TUBERCULOSIS AS A SOCIO-ECONOMIC CHALLENGE IN EAST SIKKIM

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Submitted by

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DECLARATION

I, Amit Singh, hereby declare that the issues and matters raised in this thesis entitled **"Tuberculosis as a Socioeconomic Challenge in East Sikkim"** are records of my own effort, that the contents of this thesis did not appearance for the award of any previous degree to me as well as to anybody else to my best of knowledge, and no part of this has been submitted by me for any degree in any other educational institution.

This is being submitted in partial fulfillment of the requirements of the degree of **Master of Philosophy** in the department of Economics, School of Social Science.

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CERTIFICATE

This is certified that the dissertation entitled "**Tuberculosis as a Socioeconomic Challenge in East Sikkim**" submitted to Sikkim University in partial fulfillment of the requirement for the degree of **Master of Philosophy in Economics** is the result of research work that is carried out by **Mr. Amit Singh** under my supervision. No part of the thesis has been submitted for any other degree.

He acknowledges assistance and helps those he received during the course of this research.

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Abbreviations

ASHA= Accredited Social Health Activists

ATT = Anti Tuberculosis Therapy

CAGR = Compound Annual Growth Rate

CBR = Crude Birth Rate

CDR = Crude Death Rate

C.V = Coefficient of Variation

DHQ = District Headquarter

DMC = Designated Microscopy Centre

DoNER = Development of North Eastern Region

DOTS= Directly Observed Treatment Short course

DTC= District TB Centre

DW-d= Darwin Watson d statistics

HIV/AIDS= Human immunodeficiency virus infection / Acquired immunodeficiency syndrome

IMR= Infant Mortality Rate

KMO= Kaiser-Meyer-Olkin

MDR-TB= Multi drug resistance tuberculosis

MDGs= Millennium Development Goals

N.E= North East

NEC= North Eastern Council

NSP CDR= New smear positive case detection rate

NRHM= National Rural Health mission

NTP= National Tuberculosis Program

OLS= Ordinary least square

RNTCP= Revised National Tuberculosis Control Program

S.D= Standard Deviation

SARS = Severe acute respiratory syndrome

TB= Tuberculosis

TRC= Total number of registered cases of TB patient

UNAIDS = Joint United Nations Programme on HIV/AIDS

US = United States

WHO= World Health Organization

Chapter 1

INTRODUCTION

Chapter 1

1.1 Introduction

According to WHO, state of complete physical, mental and social well-being of an individual or society is called as a health which is not only the absence of disease or infirmity, and by healthcare we mean goods and services provided to promote health, prevent or eliminate ill-health (Dictionary of Health Economics)[1]. On the other hand, Lionel Robbins defined economics is a science which studies human behaviors as a relationship between given ends and scarce means which have alternatives uses[2]. Thus, health economics is a branch of economics which concerns about the scarcity, allocation and use of resources related to health and health care. There is a long term relationship between human health and economic well-being as good health leads to increase in human capital as a result there will be an increase in individual productivity which further gives an impetus to output and as at last the overall economic growth increases.

The impact that health may actually be a driver of the economic well-being of nations was stressed by Sachs et al., (2000). Global Fund Africa 2010 identified malaria, HIV/AIDS and tuberculosis (TB) as an obstacle which hinders the economic development in the form of human capital formation and productivity loss.

Tuberculosis is an upsetting public health problem with grave socio-economic consequences. Tuberculosis causes an enormous burden of morbidity and mortality around the world. Tuberculosis is an infectious disease, transmitted either by person to person via infected sputum and inhalation to the respiratory system mycobacterium tuberculosis, or through human consumption of animal products infected with the disease named mycobacterium bovis through pasteurization of milk, financial concessions to farmers. Tuberculosis affects lungs mostly but can also affect any other organs of the body. Tuberculosis remains a central issue of global concern despite the long term identification of the cause of infection, drugs for treatment. In 1993 the World Health Organization (WHO) declared Tuberculosis as a global emergency and recommended a standard strategy for control of the disease that since 1993 is known as the Directly Observed Treatment Short course (DOTS) strategy.

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[1] Culyer, AJ. The Dictionary of Health Economics. Edward Elgar Publishing limited. 2005

[2] L. Robbins, *The Nature and Significance of Economic Science* (2nd ed.; Macmillan & Co.), p. 16

Tuberculosis kills more people than any other infectious disease like malaria, diabetes etc. (WHO reports, 2012). In 2005 there were 8.8 million new cases of tuberculosis; by 2008 there were 9.0 million cases. As per the 2009-10 reports of World Health Organisation (WHO) one-third of the world's population is infected with TB and 9.4 million cases of TB occurs globally with 2 million dying every year. According to Dye and Borgdroff (2008), Global Epidemiology and Control of Tuberculosis, the highest rate of fatality is in Africa, but the highest rate of incidence is in countries with growing population such as India, China, Indonesia, and Pakistan. Incidence is increasing in sub-Saharan Africa and parts of Eastern Europe, predominantly countries of the ex-Soviet Union, and is declining in West and Central Europe, North America, Latin America, the Middle East, and South East Asia. Despite incidence rates slowly declining globally and a relatively high level of treatment success, tuberculosis highlights the relationship between health and socio-economic inequality and poverty. Tuberculosis "is the leading killer of people with HIV" (WHO) and hence effects people in developing countries in their young productive years of ages, driving the poverty cycle between health and productivity. The relationship between poverty and burden of disease has been established by many studies including Gallup and Sachs (2001) and Commission on Macroeconomics and Health (2001). These studies reveal that many serious diseases predominantly found in poor countries clearly are a direct consequence of poverty, caused by inadequate sewage treatment, unsafe drinking water, poor hygiene, or substandard housing. It has been identified that the usual complex and interlocking problems of poverty are all operative: the poor may lack the knowledge to protect themselves adequately or seek needed services; they may lack the power to protect their rights; or they may lack income to access services.

According to Stop TB (2000) poverty and the tubercle bacillus (A rod-shaped aerobic bacterium *(Mycobacterium tuberculosis)* that causes tuberculosis)[3]crea te a second vicious circle. Poor people, plagued by hunger and crowded into close, non-hygienic quarters, are easy victims in an environment where TB flourishes. Treatment is often inconsistent or incomplete, to non-existent. The poor are less likely to seek and receive proper care when ill, exacerbating the impact of the disease and

[3] The American Heritage® Dictionary of the English Language, Fourth Edition copyright ©2000 by Houghton Mifflin Company. Updated in 2009. Published by Houghton Mifflin Company. All rights reserved.

there is the greater tendency for them to self-medicate which encourages the emergence of drug-resistant TB strains, further increasing the impact of TB on the poor and the risks to others in society.

In South and South East Asia India, Indonesia and Bangladesh, three of the most populous countries were major contributors of TB cases. Five countries, namely Bangladesh, India, Indonesia, Myanmar and Thailand account for more than 95 percent of the cases in the region. Tuberculosis is the biggest killer among adults in the region. Tuberculin positivity is more than 50 percent of adults in Bangladesh is indicative of high incidence of active disease in the country (WHO, WORLD TB REPORT, 2009-10).

In India 40 percent of the population is infected with TB and one TB infected patient infects 15-20 persons in a year and India carries one-third of the global burden of the disease (TB India Annual Status Report, 2012). The impact of TB on individuals is often all encompassing, affecting not only physical health, but also social and economic, and well-being. Since the disease affects the economically productive age group, households are adversely affected. The social and economic repercussions may include loss of work, divorce, ostracism by family members and the local community, and loss of housing. Discrimination, whether experienced or expected, has been found to be associated with increased anxiety and depression and lower life satisfaction, as well as with higher unemployment and lower income in India. Tuberculosis situation in most part of India continues to be grave with an average about 1100 – 1900 persons (in different zone's) out of every 100,000 acquiring new tuberculosis infection each year and potentially at risk of breaking down into disease any time in future.

Sikkim is a tiny state of India located in the foothills of Eastern Himalayas between latitude of 27degree 49" and 28 degree 10" north and the longitudes of 88 degree 28" and 88 degree 55" East. The state is bordered by Nepal to the west, Tibet Autonomous Region of China to the north and east, and Bhutan to the east. The Darjeeling district of West Bengal lies to the south. With 610,577 inhabitants (2011 Census) 4,56,999 residing in rural areas and 153578 residing in urban areas, Sikkim is the least populous state in India and the second-smallest state after Goa in total area, covering approximately 7,096 sq km. The density of population in Sikkim is 86

persons/sq km and the sex ratio is 890 females/1000 males (Census 2011). The current literacy rate of the state is 81.40 per cent among which 86.60 per cent are male literates and 75.60 per cent are female literates (Census 2011). The state comprises four districts namely East, West, North and South with sixteen sub divisions. The state is connected to rest of the country through National Highway 31A which links the capital Gangtok with the city of Siliguri in West Bengal bearing a distance of 114 kms. The nearest railway station to Sikkim is New Jalpaiguri railway station and the closest airport is Bagdogra airport (Siliguri). Sikkim comprises total of seven ethnic groups namely, Nepalis, Lepchas (native inhabitants of the land), Bhutias, Tibetan immigrants, Marwaris, Biharis and Bengalis in some proportions. Nepali is the most widely spoken language in Sikkim despite of Hindi and English being the official language of the state. The diverse ethnicity of Sikkim has a diverse culture as almost all important festivals of Hindus, Buddhists, Christians, Lepchas and Muslims are celebrated, but the culture of Buddhism is quite prime in Sikkim. River Teesta and Rangit are the life line of Sikkim and the state is beautifully blessed by Mother Nature as the hospitality industry is the largest industry in state other than agriculture. Summer and spring seasons are the most popular tourists season in Sikkim. Agriculture and tourism sector predominates the economy of Sikkim, despite some of the population are engaged in small scale local handicraft industries. In the recent years eco tourism has also emerged as an important economic activity in the state.

