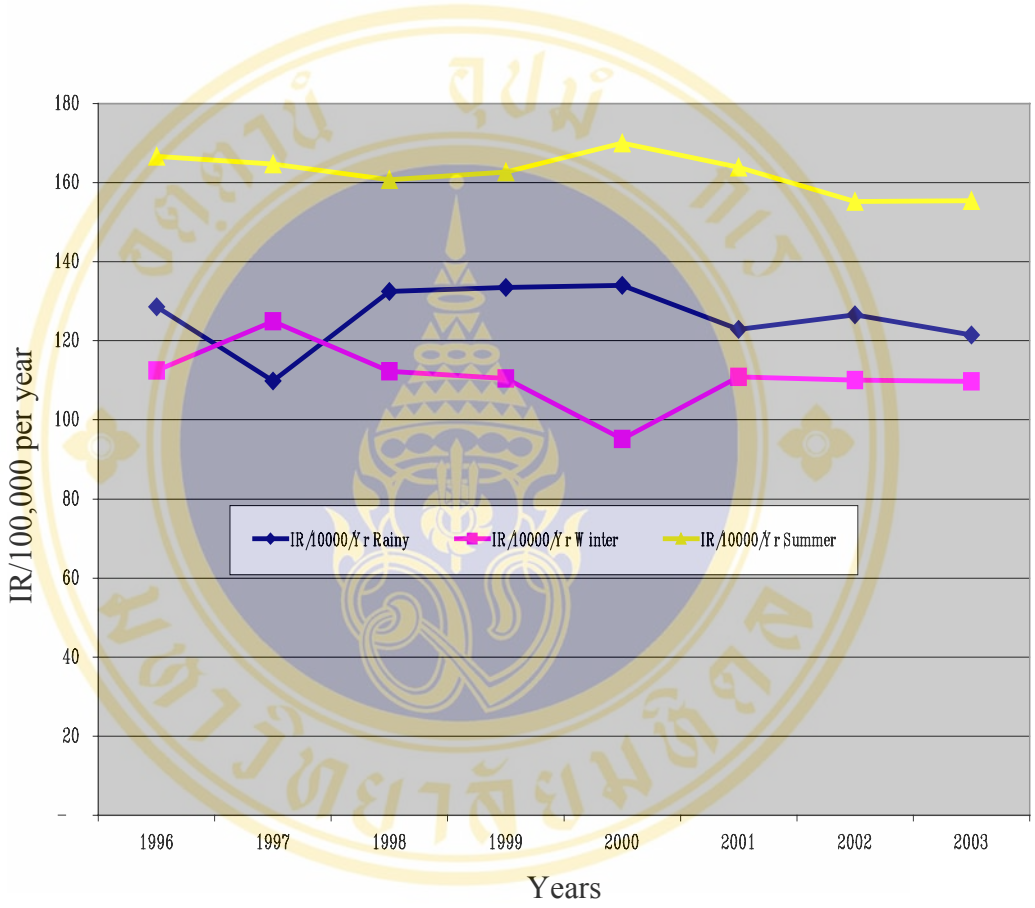


Figure 10 : IR of TB cases in Nepal during 1996-2003

CHAPTER V
DISCUSSION

The results of this study reflected the present situation of TB in Nepal during 1996 to 2003. This was a descriptive study carried out on 2004 based on epidemiological study using routine surveillance data on tuberculosis to describe the tuberculosis situation regarding person, place, and time characteristics.

The total number of reported tuberculosis in Nepal during 1996 to 2003 was 241,078. The incidence rate during 1996 was 136/100,000 per year and 129/100,000 was in 2003. The overall changed in incidence during this period was 5.2%. But during 1996 to 2003 the expected incidence (calculated from annual risk of TB infection) decreases from 241/100,000 to 186/100,000 per year with decreased by 22% during this period.

A high incidence in one region does not automatically indicate a TB problem, because of better detection rate on those areas. Also the areas with low incidence rate could be a problem of surveillance system and low detection rate. The discussion on the study results were presented as follows:

5.1 Discussion on person characteristics in term of types of TB, sex, and age groups

During 1996 to 2003, 241,078 tuberculosis cases were reported all types. Among them 99,694 (41%) were new pulmonary positive TB cases and 141,384 (59%) were others TB cases.

For types of TB, overall, 241,078 TB cases of all types were reported in Nepal during 1996 to 2003. Of these, 41% were new pulmonary positive cases, 29% were new pulmonary negative cases, 8% were re-treatment cases, 13% were extra

pulmonary cases, and 9% were standard chemotherapy TB cases. The annual average notified TB cases in Nepal were 30,134 and overall increase was 11.8% between 1996 to 2003. For types of TB, WHO/AFRO: TB Surveillance Report 2000 (39), mentioned that 49.1 % were new pulmonary positive cases, 25.0% were new pulmonary negative cases, 3.1% were relapse cases, 18.2% were extra pulmonary cases and 4.6% had no sputum smear done at the initial treatment which was almost similar to these studies.

Types of TB were one of the important variables in TB Control Programme that every researcher would like to know the relationship among them. It was found that the ratio of pulmonary negative cases plus extra pulmonary with pulmonary positive was equal to 1.07:1 during this period. But Tuberculosis Control in Nepal: 1995-1999, long term plan (25) mentioned the ratio of pulmonary negative cases plus extra pulmonary with pulmonary positive was equal to 1.22 :1 which was much higher then the study found.

Again, Tuberculosis Control in Nepal: 1995-1999, long term plan (25) estimated that the ratio of pulmonary positive TB cases and pulmonary negative TB cases were almost same whereas the study found the ratio was equal to 1.42: 1 which is higher than those mentioned in the plan.

Sex is one of the strong variables in TB control programme. In was found that among reported TB cases, 99,696 new pulmonary TB cases, more than-two thirds (67%) were male and the rest (33%) were female with sex ratio equal to 2:1. Less than two-thirds male were reported in Can Tho Province, Vietnam during 1986 to 1995 and the rest were female with sex ratio equal to 1.7:1 study conducted by Nguyen Van Hoang on the Trend analysis of Tuberculosis incidence Rate in Vietnam (32)

It was found that the sex ratio of TB in different countries had different ratios, in USA, the sex ratio was found to be equal to 1:1 whereas in Africa more female

were infected than male after emerging of HIV/AIDS, South East Asia the ratio was 2:1, and in India it was found 2 to 3:1 (41). But in Extra pulmonary TB with age group 0-14, the sex ratio was almost equal in Vietnam during 1986 to 1995, the study conducted by Nguyen Van Hoang, which was similar with the results found in this study.

For age groups, the percentage and numbers in age group 15-24 was the highest and declined thereafter with age increasing for both male and female. The incidence cases in an age group 0-14 years old were almost the same in male and female. It was found that highest incidence rate in the age group 55-64 years old where the study conducted in Can Tho Province, Vietnam during 1986 to 1995, which was found the higher incidence rate in the age group 65 and above years old. It was mentioned in WHO/AFRO for the TB Surveillance Report (39) most of the reported new smear positive cases fell in the age group 15-34 years old with the highest incidence in the age group 25-34 years and the incidence rate decline steadily thereafter. The study conducted by Tara Sing Bam on factors affecting patients compliance with DOTS in Kathmandu Urban areas, Nepal 2003 (34), found that majority of the TB patients were belong to the economically productive age groups or between 15- 49 years old. Same proportion was nearly as Kendel Shyam Lal study (40).

The reported cases according to the age groups showed that, 0-14, the trend was steady with low incidence rate compared to other age groups. Whereas upward trend was found in age groups 15-24, 35-44, and 55-64 and slow changes were found in age groups 25-34, 45-54 and 65 and above years old. The pattern of trend of age groups was almost similar to the South East Asia (41)

In the new pulmonary positive TB, an amount 10,348 were found in 1996 and increased to 14,348 in 2003 with increase in the percentage of 39% was found whereas the standard chemotherapy 5,283 in 1996 to 12 in 2003 with almost 0% was found which is very good indicator of TB control.