Map 1.1: Location Map of Sikkim

According to 2012 Annual report, Department of Health care, Human service and Family welfare (Government of Sikkim), the state comprises one State referral hospital, four district hospitals, two community health centre, twenty-four primary health centres, one hundred and forty-six primary health sub centre and one centre referral hospital. Each district has one district TB centre (DTC) for diagnosis and

treatment of tuberculosis and the state has its state TB cell in Gangtok under Department of Health care, Human service and Family welfare (Government of Sikkim). The policy of RNTCP has been implemented on 1st March 2002 in all four districts of Sikkim.

Road infrastructure in rural Sikkim is not in a proper condition as maximum numbers of villages are not connected by all-weather or tar roads. The patients have to walk a long distance and may have to climb up the hilly areas to reach the health service centres. As per the report of the State TB Cell, 2012 more than 1800 cases of TB occur every year and under this more than 60 per cent of cases were detected as positive in Sikkim. Amongst the different states of India Sikkim has also the highest detection rate of Tuberculosis as per the reports of State TB cell 2012. Total of 1,631 cases of tuberculosis in the year 2011 was registered under RNTCP in Sikkim (RNTCP Annual Status Report, 2012), whereas on national level total of 1,515,872 cases of tuberculosis was registered under RNTCP (RNTCP Annual Status Report, 2012).

1.2 Vital Statistics of Sikkim vis a vis India:

A comparative picture of crude birth rate and death rate of Sikkim on the national average is examined in following Table 1.1.

Table: 1.1
Demographic indicators of Sikkim and India (1995-2011)

	Descreptive Statistics/ Growth	Crude Birth Rate	Crude Death Rate	Infant Mortality Rate
Sikkim	Mean	20.03529	5.764706	38.58824
	C.V	8.2712	13.00935	22.53714
	Skewness	-0.04939	0.939269	0.338013
	CAGR (in percentage)	-1.305* (0.0002)	-0.9596 (0.1228)	-3.9135* (0.000)
India	Mean	24.47647	7.894118	61.41176
	C.V	7.58381	12.65555	15.25423
	Skewness	0.425579	-1.10954	-0.21963
	CAGR (in percentage)	-1.256* (0.000)	-1.8733* (0.0029)	-3.0572* (0.000)

Source: Own estimation based on the data compiled from Annual Report (2012), Department of Health care, Human services and Family welfare, Govt. of Sikkim
Note: C.V = Coefficient of Variation; *** significant at .10 percent level, ** significant at .05 percent level, * significant at .01 percent level

Figures in the parenthesis are the p-value of the respective estimates

Refer to above Table 1.1 it can be observed that the average crude birth rate of Sikkim during 1995-2011 stood at 20.04 where as it was 24.48 at the national level during the same period. Thus the CBR of Sikkim is lower than national average for the period under observation. Low birth rate may be traced as one of the reason for smaller population size of Sikkim. The average value of crude death rate of Sikkim has been observed to smaller than the country as a whole. Thus low death rate and low birth rate can be understood as reason for slow expanding population size of Sikkim.

The average infant mortality rate of Sikkim has been found to be lower than India as a whole. Here the difference is very large as average IMR of Sikkim during the period of (1995-2011) was 38.58 and the same for India was 61.41. Low infant mortality rate of Sikkim than national average is a good health indicator for the state.

The crude birth rate (CBR) of Sikkim and India has registered a decline in growth rate during 1995-2011. The CBR of Sikkim has fallen by 1.3 per cent per annum while that of the country recorded a fall of 1.2 per cent per annum during the 17 years period of study. The growth rate has been observed to statistically significant at 0.01 percent level. Likewise, the CDR of Sikkim and India has also recorded a negative growth during 1995-2011. The growth of Sikkim has declined by .9 percent per annum and country registered a fall in growth rate of 1.8 per cent per annum during the period of study. The infant mortality rate was also growing negatively both in Sikkim and All India during the 17 years of period under observation. The IMR in Sikkim has registered a negative growth rate was 3.9 per cent per annum and it was 3 per cent per annum in national level during 1995-2011.Both these growth rates were observed strongly significant at 0.01 per cent level.

Again if we observe the Table for a general comparison in growth rates of CBR, CDR and IMR, the IMR is declining faster than other two variables in Sikkim as well as in national level during the time period of 1995-2011. Here the CDR in Sikkim is declining at a slow pace than the CDR in India and also than the CBR and IMR in both Sikkim as well as India during this period of 1995-2011. The faster pace of decline in IMR signifies the success of approaches both by the State and Central Government in controlling the infant's death up to certain level. But the slower pace

in decline of CDR again shows some loop holes in the existing health policies and programmes.

1.3 TB as a Socio Economic Threat

TB primarily affects people in their productive age group with important socio-economic consequences for the household. Almost 70 percent of TB patients are aged between 15 and 54 years. The disease is more common amongst the poorest and the marginalised sections of the community. Whilst two-thirds of cases are male, TB takes a disproportionately larger toll among young females, with more than fifty percent of cases occurring amongst females less than middle age group. On an average, 3-4 months of work-time is lost as a result of TB, resulting on an average potential loss of 20-30 per cent of the annual household income (RNTCP Annual Report, 2010). This leads to increased debt burden, particularly for the poor and marginalized sections of the population. The nature of the disease, its management and treatment presents substantial economic burden to affected households as well as to the nation. Low income households face catastrophic expenditure (in the form of non-medical cost since TB treatment is "free"), loss of household income due to illness, utility loss to household and high possibility of death with its associated mortality cost and loss of lifetime income to the nation. Social stigma and economic constraints attached with a disease like tuberculosis has lead to increase in societal illiteracy in the form of annihilating atmosphere faced by TB patients, divorce, and ostracism by family members especially in rural areas of India. Since the disease affects the economically productive age group, households are adversely affected in the form of higher unemployment and lower income. Such discrimination and deprivation both socially and economically causes severe deterioration among the patients resulting depression and lower life satisfaction.

1.4 Rationale of the Study

Total population coverage in terms of disease prevention and control through structured efforts is what public health is concerned. However, the role of Governmental health policies is vital for tackling the challenges regarding health and health care and achieving health equity. The system of formal health care is accompanied by other different systems outside for contribution in health of a

population. Such potential inter-sectoral contributions towards the health are coming under recognition rapidly. Hence, the Governmental influence in public health is not concentrated within the boundary of health sector but it is also persuaded by various sectors outside the health systems. Some of the achievements and initiatives in the past by Government in tacking the diseases have already created a landmark in the history of the public health such as a launch of Expanded Program of Immunisation in 1974, Primary Health Care enunciated at Alma Ata in 1978, eradication of Smallpox in 1979, launch of polio eradication in 1988 and its eradication in 2013, FCTC ratification in 2004 and COTPA Act of 2005, public initiative of DDT for controlling malaria (1971) to name a few. Such initiatives gave a glorious experience but the public health programmes in India are needed to formulate in the framework of sustainable development.

RNTCP in India was introduced as a revised strategy of NTP by Government of India for controlling the epidemics of tuberculosis in October 1993. Most of the states and Union Territories have been covered up under RNTCP by March 2006 with positive result outcomes. Sikkim was brought under the umbrella of RNTCP in the year 2002 by State TB cell of Sikkim (Department of Health Care, Human Services and Family Welfare, Government of Sikkim) with full coverage of all four districts.

Tuberculosis is the most important infectious cause of adult deaths after HIV/AIDS in low and middle-income countries (Laxminarayan et al.,2007).Studies has claimed that the cost of TB to the patients & their families can be quantified are principally in the form of loss of earnings due to illness or death. Apart from economic cost TB has social cost too. TB affects all age groups, but its greatest impact is on adult. A study by Muniyandi et al., (2006), found that TB affected patient could not send their children to school due to loss of income. TB in mother affects routine of household activities and loss of earnings outside. Economic loss due to TB in parents necessitated their children to take up employment. Study clearly shows TB causes low productivity & increase in debt. TB also is cause of child labour in India. Tuberculosis (TB) is one of the major public health problems in India with a significant impact on the health and economy of the country. India is the highest tuberculosis (TB) burden country in the world, accounting for nearly one-fifth of the global incidence (Policy Brief Series, 2011). Annually more than 250,000 people die

out of TB in India. This is most unfortunate as TB is a curable disease if treated appropriately and adequately (Policy Brief Series, 2011).

Various studies has been undertaken so far to see the epidemic influence of tuberculosis in North East India in general and Sikkim in particular. But there is hardly any study relating to the socio economic status and incidence of Tuberculosis in East Sikkim. Present study is an attempt to bridge that gap.

1.5 Objectives of Study

The objectives for the present study are as follows:

i) To examine the success of public policy in controlling the incidence of Tuberculosis in North East in general and Sikkim in particular.

ii) To identify whether Tuberculosis has any significant relation with income and expenditure of the TB affected sampled families in East Sikkim.

iii) To examine the variation in income, expenditure pattern and indebtedness status of the household with the emergence of TB.

iv) To study the relationship between Socio Economic factors and the incidence TB in East Sikkim.

1.6 Research Question

i) How far public policy has been successful in controlling the incidence of T.B in India's North Eastern state in general and Sikkim in particular?

ii) How significantly TB is associated with income and expenditure of TB affected families in East Sikkim.

iii) Whether there has been any change in the income, expenditure pattern and indebtedness status with the emergence of TB amongst the household?

iv) What is the association between socioeconomic factors and incidence of tuberculosis in East Sikkim?

1.7 Methodology of the Study

1.7.1 Data Source

Present study is based on both secondary as well as primary data.

Source of Secondary Data:

Published vital statistics on crude birth rate, death rate and infant mortality rate of India vis a vis Sikkim has been collected from Department of Health care, Human services and Family welfare, Govt. of Sikkim. Secondary level data on epidemic influence of TB detected cases on the number of deaths, population covered by RNTCP, annual new smear positive detection rate, total number of registered cases, cured cases, completed cases, failure cases, defaulted cases, transferred out cases and outcome of treatment in India and her North Eastern states have been collected from reliable published sources such as RNTCP Annual Status Reports (Government of India).

Source of Primary Data:

Primary data has been collected by conducting field survey with a interview schedule (asking questions on family status, household status, health status, income status, expenditure status, indebtedness status etc.) by conducting interview with TB affected patient and the head of non TB affected household during January 2014-March 2014.Following sample design was applied for selection of household.

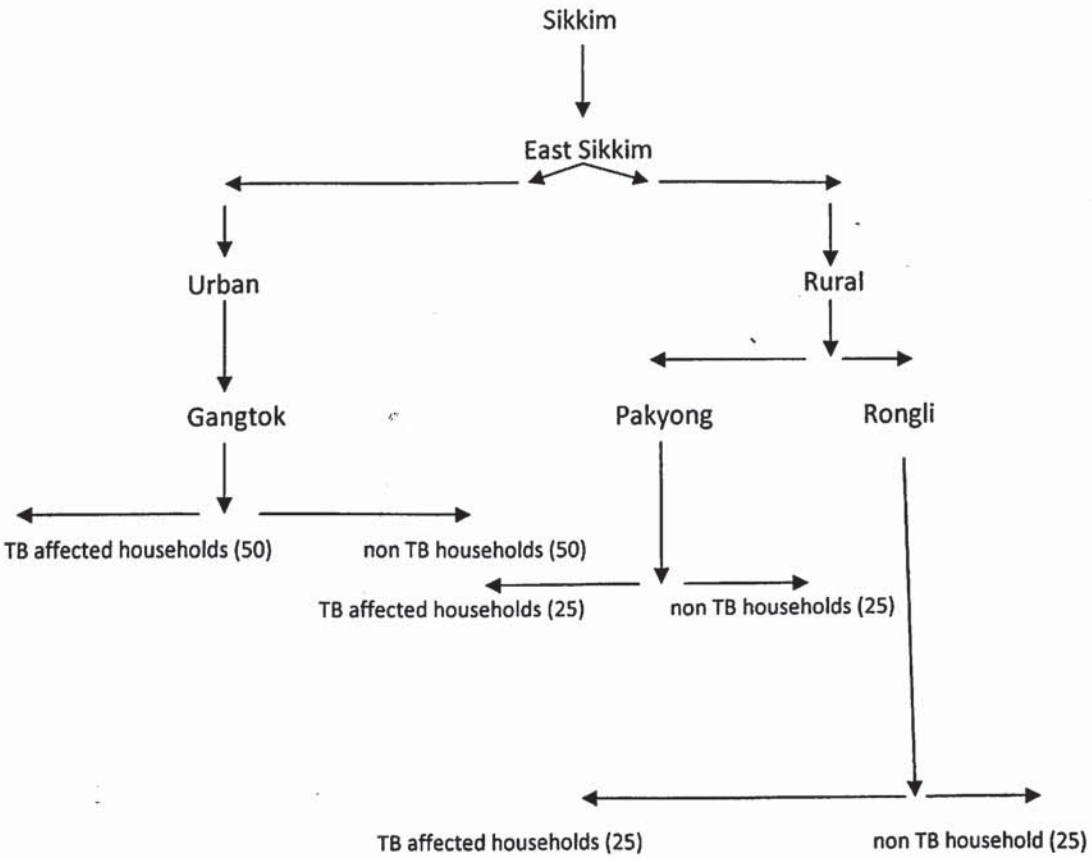
Sample Design:

Given the large size of the Universe (Sikkim) the present study purposively selected East Sikkim because of highest density of population amongst other districts of Sikkim.

A pilot survey was conducted with consultation of State TB Cell (Government of Sikkim) during July 2013 for confirming the questions to be interviewed for the sampled household of East Sikkim.

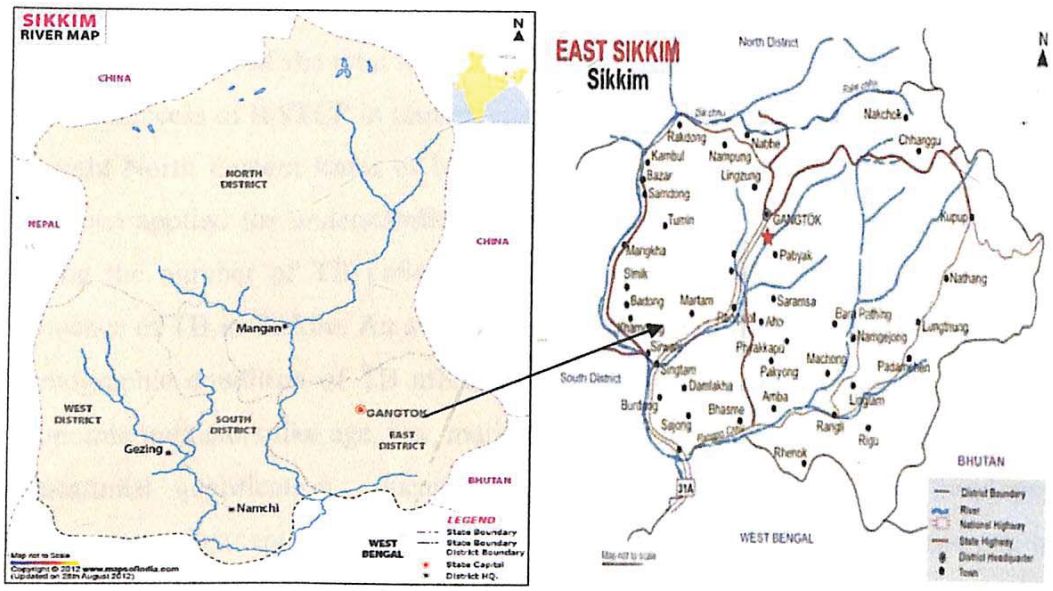
All the three subdivisions[4] of East Sikkim were selected for collection of field level data. Having identified the TB affected households of East Sikkim (after getting the statistical information on the number of current registered cases in East Sikkim) the study was alienated into two areas namely rural (Pakyong and Rongli) and urban (Gangtok) to identify the diversity of respondents. Purposive sampling method was applied for preparation of the sample design for both TB affected households and non TB affected households.

Figure 1.1: Sample Area Design



[4] Gangtok, Pakyong, Rongli

Map 1.2: Location of Study Area, East Sikkim



1.7.2 Sample Selection

Given the large size of the Universe (all TB affected population of East Sikkim) with time and resource constraint the present study purposively selected 100 TB affected household[5] from the three different subdivisions of East Sikkim with a breakup of 50 household from urban and 50 household from rural. Another 100 non TB affected households were selected with similar rural urban breakup who were the neighbour of TB affected sampled families in the study area.