But sex distribution of all types of TB in 2002 were calculated and it showed that 31,340 of all TB cases were registered and among them 20,265 (64.7%) were male and 11,075 (35.3%) were female with sex ratio equal to 1.83:1 which was lower than new pulmonary positive TB. The study conducted in Can Tho Province, Vietnam during 1986 to 1995 by Nguyen Van Hoang found that the sex ratio of male and female was equal to 1.6:1 which was much lower than the ratio found in this study (32). The deviation of new pulmonary positive TB cases for male and female was higher followed by re-treatment cases, and the deviation was lower among the new pulmonary negative cases and almost equal in extra-pulmonary TB cases and standard chemotherapy TB cases.

5.2 Discussion on place characteristics in term of development regions and ecological zones

The reported tuberculosis cases in Nepal during 1996 to 2003 by development region showed 21% from Eastern Development Region (EDR), 40% from Central Development Region (CDR), 19% from Western Development Region (WDR), 13% from Mid-West Development Region (MWDR) and 7% from Far West Region (FWDR).

The variation of percentage change between years since 1996 to 2003 was very low in each developmental region but few more cases were reported in 2003 from Mid-Western Development Region and Central Development Region.

The reported incidence rate of Tuberculosis in Nepal during 1996 to 2003 by regions showed 117/100,000 from Eastern Development Region, 160/100,000 from Central Development Region, 124/100,000 from Western Development Region, 134/100,000 from Mid-Western Development Region, and from 99/100,000 from Far-Western Development Regions. If compared the incident rate of the regions with respect to year since 1996 to 2003, the rate was decreasing from 114/100,000 to 108/100,00 in Eastern Development Regions, 181/100,000 to 149/100,000 in the

Central Development Regions, and 122/100,000 to 113/100,000 Western Development Region per year. But the incidence rate was increasing from 114/100,000 to 158/100,000 in Mid-Western Development Region and from 89/100,000 to 106/100,000 in Far-Western Development Region. The Ratio of reporting incidence rate for CDE, EDR, WDR, MWDR, FWDR was 1.6:1.2:1.3:1.4:1.

A descriptive study was conducted on routine surveillance data in Austria from 1995-99: geographical distribution and trends by R Strauss was found Upper Austria showed the highest in yearly incidence for all five years and the decreased of the yearly incidence was observed for all federal states except for Carinthia (37

The reported TB cases according to the ecological Zones in Nepal during 1996-2003 was 3% from Mountain Ecological Zones, 38% from Hilly Ecological Zones, and 59%, from Terai (Flat) Ecological Zones which showed that the maximum deviation of tuberculosis from different ecological zones. It was necessary to understand for policymaker that the priority should be given to combat TB in Nepal according to the burden of tuberculosis. According to the yearly reported status, almost 3% from Mountain Ecological Zone each year from 1996 to 2003, Hilly Ecological Zone in each years since 1996 to 1999 it was around 38%, from 1999 to 2001 was around 36% and 40 % from 2002 to 2003. Also in Flat Ecological Zones, from 1996 to 1997 it was 59%, from 1998-2002 it was around 60% and from 2002 to 2003 was 57%.

According to the reported TB incidence rate from Ecological Zones in Nepal during 1996-2003, it found that 54/100,000 from Mountain Zone, 112/100,000 from Hilly Zone and 166/100,000 from Flat Ecological Zones per year. The ratio of the incidence rate of Flat, Hilly, and Mountain Ecological Zones was equal to 3.1:2.07:1.

The incidence of TB in Flat ecological zone could be due to the higher population density (23), high temperature which facilitate the TB bacilli to transmit person to others whereas in Hilly and Mountain it is lower due to scatter settlement on those area .Therefore this study concluded that the TB burden was higher in Flat

ecological zones followed by Hilly and Mountain ecological zones. Also for development regions showed that the Central Development Region contributed more TB incidence rate follow by Western Development Region, Mid-West Development Region, Eastern Development Region, and Far- West Development Region. The direct standardization of ecological zones showed that much variation of incidence rate was observed in different ecological zones in Nepal during 1996 to 2003.