1.7.3 Technique of Analysis

Simple descriptive statistics and compound annual growth rate (CAGR) has been estimated for understanding the vital statistics of Sikkim vis-a –vis the coutry as a whole. The epidemic influence of TB detected cases on the number of deaths, population covered by RNTCP, annual new smear positive detection rate, total number of registered cases, cured cases, completed cases, failure cases, defaulted cases, transferred out cases and outcome of treatment in India and her North Eastern states have been measured by applying the simple descriptive statistics and calculating the CAGR. The compound annual growth rate (CAGR[6]) of detected cases has been

[5] Currently under registration of RNTCP

[6] $Y = Ae^{rt}$; where r is growth coefficient, t is period of study under consideration, A is an efficiency parameter, Y is endogenous variable

analysed by fitting the following exponential function. Fixed effect model analysis was done for studying the cured rate of registered TB patient in eight North Eastern states of India out of the total number of registered cases of TB patient in these states and the success of RNTCP in minimizing the number of deaths of registered TB cases in eight North Eastern states of India during 2003-2011. Simple regression analysis has been applied for understanding the success of public policy such as RNTCP in curing the number of TB patient in Sikkim and also to understand the epidemic influence of TB in Sikkim. An attempt has been made to study the socioeconomic and demographic condition of TB affected respondents in East Sikkim. Various socio-economic indicators like age, sex, marital status, family size, number of living rooms, educational qualification, educational regularity, housing condition, employment status, unemployment status due to TB, family income, family expenditure etc, have been analysed using simple descriptive statistical analysis. This analysis would give an idea about the socio-economic aspect of the affected households in East Sikkim. Multicolinearity test has been conducted by applying principal component analysis for the collected primary data. In an attempt to detect whether Tuberculosis has any relation with income of the sampled families in East Sikkim the Chi-square (χ^2) test of independence of attributes have been applied. Similar attempt was made for studying the relationship between expenditure and tuberculosis of the sampled families in East Sikkim. Covariate regression model analysis has been done for studying how T.B has become socio-economic challenge and how it impacts the family income and expenditure of TB affected household in East Sikkim. Multiple regression model was applied in an attempt to study the pattern of indebtness status across the TB affected sampled families in pre and post tuberculosis phase. For understanding the diversity of TB affected families from non TB affected families the frequency, percentage and mean of socioeconomic and demographic characteristics has been measured. For understanding the factors effecting incidence of TB in the study area has been done by applying binary choice model. Given the endogenity problem of exogenous variables present study undertook an analysis of four different binary choice regression models (by excluding the co-linear type of variables in different models).

Chapter 2

LITERATURE REVIEW: A SURVEY FOR THEORETICAL UNDERSTANDING

Chapter 2

Literature Review: A Survey for Theoretical Understanding

2.1 Introduction

A balanced state of health is essential for generation of income by an individual and contributing towards the production process. To appreciate the possible ways in which disease may lead to economic costs and losses, it is necessary to start by considering what it is that people or societies value in terms of welfare (WHO, 2009). This chapter made attempts to review the theoretical foundation and review the available studies of ill-health due to tuberculosis and its social and economic impact on the affected households.

As welfare economics investigates the condition that maximizes economic welfare of the society as a whole, the theory clearly states that individual or society always seek to maximize their satisfaction level or their utility subject to a income, taste and preference, time, technology obligations. The utility is maximized by choosing the best possible combination of goods and services in a given period of time.

Health is considered to be very particular or peculiar property of an individual than any other assets which cannot be transferred. It represents valuable investments in people's capacities to learn and to work, and are sometimes essential to rescue people from poverty or prevent their impoverishment (Ruger, Jamison and Bloom 2001). Health acts as an instrument to an individual's or community's capability to undertake desired activities or functions. While the consumption of most types of goods and services yields welfare directly, the consumption of health goods and services does not. People would prefer not to incur these expenses in terms of money and time, but do so because they believe it will protect or promote their health (Blackson and Kodwo 2012). So in such context, Health or health care can be considered as a best possible combination of goods and services which an individual or society chooses in order to maximize their utility in terms of sound health which will further help them in achieving their social and economic benefits.

2.2 Impact of Disease on Household:

As per UNAIDS guidelines (2000) and WHO guidelines (2009) the incidence of a disease has negative effect on the socioeconomic status at communal or household level resulting in reduced level of livings and welfare. WHO (2009) clearly states that the prevalence of disease has two immediate potential effects on household. Firstly, an individual with poor health status may have to condense his/her normal level of productive activity (whether paid or unpaid) and, secondly, the household expenditure pattern may vary in the form of augmentation in health expenditure and decrease in the consumption of non-health goods and services, or they may try to maintain current levels of non-health consumption by liquidating household assets or resorting to loans. They may also have to cut back on other, nonmarket activities (e.g. including household production and subsequent consumption of home produced goods and services) or their investment in people, e.g., education, health and social capital formation (Steinberg et al., 2002).

2.3 Tuberculosis and Socioeconomic Status:

There exists a two way relationship between disease like tuberculosis and socioeconomic factors. Firstly, tuberculosis has serious social and economic consequences on households in the form of social and economic repercussion. Tuberculosis leads to the loss of earnings due to absence of work, rise in household expenditure due to additive burden of medical expenditure, increase in debt and loss in productivity. The social burden is in the form of marriage disqualification, ostracism by family members and the local community, and loss of housing (Cornwall, 1997). There are number of studies which indicate that TB has significant impact on socio-economic status of the society or household (WHO, 2000; Jack, 2001; Ray et al., 2005; Ukwaja et al., 2011; Gurung et al., 2012 and Blamkson et al., 2012).

A study by WHO (2000) on the Economic Impact of Tuberculosis has claimed that Tuberculosis has a significant economic impact in the society. As highest percentage of the disease occur in case of economically active population, as a result working capacity of the affected people decline. Moreover, the disease has either direct or indirect cost which is often underestimated. The affected families have to

bear the direct monetary cost as well as non-monetary cost such as mental tension hampering children's education.

Ray, et al., (2005) from their study, 'Economic burden of tuberculosis in patients attending DOT centres in Delhi', found that the Study participants (TB patients) incurred economic loss both in terms of direct and indirect costs, more so in lower socio-economic group, besides delay in attending DOT centre for treatment. And suggested that, Awareness campaign focussing on treatment availability and DOT centre could help in reducing such economic loss.

Ukwaja et al., (2011) attempted to study the economic burden of tuberculosis care for patients and households in Africa. They came up with the conclusion that the average patient's/household's pre-diagnostic costs for TB care were catastrophic and suggested that household costs for TB treatment account for a significant proportion of the expenses incurred by households.

In an attempt to study the economic impact of pulmonary tuberculosis on patients and their families of Dharan municipality (Nepal) Gurung et al., (2012) made their study with the objectives to estimate the household expenditure before and during the course of disease, to explore the direct and indirect cost burden of tuberculosis in terms of annual family income and to compare the total cost burden in a family of case treated with directly observed treatment short course (DOTS) and without DOTS. Chi Square test was carried out in categorical variables and wilcoxson rank sum test for non-parametric distribution to find out the significant association. For non-normally distributed data median and inter quartile range were calculated. The study found that the direct cost burden in terms of annual family income was higher than indirect cost burden. But, free distribution of anti tuberculosis therapy (ATT) through DOTS reduced the total cost burden of patient by more than 8 percent and they concluded that overall cost burden of pulmonary tuberculosis is high even though the treatment is free of cost.

In an attempt to study the economic burden of T.B in Ghana Blamkson et al., (2012) prepared there study with the objectives of estimating the economic burden of T.B by identifying how the disease affects household incomes and the coping strategies those households adopts, analyzing the institutional cost of the disease, estimating the probability of infection of T.B within households, and to analyze the impact of T.B and its outcome on household welfare (workdays lost due to T.B, Debt

accumulation). They concluded that T.B causes a considerable economic burden and a significant deterioration in household income impacting negatively on welfare and utilizes scarce national resources in terms of its management. The cost burden of T.B is extremely high for poor households as mentioned in the study.

On the other side of the coin, many other scholars (Karyadi et al., 2002; Gupta et al., 2004; Akhtar et al., 2006; Kaulagekar et al., 2006; Khan, et al., 2007; Maria et al., 2007; Santos et al., 2007; Tungdim et al., 2010 and Sial et al., 2012) have found that poor social and economic condition leads to the incidence of tuberculosis. The disease like tuberculosis has a maximum prevalence in a middle income or poor countries where the majority of the people have low household income, under nutrition, inadequate sewage treatment, unsafe drinking water, poor hygiene, substandard housing, low literacy, overcrowded living conditions etc.

Study by Karyadi, et al., (2002) for the urban area of Jakarta (Indonesia) found that TB patients have not only medical but also social problems associated with their illness. The study found that most of the TB patients bear poor nutritional status with crowded living condition. They suffered from joblessness and negative attitude from their relatives and neighbours.

Gupta, et al., (2004) considered socioeconomic variables such as age, level of education, crowding, type of housing, water supply and number of consuming articles in multivariate logistic regression analysis to perceive the association of such variables with higher threat of TB. There was significant association of a higher risk of TB with the socioeconomic variables as found in the study.

The study by Khan, et al., (2007) has found that, socio-demographic factors such as poverty, poor housing, overcrowding, under nutrition, smoking, and consumption of raw milk and lack of health education were the major contributing factors for the incidence of tuberculosis among the patients admitted in the chest ward of DHQ hospital, Sahiwal (Pakistan).

Maria, et al., (2007) from their study concluded that the prevalence of disease like tuberculosis is at higher degree in socio-economically deprived areas of Brazil. The main objective of the study was to evaluate the epidemiological status of TB regarding the socio-economic factors. They considered socio-economic factors on the

basis of schooling, income, and family size in measuring the incidence of TB in the study area.

In an attempt to evaluate the epidemiological status of T.B Santos et al., (2007) found that socio-economic characteristics of Sao Jose do Rio Preto (Brazil) for a period of 6 years (between 1998 and 2004). The study included socio-economic variables such as average years of schooling of people from each household; average years of schooling of the women from each household; average income of people from each household; average income of the women from each household; rate of illiterate people over 5 years of age; rate of illiterate women over 5 years of age; rate of households with more than 5 inhabitants were analyzed by using principal component analysis and statistical technique to see the representation of important aspects characterized by the correlation between variables. The findings of this study confirmed that the pattern of T.B morbidity in the population of Rio was influenced by living conditions of the people between1998-2004.