5.3 Discussion on time characteristics in term calendar years and seasons

The total number of reported tuberculosis in Nepal during 1996 to 2003 was 241,078. During 1996, 28,312 cases were reported and 31,631 were in 2003 with change in 11.7%. The incidence rate during 1996 was 136/100,000 per year and 129/100,000 was in 2003. The overall change in incidence during this period was 5.2%. But during 1996 to 2003 the expected incidence (calculated from annual risk of TB infection) decreased from 241/100,000 to 186/100,000 per year with by 22% during this periods. By comparing notified incidence rate with expected incidence rate in Nepal during 1996 to 2003, it showed that the tuberculosis is still a major public health problem in Nepal.

In Nepal, the new strategy of tuberculosis DOTS has been started since 1996. From 1996 to 1998, the DOTS population coverage was almost 20% whereas in 1998 onward up to 2001, the coverage rate was rapidly increasing with almost 85% which helped to decrease the incidence rate of tuberculosis .

The reporting incidence rate of tuberculosis in seasons during 1996 to 2003 was highly different in Nepal. The incidence rate in summer was 162/100,000 per year whereas in rainy and winter were respectively 111/100,000 and 162/100,00 with ratio equal to 1.5:1.2:1.

The incidence of TB in summer season could be higher due to high temperature during this season which facilitate the TB bacilli to transmit easily whereas in rainy

season and winter season the transmission of TB will be limited by low temperature and rainy during this seasons (30).

The result showed that the incidence rate in different seasons were highly different whereas the yearly incidence rate among seasons were almost equal from 1996 to 2003.

5.4 Limitation of the study

There were several limitations in this study as and it can be summarized in details as follows.

(1) This study was a descriptive study conducted by using secondary sources of regular TB serveillance data in Nepal during 1996 to 2003. The recording and reporting systems are poor in private sector but patients hav been treated which could be the regions of underestimate the incidence rate.

(2) For calculation of incidence rate, projected population was given by Ministry of Population and Environment.

(3) Although the number of HIV infected persons and TB patients with HIV infection are reported very small, it is presumed that the declination of TB incidence rates will be limited by HIV/AIDS cases.

(4) A high incidence rate in one region does not automatically indicates a real TB problem, because it could also be due to better recording and reporting systems and therefore higher detection rate on that areas. On the other hand, in the areas with low incidence, there could be a problem of recording and reporting system and therefore it results in a low detection rate.

CHAPTER VI
CONCLUSION AND RECOMMENDATION

A descriptive study was conducted to describe the ongoing pattern of Tuberculosis and its trend of TB incidence rate in Nepal during 1996-2003 regarding person, place, and time. The study was conducted with regular TB surveillance data during 1996-2003. The high incidence rate does not automatically indicates a tuberculosis burden, it could be due to better surveillance and detection rate and vice-versa. The result of the study is useful to examine the notification behavior of people of public health authorities working in tuberculosis control Programme

6.1 Conclusion

6.1.1 TB situation classified by person characteristics

The epidemiological situation of TB in Nepal is still an important public health problem.

The ongoing pattern of TB and its trend showed declination during this period with equal to 0.81/100,000 per year.

The ratio of male and female incidence rate of new pulmonary positive TB cases was equal to 2:1 whereas in all TB cases calculated in 2002 was equal to 1.8:1 which was lower than new pulmonary positive cases.

The trend of incidence rate of pulmonary positive TB showed that male has steadily increasing than female.

For new pulmonary positive TB, the higher cases were reported in age group 15-24 years old and decreases as the age-groups increase. But the incidence

rate was higher for pulmonary positive TB in age group 55-64 years old and decreases as age groups decreases.

The incidence rate of male and female were almost the same in age-groups 0-14 years old whereas the difference was higher when the age groups were increased up to maximum deviation of 55-64 years old. The trend was found lowest among age group 0-14 during this period, whereas upward trend was found in age groups 15-24, 35-44, 55-64 and no trend was found for age groups 25-35, 45-54 and 65 years old.

All TB cases were increasing during this periods whereas standard chemotherapy TB cases (12-months) were heavily decreasing during this period which is a very good indicator in the National TB Control Programme.

The ratio of incidence rate of pulmonary TB cases to extra pulmonary TB cases was 6:1 during this period and the ratio of non-infectious and infectious TB case was equal to 1:1. Incidence rate of the new pulmonary positive TB cases, new pulmonary negative TB cases, and extra pulmonary TB cases had increasing during this period whereas the standard chemotherapy cases was decreasing heavily almost equal to zero during this period. The increasing was much faster in extra-pulmonary TB cases during this period, which was a good indicator for TB control activity.

6.1.3 TB situation classified by place characteristics

According to the development region, the incidence rate of Central Development Region contributes higher followed by Mid-West Development Regions, Western Development Region, Eastern Development Region, and Far-West Development Region with the ratio equal to 1.6:1.2:1.3:1.4:1.

The incidence rate of flat ecological zones had higher TB burden followed by hilly ecological zones and mountain ecological zones with ratio equal to 3.1:2.1:1.

6.1.3 TB situation classified by time characteristics

The overall increasing of all types of TB during this period was 11.7% whereas the decreasing percentage in incidence rate was equal to 5.2 %. During this period 1996 to 2003, the incedence rate was decreasing by an amount of 0.81 cases per 100,000 population per year.

The incidence rate of TB by seasons during this period had higher in summer followed by rainy and winter with the ratio was equal to 1.5:1.2:1.

Although the number of HIV infected person and TB patients with HIV infection are reported very small, it is presumed that the declination of TB incidence rates will be limited by HIV/AIDS cases.

6.2 Recommendation from findings

The following recommendation have been made based on the findings from this study, for improvement of the recording and reporting system of the National Tuberculosis Control Programme in Nepal. It can be summarised as follows:

1. Recording and reporting system of National Tuberculosis Control Programme need to be strengthened at all level by giving proper training to the health workers who are directly responsible for this job.
2. For improvement of their jobs, close supervision, monitoring and evaluation from central and regional level is needed for systematic and strengthening the survillance system of the National TB Control Programme.
3. Develop the standard working formats for recording and reporting for more information like, ethinicity, occupation etc.
4. The resources should be allocated according to the burden of TB considering person, place, and time as;

- Priority should be given to female regarding TB health education and a focus on productive age groups of both sexes.
- The community mobilization of people and the TB patients living in flat and hilly ecological zones should be the highest priority than the people living in mountain ecological zone
- Awareness for the protective behavior of TB has to be purposed during summer season followed by rainy and winter seasons, focusing on CDR followed by MWDR, FWDR, WDR and EDR.
- New policies regarding recording and reporting to be disseminate immediately in all level to improve the reporting system.

6.3 Recommendation for future study

This study did not cover all the aspect of person, place, and time characteristics like ethnicity, urban, rural, migrated population, TB and HIV/AIDS. Therefore following areas could be studied further for better TB control in Nepal.

(1) The epidemiological study of TB to be conducted in different development regions, ecological zones to know the real situation of the problem for TB control in Nepal.

(2) The trend analysis of TB in other aspects such as in terms of ethnicity, migration, TB with HIV/AIDS and occupation, etc.

(3) The trend analysis in the next study should be conducted to verify the consistency of difference sources of data information.

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APPENDIX

APPENDIX

Tuberculosis information in Nepal during 1996-2003

Table A1 Types of TB registered in Nepal during 1996-2003

Years	NPPos	NPNeg	Re-Tre	EP	STD	TB
1996	10,348	8,993	1,416	2,274	5,283	28,314
1997	10,620	8,251	1,957	3,059	4,516	28,403
1998	11,306	8,499	2,045	2,951	4,718	29,519
1999	12,231	8,263	2,242	3,563	4,016	30,315
2000	13,446	7,990	2,551	4,293	2,193	30,473
2001	13,683	9,074	2,563	4,955	802	31,077
2002	13,714	9,549	2,673	5,193	211	31,340
2003	14,348	9,384	2,723	5,170	12	31,637
Total	99,696	70,003	18,170	31,458	21,751	241,078