Gender differentials in tuberculosis were studied by Tungdim et al., (2010) by analyzing the impact of socio-economic and cultural factors among the tribal of Northeast India (case study of Manipur) tried to understand the gender differentials amongst tuberculosis patients on their socioeconomic and cultural aspect. The lesser number of TB patients among females as compared to males reporting to the TB centres is clearly a case of gender difference in reporting and diagnosis of the disease. The study stated that female subjects belonged to lower socio-economic status and were less educated. Both these factors i.e. poor living conditions combined with lesser awareness levels predisposes them towards tuberculosis as well as binds them to social stigma.

A study for Sargodha district of Pakistan by Sial, et al., (2012) found existence of relationship between some important socio economic factors such as schooling, monthly income, crowding, family system, and marital status affecting the likelihood of incidence of tuberculosis. Socioeconomic factors were found to be statistically significant in logistic regression model estimation and were observed to be contributing factors for the incidence of tuberculosis in the study area.

While a study by Jackson et al., (2006) claimed that poverty is strongly associated with TB incidence even after controlling for smoking and other risk factors. Excluding income losses, direct out-of-pocket treatment costs (medical and

non-medical) accounted for 55.5 per cent of average annual household income, and most TB cases fell into heavy debt. The DOTS cure rate was very satisfactory in China. When DOTS was incomplete or not done, mortality was high. Poverty is both a cause and a devastating outcome of TB. Ongoing poverty reduction schemes in China must also include reducing TB. Patients badly need financial help because of income loss and debts due to TB illness. There are negative externalities with risks of transmission to others, especially those who are already poor. More government Intervention is warranted, particularly now that more financial assistance is affordable in the present situation of China's economic growth. As poverty is both an important cause and a devastating consequence of TB, control of this disease will help alleviate poverty in China.

Based on this theoretical framework/argument/literature review, the present study made an attempt to study whether tuberculosis deteriorates socio-economic status of the household or poor socioeconomic status leads to the prevalence of TB in East Sikkim.

Chapter 3

ROLE OF PUBLIC POLICY IN CONTROLLING TUBERCULOSIS IN NORTH EAST INDIA IN GENERAL AND SIKKIM IN PARTICULAR

Chapter 3

Role of Public Policy in Controlling Tuberculosis in North East India in general and Sikkim in particular

3.1 Introduction

With the objective of coverage and control, public health attempt to avert disease, endorse health, and protract life among the entire population. Public health services helps in generation of public goods of immeasurable benefit for facilitating economic growth and poverty reduction. The Government initiative for draining the malarial swamps of Washington D.C has helped the long term growth possibilities. In opposition, the poor poultry keeping and health practices in a few Chinese localities has charged global economic cost through the spread of avain flu and SARS (severe acute respiratory syndrome). Estimates of WHO (2000) reveals that poor municipal sanitation in Surat (India) due to outbreak of plague during 1994 has resulted a loss up to 2 billion U.S dollar. Poor public health services have been a factor of economic losses (reducing attractions of investors, tourist and also labour productivity loss) not only in underdeveloped countries in but also in some developing and developed economies (Gupta, 2010).The Government plays a vital role in formulation of a efficient health policy and its implementation for effective capacity to prevent the epidemics of diseases. A study by Lakshminarayanan (2011) mentioned that the practice of public health has been vibrant in India along with many hurdles in its attempt to affect the lives of the people. Since independence, major public health problems like malaria, tuberculosis, leprosy, high maternal and child mortality and lately, human immunodeficiency virus (HIV) have been addressed through a intensive act of the Government. Social development coupled with scientific advances and health care has led to a decrease in the mortality rates and birth rates.

RNTCP in India was introduced as a revised strategy of NTP by Government of India for controlling the epidemics of tuberculosis in October 1993. Most of the states and Union Territories have been covered up under RNTCP by March 2006 with positive result outcomes. Sikkim was brought under the umbrella of RNTCP in the year 2002 by State TB cell of Sikkim (Department of Health Care, Human Services and Family Welfare, Government of Sikkim) with full coverage of all four districts. Present chapter made an attempt to study the success of public policy in controlling

the epidemics of Tuberculosis in Northeastern states in general and Sikkim in particular.

3.2 Status of Tuberculosis cases and RNTCP in Northeast India (2003-2011)

The tuberculosis scenario of North Eastern states of India for the registered cases of patient under RNTCP has been explained in the following table.

Table: 3.1

Descriptive Statistics and Compound Annual Growth Rate on TB in Northeast India (2003-2011)

States	Descriptive Statistics/ Growth	Population Covered By RNTCP	Annual New Smear Positive Detection Rate	Total No. of Regd. Cases	Cured	Completed	Died	Failure	Defaulted	Transferred Out
Arunachal Pradesh	Mean	11.88889	66.33333	815.7778	709.5556	12.44444	22.3333	28.22222	37.44444	5.777778
	C.V	2.803735	8.886804	8.208852	7.114029	46.18111	31.9765	22.11218	25.61959	76.31975
	CAGR (in percentage)	0.5801 (0.1269)	-0.4822 (0.6943)	0.7864 (0.4953)	0.6433 (0.5198)	-1.3731 (0.8625)	-0.3168 (0.945)	1.896 (0.5269)	3.2744 (0.3958)	9.9602 (0.1215)
Assam	Mean	274.5556	53.55556	13575.22	11080.44	387.2222	598.444	272.1111	1146	91
	C.V	22.8267	17.59331	32.35539	33.8388	49.55715	26.0689	30.66533	35.70799	35.83665
	CAGR (in percentage)	7.508*** (0.0768)	2.3107 (0.3095)	13.5944** (0.0155)	13.881** (0.0173)	17.7903** (0.0296)	8.683** (0.045)	9.70*** (0.069)	13.8795** (0.0177)	9.7114*** (0.0673)
Manipur	Mean	25.66667	44.11111	1147	965.3333	9.111111	37.5555	28.55556	101.3333	5.111111
	C.V	4.355976	14.97099	13.48339	14.55151	66.8622	30.5955	15.57392	15.43076	82.10659
	CAGR (in percentage)	-0.6724 (0.2624)	-3.1319*** (0.0822)	-2.848*** (0.0834)	-3.128*** (0.079)	9.7564*** (0.0666)	-2.5963 (0.506)	1.3548 (0.5485)	-3.3941 (0.1027)	-7.2464 (0.46)
Meghalaya	Mean	25.5	55.375	1447.875	1163.25	28.25	59.875	83.625	97.375	15.5
	C.V	2.096165	17.21167	14.89846	16.66486	59.34581	13.9573	6.293262	25.00466	57.70498
	CAGR (in percentage)	0.7297** (0.0318)	4.9073** (0.0212)	15.3499** (0.0303)	16.394** (0.0253)	19.8156 (0.1576)	13.044*** (0.096)	10.3408 (0.141)	9.3469*** (0.0801)	21.9717** (0.0251)
Mizoram	Mean	9.888889	61.22222	571.8889	514.1111	6.222222	14.77778	16.88889	18.33333	1.555556
	C.V	3.370783	18.16628	18.14041	19.12035	97.02198	55.15948	43.35371	49.16662	116.3869
	CAGR (in percentage)	0.7024 (0.1269)	-3.4489 (0.1464)	-1.5617 (0.5278)	-0.6823 (0.7934)	11.5781 (0.3467)	-22.08*** (0.080)	-15.262*** (0.0797)	-23.38*** (0.0782)	-3.4055 (0.6861)
Nagaland	Mean	21.88889	49.88889	1076.333	959.1111	9.333333	25.22222	34.44444	46	2.222222
	C.V	6.2325	20.18051	23.32034	25.01549	70.66557	20.48458	25.4803	25.92796	89.37284
	CAGR (in percentage)	0.5426 (0.5478)	7.2577* (0.0001)	8.6343* (0.0002)	9.3027* (0.0003)	6.0736 (0.445)	4.0998 (0.1718)	6.9613** (0.0171)	0.5638 (0.8742)	-3.7803 (0.6457)
Sikkim	Mean	6	83.55556	495.4444	425.8889	0.555556	14.44444	42.66667	8.555556	3.333333
	C V	0	5.835932	6.788748	7.8338	182.4828	18.67664	27.43289	37.47152	58.09477
	CAGR (in percentage)	0.0000** (0.0331)	-0.7007 (0.3824)	-0.4799 (0.6169)	-1.4174 (0.1596)	-10.789 (0.1924)	2.0997 (0.4328)	8.4984* (0.0054)	-6.0672 (0.3741)	12.9147*** (0.0612)

Tripura	Mean	33.33333	36.04889	1234.691	1074.568	25.55556	53.08556	29.38222	46.41889	5.678889
	C.V	11.90588	31.66888	35.26426	36.4702	49.30712	34.75565	32.98066	40.8203	97.222
	CAGR (in percentage)	3.4816** (0.03)	11.2248*** (0.0852)	12.708*** (0.0519)	13.152*** (0.0527)	-7.4002 (0.2475)	13.1991*** (0.09)	10.4028** (0.0161)	13.0527** (0.0339)	20.1025 (0.1741)
All India	Mean	10809.78	52.66667	554487.1	468710.8	13124	23990.67	11628.56	33184	3849.111
	C.V	12.57585	3.288704	17.16705	17.34596	32.94701	15.84217	12.52005	12.48499	54.43208
	CAGR (in percentage)	4.2536* (0.0052)	0.6364 (0.1475)	6.2845* (0.0011)	6.3935* (0.0007)	13.5432* (0.0019)	5.1073* (0.0096)	3.6999** (0.0209)	2.5501 (0.1907)	14.4304** (0.0198)