Sources: Annual report, National TB Programme, Nepal, 2002

Table A2 Sex distribution of reported total TB cases in Nepal, 2002

Types of TB	TB Cases		
	Male	Female	Total
NPPos	9,304	4,410	13,714
Re-Tre	2,009	664	2,673
NPNeg	6,104	3,445	9,549
EP	2,719	2,474	5,193
12-months tret(STD)	129	82	211
Total	20,265	11,075	31,340

Sources: Annual report, National TB Programme, Nepal, 2002

Table A3 New pulmonary positive TB cases in Nepal during 1996-2003 by sex

Years	TB Cases		
	Male	Female	Total
1996	6,772	3,576	10,348
1997	7,004	3,616	10,620
1998	7,278	4,028	11,306
1999	8,331	3,900	12,231
2000	9,056	4,390	13,446
2001	9,149	4,534	13,683
2002	9,304	4,410	13,714
2003	9,664	4,684	14,348
Total	66,558	33,138	99,696

Sources: Annual report, National TB Programme, Nepal, 2002

Table A4 New pulmonary positive cases in Nepal during 1996-2003 by age groups and sex

Age groups	TB Cases		
	Male	Female	Total
0-14	1,119	1,339	2,458
15-24	14,496	8,942	23,438
25-34	12,680	8,002	20,682
35-44	12,539	5,938	18,477
45-54	11,070	4,729	15,799
55-64	9,393	2,599	11,992
65+	5,261	1,589	6,850
Total	66,558	33,138	99,696

Sources: Annual report, National TB Programme, Nepal, 2002

Table A5 New pulmonary positive cases in Nepal during 1996-2003 by age groups

Age-groups	1996	1997	1998	1999	2000	2001	2002	2003
0-14	245	241	312	329	335	298	331	367
15-24	2,403	2,751	2,683	2,763	3,116	3,252	3,183	3,287
25-34	2,250	2,300	2,238	2,521	2,939	2,769	2,748	2,917
35-44	2,022	2,039	2,102	2,226	2,467	2,581	2,482	2,558
45-54	1,573	1,552	2,140	2,015	2,113	2,064	2,123	2,219
55-64	1,200	1,086	1,192	1,430	1,477	1,722	1,891	1,994
65+	655	651	639	947	999	997	956	1,006

Sources: Annual report, National TB Programme,Nepal,2002

Table A6 Development Region wise TB cases in Nepal during 1996-2003

Years	TB Cases					
	EDR	CDR	WDR	MWDR	FWDR	TOTAL
1996	5,681	12,660	5,178	3,105	1,690	28,314
1997	5,035	12,872	5,690	3,132	1,674	28,403
1998	6,431	12,668	5,558	3,150	1,712	29,519
1999	7,155	11,505	5,965	3,661	2,029	30,315
2000	6,664	11,691	5,909	4,057	2,152	30,473
2001	6,586	11,749	5,879	4,545	2,318	31,077
2002	6,683	11,761	5,657	4,814	2,425	31,340
2003	6,269	12,299	5,592	5,039	2,438	31,637
Total	50,504	97,205	45,428	31,503	16,438	241,078

Sources: Annual report, National TB Programme, Nepal, 2002:

Table A7 TB cases in Nepal during 1996-2003 by Ecological Zones

Years	Mountain (snowfall area)	Hill (In between)	Terai (Flat area)	Total
1996	727	10,785	16,802	28,314
1997	812	10,796	16,795	28,403
1998	794	11,011	17,714	29,519
1999	1,183	10,986	18,146	30,315
2000	952	10,899	18,622	30,473
2001	960	11,041	19,076	31,077
2002	975	12,517	17,848	31,340
2003	987	12,497	18,153	31,637
Total	7,390	90,532	143,156	241,078

Sources: Annual report, National TB Programme, Nepal, 2002

Table A8 All TB cases in Nepal during 1996-2003

Years	TB cases
1996	28,314
1997	28,403
1998	29,519
1999	30,315
2000	30,473
2001	31,077
2002	31,340
2003	31,637
Total	241,078