Source: Own estimation based on the data compiled from RNTCP Annual Status Report (2003-2011)
Note: C.V = Coefficient of Variation; CAGR = Compound Annual Growth Rate; RNTCP = Revised National Tuberculosis control Programme
Note: *** significant at .10 percent level, ** significant at .05 percent level, * significant at .01 percent level
Figures in the parenthesis are the p-value of the respective estimates

Amongst the Northeastern states the average number of population covered by RNTCP recorded to be highest in Assam with the coverage of 274.55 lakhs population on an average, and it was found to be smallest in Sikkim with an average of 6 lakhs. The total population size of these states may be one of the reasons for such difference in average number of patients covered by RNTCP. Again, taking into account the annual new smear positive detection rate, on an average it was found to be highest in Sikkim (83.55 per lakh on an average) followed by Arunachal Pradesh in the second position. The average annual new smear positive detection rate has been recorded to be smallest in Tripura (36.04 per lakh on an average). The total number of registered cases on an average has been observed to be largest in Assam with an average value of 13575.22 and it was lowest in Sikkim with an average value of 495.44 during 2003-2011. The average number of cured cases of TB affected patient has been recorded to be again highest in Assam (11080.44 on an average) and it was lowest in Sikkim (425.88) during the period under observation. The average number of patients completing the period of treatment was found to be highest in Assam, while it was smallest in Sikkim. The average number of patient died post registration under RNTCP/DOTS also recorded to be largest in Assam and it was smallest in Sikkim. The average number of failure cases of the registered TB patients was also highest in Assam and was found to be smallest in Mizoram amongst the other Northeastern states during 2003-2011. In Sikkim the average number of failure cases was recorded as 42.66 during the period under observation. The average number of defaulted cases also recorded to be highest in Assam and was recorded lowest in

Sikkim in the period of study. The average number of transferred out cases of TB registered patients was found to be highest in Assam and it was lowest in Mizoram (Refer to Table 3.1).

Thus from the above analysis we can understand that Assam is leading state in terms of number of registered cases of new smear positive TB under RNTCP/DOTS, population covered under RNTCP, cured cases, death cases, completed cases, failure cases, defaulted cases and also transferred out cases. In all these respects except failure and transferred out cases the average of Sikkim was smallest amongst the Northeastern states of India. Interesting to observe that the number of detection rate has been recorded to be highest in Sikkim while comparing with other Northeastern states and it was even higher than the national average. Hence, in a small population size of Sikkim we can understand that the burden of TB is not ignorable when compared with other Northeastern states and the country on an average.

Sikkim is the most consistent state in terms of total number of registered cases of TB patients, annual new smear positive detection rate and the population covered by RNTCP amongst the other Northeastern states which is explained by the respective minimum C.V values of the mentioned variables (Table 3.1). Arunachal Pradesh has been found to be most consistent in terms of number of TB patients cured (C.V = 7.11) and patients completing the period of treatment (C.V= 46.18). In case of number of patients died and failure cases, the consistency of Meghalaya was highest. Whereas, in case of defaulted cases the Manipur was found to be most consistent amongst all the states of Northeast India. Assam has been observed to be most consistent with the C.V value of 35.83 in transferred out cases in the Northeastern region of India during the period of 2003-2011.

Hence, we can understand that Sikkim has larger detection rate and the registered cases, indicating the consistent degree of TB prevalence in the state than any other Northeastern states. The Governmental health policy of RNTCP has also been found to be most consistent in Sikkim in terms of population coverage under RNTCP.

While comparing the growth rate for different cases of TB as mentioned in Table 3.1, it has been observed that Assam has registered maximum growth in the number of population covered by RNTCP (7.5 per cent per annum) and defaulted cases of TB

patients (13.87 per cent per annum), whereas annual new smear positive detection rate, death cases and failure cases has been found to be growing at a highest rate in Tripura annually with the growth rate of 11.22 per cent, per cent, 13.19 per cent 10.40 per cent respectively. Again, the total number of registered cases, cured cases, completed cases and transferred out cases has recorded a highest growth in Meghalaya than any other Northeastern states during the period of 2003-2011. Population covered by RNTCP, total number of registered cases, cured cases and the transferred out cases has been found to be lowest in Manipur. Mizoram has recorded minimum growth in case of annual new smear positive cases, died cases, failure cases and defaulted cases amongst other Northeastern states. Sikkim has recorded minimum growth of -10.78 per cent per annum in terms of number of completed cases during the period of study (Refer to Table 3.1).

Normally the cure rate of TB depends largely on completion of treatment course, but disappointing to observe that the growth rate of completing the course of treatment has been found to be smallest in Sikkim which indicates that the patient registered for treatment leaves the course of treatment during the progressing phase of treatment which is not desirable for preventing the epidemics of the disease in the state. Likewise the negative growths in cured cases and positive growths in death cases, failure cases and transferred out cases reveals that the public policy of health care through RNTCP measures have been less successful producing desirable result. On contrast, variables such as annual new smear positive detection rate and defaulted cases has recorded negative growths despite of bearing highest detection rate by the state during the period of 2003-2011.

3.3 Inter State Recovery Rate of Registered TB Cases

Normally the cured rate of TB depends upon various factors such as registration for treatment; completing the course of the treatment. The study anticipates registration for treatment to be positively related with the cure rate. As registration for treatment increases more will be the probability of cure rate to increase. So, in an attempt to study the cured rate of registered TB patient in eight North Eastern states of India out of the total number of registered cases of TB patient during 2003-2011, following fixed effect model has been fitted.

$$Y_{it} = \alpha + \beta X_{it} + U_{it} \qquad \text{(i)}$$

Y_{it} is the number of patient cured in ith states (8) during time period (2003-2011)

X_{it} is the total number of registered cases of TB patient in 8 states during time period (2003-2011)

U_{it} is the well behaved error term

The resulted estimated for the fitted model being presented in Table 3.2 as follows;

Table: 3.2

Cure Rate of TB Registered Cases

Endogenous Variable: Number of TB Patient Cured in Eight different North Eastern States of India	
Exogenous Variable Estimated	Fixed Effect Estimator
Constant Intercept	31.75214 (0.1594)
Total number of Registered Cases	0.817044* (0.0000)
R^2	0.998
DW	0.962914

Source: Self Estimates based on the Data compiled from (RNTCP Report, Various Issues)

Figures in the parenthesis are the respective p-values of the estimates

Note: * significant at 0.01 percent level

Refer to Table 3.2 it can be observed that a percentage change, on an average, in total number of registered cases of TB patient in the eight North Eastern states has increased the cured rate by .82 per cent annually during the nine years period of the study (2003-2011).Thus we can understand that RNTCP measures of Government has been successful to some extent in curing the number of registered TB patient in the region for the study period. The regression line has been observed to be good fit in terms of the value of R^2.

The study anticipates that deaths due to tuberculosis can be controlled through proper treatment which is possible through registration under RNTCP. So, in an attempt to study the success of RNTCP in minimizing the number of deaths due to TB in eight North Eastern states of India during 2003-2011, following regression models was fitted.

$$Z_{it} = \gamma + \theta X_{it} + U_{it} \qquad \text{(ii)}$$

Z_{it} is the number of patient death rate in ith states (8) during time period (2003-2011)

X_{it} is the total number of registered cases of TB patient in 8 states during time period (2003-2011)

The estimated model is presented in Table 3.3 as follows;

Table: 3.3

Death Rate of TB Registered Cases

Endogenous Variable: Number of TB Patient Died in Eight different North Eastern States of India	
Exogenous Variable Estimated	Fixed Effect Estimator
Constant Intercept	-7.864398** (0.0235)
Total number of Registered Cases	0.043649* (0.0000)
R^2	0.984031
DW	1.123320

Source: Self Estimates based on the Data compiled from (RNTCP Report, Various Issues)
Figures in the parenthesis are the respective p-values of the estimates
Note: * significant at 0.01 percent level, ** significant at 0.05 percent level

Refer to Table 3.3 it can be observed that a percentage change, on an average, in total number of registered cases of TB patient has increased the death rate by 0.04 per cent annually during the nine years period of the study in the eight North Eastern states. The regression line has been observed to be good fit in terms of the value of R^2.

Hence, the cure rate of TB is more influenced by the number of registered cases than that of the death rate which explicates that the public health policy for curing the registered cases through RNTCP has been successful, although there is some percentage of failure in terms of death rate.