Sources: Annual report, National TB Programme, Nepal, 2002

Table A9 Season wise reported TB cases in Nepal during 1996-2003

Years	TB Cases			
	Rainy	Winter	Summer	Total
1996	8,932	7,810	11,572	28,314
1997	7,813	8,882	11,708	28,403
1998	9,643	8,177	11,699	29,519
1999	9,956	8,235	12,124	30,315
2000	10,227	7,264	12,982	30,473
2001	9,605	8,663	12,809	31,077
2002	10,122	8,803	12,415	31,340
2003	9,939	8,978	12,720	31,637
Total	76,237	66,812	98,029	241,078

Sources: Annual report, National TB Programme, Nepal, 2002

Population information of Nepal during 1996-2003

Table A10 Projected population by sex in Nepal ,1996-2003

Years	Population		
	Male	Female	Total
1996	10,393,913	10,437,731	20,831,644
1997	10,645,633	10,685,729	21,331,362
1998	10,903,447	10,939,621	21,843,068
1999	11,167,503	11,199,545	22,367,048
2000	11,437,952	11,465,646	22,903,598
2001	11,714,949	11,738,070	23,453,019
2002	11,987,250	12,006,457	23,993,707
2003	12,265,878	12,280,983	24,546,861
Total	90,516,525	90,753,782	181270307

Sources: Population projection for Nepal 1996-2016,Volume I, Ministry of Population and Environment Nepal

Table A11 Projected population of Nepal by age groups and sex, 2001

Age-Groups	Population		
	Male	Female	Total
0-14	4,830,646	4,619,587	9,450,233
15-24	2,144,507	2,302,116	4,446,623
25-34	1,671,861	1,728,172	3,400,033
35-44	1,203,593	1,199,966	2,403,559
45-54	884,741	868,199	1,752,940
55-64	579,907	580,696	1,160,603
65+	399,694	439,334	839,028
Total	11,714,949	11,738,070	23,453,019

Sources: Population projection for Nepal 1996-2016,Volume I, Ministry of Population and Environment Nepal

Table A12 Projected population by development Regions Nepal, 1996-2003

Years	EDR	CDR	WDR	MWDE	FWDR	Total
1996	4,979,686	7,002,521	4,227,482	2,716,152	1,905,802	20,831,643
1997	5,086,251	7,162,178	4,318,795	2,776,450	1,946,395	21,290,069
1998	5,195,096	7,325,475	4,412,081	2,838,087	1,987,853	21,758,592
1999	5,306,271	7,492,495	4,507,382	2,901,092	2,030,194	22,237,434
2000	5,419,825	7,663,323	4,604,741	2,965,496	2,073,437	22,726,822
2001	5,578,906	7,916,525	4,740,668	3,058,471	2,158,449	23,453,019
2002	5,698,294	8,097,021	4,843,066	3,126,329	2,249,529	24,014,239
2003	5,820,237	8,281,633	4,947,676	3,195,734	2,297,444	24,542,724
Total	43,084,566	60,941,171	36,601,891	23,577,811	16,649,103	180,854,542

Sources: Population projection for Nepal 1996-2016,Volume I, Ministry of Population and Environment Nepal

Table A13 Projected population by ecological zones in Nepal ,1996-2003

Years	Mountain	Hill	Terai	Total
1996	1,585,197	9,385,092	9,861,355	20,831,644
1997	1,615,315	9,581,240	10,095,069	21,291,624
1998	1,645,844	9,781,487	10,334,322	21,761,653
1999	1,676,950	9,985,920	10,579,245	22,242,115
2000	1,708,644	10,194,625	10,829,973	22,733,242
2001	1,747,417	10,475,109	11,230,498	23,453,024
2002	1,780,443	10,694,038	11,496,661	23,971,142
2003	1,814,093	10,917,543	11,769,132	24,500,768
Total	13,573,903	81,015,054	86,196,255	18,0785,212

Sources: Population projection for Nepal 1996-2016,Volume I, Ministry of Population and Environment Nepal

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