3.3.1 Cured rate and Death Rate of TB Cases Post Registration under RNTCP (Sikkim)

In a small state like Sikkim where we have seen the number of detection being high (refer to Table 3.1) it is important to understand whether public policy has made some progress in minimizing the burden of TB in the state. The study anticipates positive relation of total number of registered cases of TB with cured rate and negative association with death rate in Sikkim. Following simple regression models has been fitted for understanding the success of public policy such as RNTCP in curing the number of TB patient in Sikkim and also to understand the epidemic influence of TB in Sikkim.

$$CR_t = a + b\,TRC_t + U_t \qquad (iii)$$

$$DR_t = a + b\,TRC_t + U_t \qquad (iv)$$

Where,

DR is number of death due to TB in Sikkim

CR is number of cured TB patient in Sikkim

TRC is total number of registered cases of TB patient in Sikkim

t is time period under consideration (2003-2011)

The result obtained from application of OLS to the fitted model in equation being presented in the following Table.

Table: 3.4

Cured rate and Death rate of Registered Cases in Sikkim (2003- 2011)

Intercept/ Constant/ Variable	Endogenous Variable: Number of TB Patient Cured in Sikkim	Endogenous Variable: Number of TB Patient Died in Sikkim
Constant Intercept	-23.85657 (0.7598)	-14.52724 (0.2013)
Total number of Registered Cases	0.907762* (0.0005)	0.058476** (0.0258)
R^2	0.837480	0.531530
DW	1.053921	1.813799

Source: Self Estimates based on the Data compiled from RNTCP Report (Various Issues)
Figures in the parenthesis are the respective p-values of the estimates
Note: * significant at 0.01 percent level, ** significant at 0.05 percent level

Refer to Table 3.4; it can be observed that one percent change, on an average, in number of registered cases has helped .90 per cent increase in cured rate of TB affected patient in Sikkim during 2003-2011. This result is also in line with the study by Tiwari et al. (2008) which found that with the inception of RNTCP measures has been successful in increasing the cure rate and case detection rate in Sikkim. Such, increasing rate reflects the success rate of RNTCP on curing TB patients in Sikkim. The regression line has also been observed to be fit. About 83 percent variation in the model is explained. The result from the estimate of total number of registered cases on number of death reveals that a percentage increase, on an average, in number of registered cases has increased the number of death of TB patients in Sikkim by 0.05 per cent. About 53 per cent variation in the model is explained and rest 47 percent remains unexplained. Hence it implies that the cure rate of TB is more influenced by the number of registered cases than that of the death rate. Hence public policy like RNTCP has been helpful in minimizing the prevalence of TB in Sikkim although there has been some record of number of death cases in the state registered under the program.

The results from all the above analysis holds a similar conclusion with the report of Civil Society Perspective of TB Care and Control in India: Challenges & Solutions (2011) which stated that, India has been so far successful in improving access to Tuberculosis detection and treatment across the country with its Revised National Tuberculosis Control Programme (RNTCP), based on DOTS strategy which

is being implemented through the general health system of the states under the umbrella of National Rural Health mission (NRHM). The Programme is implementing all components of WHO Stop TB Strategy 2006 and has made great strides in achieving global targets for new smear positive case detection (NSP CDR) (70percent) and treatment success (85 per cent), as per the Millennium Development Goals (MDGs) and the related Stop TB Partnership's Global Plan (2006-2015). The RNTCP has been one of the successful Public health Programs in India with a high detection and cure rate[7].

Similarly the study by Sandhu (2011) stated that India's DOTS program is the fastest-expanding and the largest program in the world in terms of patients initiated on treatment; and the second largest, in terms of population coverage. Likewise, according to Annual report on Health, Ministry of Health, Government of India (2011) RNTCP Programme has achieved and sustained its twin objectives of Case Detection and Treatment Success Rate amongst the New Smear Positive TB cases. In between 1995-2008, a cumulative total of 36 million TB cases were successfully treated in DOTS programs, and up to 6 million deaths were averted worldwide. The treatment success rate (i.e. 86 per cent) achieved in DOTS cohorts worldwide exceeded the global target of 85 per cent for the first time in 2007[8]. Directly Observed Treatment Short Course (DOTS) is one of the most cost-effective strategies available for the tuberculosis control in South Asian region (Joshi et al. 2009).

The Governmental policies in public health services have remained key in the process of Human Resource Development in major economies of the world including India. The role of RNTCP/DOTS in minimizing the epidemics of Tuberculosis is not ignorable in this respect. Although there still prevails a multidimensional challenge of caring and controlling Tuberculosis globally as well as in India but RNTCP has made some progress in minimizing the number of death cases for the registered cases by offering proper treatment to the affected population as observed from the present study.

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[7] CIVIL SOCIETY PERSPECTIVE OF TB CARE AND CONTROL IN INDIA: Challenges & Solutions (2011)

[8] Geneva: WHO; 2006. [Last cited on 2010 Oct 15]. World Health Organization. THE GLOBAL PLAN TO STOP TB 2006-2015: PART I Strategic directions. Available from:http://www.searo.who.int/LinkFiles/TB_Day_Kit_The_Global_Plan_to_Stop_TB_2006-2015.pdf . [Ref list]

Chapter 4

SOCIAL AND ECONOMIC CHALLENGES FROM TUBERCULOSIS (EAST SIKKIM)

Chapter 4

Social and Economic Challenges from Tuberculosis in East Sikkim

4. 1 Introduction

Socio economic condition measures the economic and social position of an individual or family relative to those of others based on income, education, occupation, health (physical and mental) and other socioeconomic parameters. A society which is socially secure [9] and economically nondiscriminatory helps in promotion of economic welfare and overall development (Kar, 2009). A minimum state of health (disease free) is important for physical and mental development of a human being in a society. If a person is in a healthy state then he can contribute to the social and economic upliftment of his/her own and the society. Emergence of any disease (Chronic disease like HIV/AIDS, Tuberculosis, and Cancer etc) can be a major threat for the normal livelihood of the person and the family. HIV/AIDS, Cancer, Tuberculosis etc has remained a major threat during last few decades in maintenance of healthy state in the global context. Tuberculosis has remained a major threat for normal livelihood of many countries of the world (Sub Saharan African countries, South Asian countries) including India. Though the severity of Tuberculosis on number of death has dropped over the years after introduction of DOTS/RNTCP measures in India, but still the number of affected is not ignorable in some states of India especially Sikkim. Amongst the northeastern states the detection rate of Tuberculosis has been recorded to be highest in Sikkim (Report of State TB cell 2012) even higher than national average.

Universal access to quality diagnosis and treatment, and reducing the human suffering and socio-economic burden associated with TB, are key objectives of the current Stop TB strategy[10]. The 2005 WHO report 'addressing poverty in TB control' lists four different kinds of barriers associated with accessing TB care: geographical, social/cultural, health system and economic barriers. Economic barriers may come from administrative charges, transport, accommodation and subsistence costs, and lost

[9] Security in the form of compensation for poor, unemployed, sick and aged people from Government.

[10] World Health Organization. Addressing poverty in TB control. WHO report 2005. WHO/HTM/TB/2005.352. Geneva, Switzerland: WHO, 2005. http://whqlibdoc.who.int/hq/2005/ WHO_HTM_TB_2005.352.pdf Accessed January 2012.

income, productivity and time[11]. Tuberculosis has resulted in huge social and economic losses as it leads a family towards a circle of socioeconomic burden. A study by Muniyandi et al., (2006) found that TB affected patient could not send their children to school due to loss of income. TB in mother affects routine of household activities and loss of earnings outside. Economic loss due to TB in parents necessitated their children to take up employment. Study clearly shows TB causes low productivity and increase in debt. Numbers of studies have been undertaken so far for understanding socio-economic burden of Tuberculosis. Present chapter has made an attempt to study the relationship between Tuberculosis and different socio-economic variables for the sampled household of East Sikkim.

4.2 Descriptive Statistics on Socio-Economic Parameter of Tuberculosis affected Households

In an attempt to study the average distributional pattern of different surveyed families the results drawn from 100 families being presented in Table 4.1. The average age of the respondents/patients in the surveyed TB affected families has been observed to be ranging in 29 to 30 years which is a productive age group. Since majority of respondent falls in the productive age group (that is 18 to 54 years) so they remain jobless during the period of the disease which became a constraint in the income generation process of the individual and the families. Due to the communicability disease like TB the affected person should stay separately in a single room as per recommendations of medical science. However, it becomes difficult for families where the family size is large which increases the dependency ratio. The average family size of the TB affected families in the present study has been observed to be 5.Since the average number of living rooms in the sampled families has been observed to be 3 hence there has been need for sharing of room for the affected families in the study area, which is medically undesirable.

From the present study it has been observed that the patient suffering from Tuberculosis remain jobless on an average for 4 to 5 months (almost half of the year) during the year in the study area which results loss of labor productivity there by creating manpower shortage(loss of man days of work) for the economy. Sound health infrastructure (Health centre, Hospitals, DOTs centre, proper ambulatory

[11] The Stop TB strategy: building on and enhancing DOTS to meet the TB-related millennium development goals. WHO/HTM/TB/2006.368. Geneva, Switzerland: WHO, 2006.

services etc) is an essential condition for maintenance disease free society. In the case of disease like Tuberculosis, availability of health service centre in locality helps in minimization of this disease to large extends. The distance of health service centre is an important parameter in easy accessibility to health facilities. The average distance of nearest health service centre from the surveyed TB affected families of East Sikkim has been found to be 4 to 5 kilometers which is less agreeable as the patient have to budge in a state of ill health. However there has been an observation that accredited social health activists (ASHA) have been initiated under NRHM scheme in rural areas to provide TB medicines to the patients at door steps. Food and health have some colinearity; proper food in proper time helps for the maintenance of a balanced health.

Table: 4.1

Descriptive Statistics for Socio-economic and Demographic variables of TB affected Households

Variables	Mean	Std. Deviation	Range
Age	29.09	13.028	73
Number of Family member	4.85	2.027	9
No. of living rooms in the house	3.11	2.150	9
No. of months patient remained jobless/workless	4.82	3.115	17
Distance of nearest health service centre	4.32	4.000	18
How many times do you eat in a day?	2.79	.409	1
Sleeping/Resting duration	9.09	1.342	8
No. of times free medical camps organized in a locality (yearly)	1.16	1.496	6
Premium paid for insurance (Yearly)	2760.00	9595.664	74400
Family expenditure on cereals and pulses (monthly)	2415.00	1885.370	16000
Family expenditure on vegetables and fruits (monthly)	1625.00	932.616	5000
Expenditure on education (monthly)	1239.00	1370.313	7000
Medical expenses (monthly)	1705.00	1183.163	7000
Family Expenditure on beedi, cigarette, alcohol, intoxicants (monthly)	188.00	365.709	2000
Monthly Family Income pre T.B	15900.00	14573.268	92000
Monthly Family income (post T.B)	15400.00	13926.771	92000
Total Monthly Family expenditure (pre T.B)	8285.00	5853.539	28500
Total Monthly Family expenditure (post T.B)	11500.00	7779.259	43000

Source: Self estimates based on the data compiled from Household Survey of T.B patients (East Sikkim) January –March, 2014

Present study observed that on an average the TB affected individual consumes 2 to 3 times in a day which can be understood as a better average. There is need for proper rest for maintenance of disease free state of health, on an average the patient use to rest for 9 hours in the study area. Frequent health awareness programmes and free medical camps especially in rural areas also play crucial role in creating awareness among the peoples and creating a disease free society with an equal opportunity to all in achieving a sound health. In such schemes, beneficiaries will mostly be the economically marginalized ones'. The result in this context is found to be less impressive in East Sikkim as the number of times free medical camps organized in a locality of respondents is observed to be once in a year on an average. Under the context of health economics, insurance related to health is considered as an important factor in determining individual's concern and awareness towards his/her health. In the study area of East Sikkim, such awareness and concerns were not discovered among the TB patients/respondents as none of the respondents were found under health insurance schemes. The respondents were mostly having insurances on their assets, life insurance etc. and the average amount of premium paid under such insurance policy is Rupees 2,760 yearly. Monthly average family expenditure on cereals and pulses of respondents is found to be Rupees 2,415 the study area. An average family expenditure on vegetables and fruits is obtained Rupees 1,625. The monthly expenditure on education is observed to be Rupees 1,239 on an average. Though the TB medicines are of no cost but still there arise lots of other medical expenses if someone gets infected with TB. The average medical expenses of respondents are observed Rupees 1,705 (monthly). The monthly family expenditure of respondents on beedi, cigarette, alcohol, intoxicants etc. is found just around Rupees 200 on an average in East Sikkim.

The interesting result is obtained as the average family income post TB is found to be slightly lower than the pre TB family income of the respondents. The fall in the family income is may be due the loss of works/jobs during the period of illness. The average family income of respondents/patients pre TB is Rupees 15,900.

In present day scenario of high inflation, it is very hard and challenging for low income groups of our society in maintaining their family day to day expenses. In such case if such families get trapped into some disease then there will be an additive challenge and burden in maintaining their livelihoods. The information related to

family expenditure before and after disease (Tuberculosis) has been obtained in order to observe the effect of disease in the family expenditure of the respondents/patients. So, the average family expenditure of the patients before disease was observed Rupees 8,285 (monthly). Whereas, after the intrusion of disease (Tuberculosis) the burden in terms of family expenditure has advanced to Rupees 11,500 (monthly) on an average. This is a clear indication of loss in income due to rise in expenditure as a result of tuberculosis which specifically affects the low and middle income families in the society.

Refer to Table 4.2 it has been observed that average literacy in terms of educational attainment of TB affected patient in the study area was 8^{th} to 10^{th} standard of educational level. Which is high school level standard, hence the affected patient on an average has not completed or attended higher educational level. Regarding the nature of occupation it reveals that on an average the majority of TB affected patient were engaged in private service for their livelihood with a work status of daily wage on an average. From the study it was discovered that the average respondents/patients were having a nuclear family type. On an average, the respondents or TB affected patients from East Sikkim resides in a rented semi pucca houses and they rely on rivers, ponds, streams etc for drinking water sources. Maximum number of TB patient has their toilet facility outside their house and the type of toilet they use is septic tank latrine. But, in some of the remote places there has been an observation that the respondents don't have proper toilet facilities as they go into the jungle and in some cases the patient shares their toilet with their neighbors in their locality. Proper drainage system was found to be maintained by majority of the families in study area but again some families were found not having a proper drainage system in their houses (Refer to Table 4.2).

Such low socio-economic settings may contribute towards an impetus for the prevalence of the disease like Tuberculosis as some of the studies by Akhtar et al., (2006), Santos et al., (2007), Tungdim et al., (2010) has claimed that prevalence of Tuberculosis is highly supported by low socio-economic status and poor living condition.

There has been an interesting observation that the majority of the patients were observed to be addicted in smoking and alcohol drinking, though the habit has not

been actively practiced after the disease. Likewise, there was an attempt to extract the information related to types of Tuberculosis that is predominant among the respondents. The result revealed that, a pulmonary tuberculosis case which affects the lungs particularly is found to be predominant than the extra pulmonary tuberculosis cases among the respondents of East Sikkim. The regularity of the patient (students) in attendance has dropped on an average from 1.42 pre T.B to 1.23 post T.B in the study area.

Table: 4.2

Descriptive Statistics for Qualitative, Socio-economic and Demographic variables of TB affected Households

Variables	Mean	Std. Deviation	Mean Code
Educational Qualification	2.78	1.440	8 to 10th Standard
Occupation	1.48	1.660	Private Service
Work Status	1.88	.879	Daily wage
Type of family	1.60	.492	Nuclear Family
Housing status	2.46	1.071	Rented
Type of House	3.34	.714	Semi Pucca
Source of Drinking water	8.95	3.852	Stream, River, ponds
Toilet facility	1.65	.479	Outside house
Toilet Type	1.28	1.910	Septic tank latrine
Proper Drainage facility	1.36	.732	Yes
Addictions (if any)	2.68	1.563	Cigarette
Type of T.B	1.26	.441	Pulmonary
Education hampered after T.B	1.72	.451	No
Regularity in education (pre T.B)	1.42	.496	Yes
Regularity in education (post T.B)	1.23	.423	Yes
Nature of medical service centre in locality	1.78	1.142	Hospital
Condition of road in locality	1.69	.465	Clear
Use of mask in dusty and public places	1.58	.496	No
Pollution affecting health in locality	3.70	1.661	Others (Dust, Local garbage)
Did you used to go for morning walk/ exercise/ yoga (pre T.B)	1.88	.327	No
Regular morning breakfast	1.09	.288	Yes
Regular lunch	1.11	.314	No
Did you used to go for evening walk/ recreation/ exercise/ yoga (pre T.B)	1.86	.349	No
Regular dinner	1.03	.171	Yes
Govt. provided Health identity card	1.91	.570	No
Medical benefit provided by the employer	1.98	.141	No
Shortage of ambulance in emergency situation	1.26	.441	Yes
Smoking habit	2.07	.637	Occasional
Alcohol drinking habit	2.07	.604	Occasional
Result of treatment from RNTCP/DOTS	1.05	.219	Positive
Insurance	1.88	.327	No

Source: Self estimates based on the data compiled from Household Survey of T.B patients (East Sikkim) January –March, 2014

Present study observed that some of the respondents specifically the students who were under the treatment of tuberculosis have mentioned that their educational regularity has been hampered by the disease. It's because of the disease that they are no more regular in their schoolings, colleges and other formal institutions. This implies that Tuberculosis has directly affected the educational career of those students who have been suffering from this disease. However, in some of the families the study of children's has been unaffected by prevalence of parental or family member's Tuberculosis.

The nature of health service centre that most of the respondents have in locality is hospital. Here again in some of the localities there is no such availability of heath or medical service centre according to some of the responses of the surveyed families. There has been an observation of low awareness among the respondents/patients about the transitional nature of this particular disease. The patients' habit of wearing the masks in public places other than in DOTs centre were observed and the observation revealed that majority of the patients don't use their masks in crowd, public places, dusty areas etc. The health consciousness among the respondents were also low as they don't have a habit to go for regular morning and evening exercises, yoga, recreations etc. Majority of the patients were not having a habit to go for morning and evening exercises, yogas etc before disease. On an average most of the patients used to take their regular breakfast and dinner but they were irregular in their lunch before being suffering by tuberculosis.

Although the major section of the respondents doesn't have the Government provided health identity card, neither are they benefitted by the employer in terms of medical benefits and also there is a poor ambulatory medical services in the locality however it has been observed positive outcome of treatment from RNTCP/DOTS indicating the success of the program in helping the TB affected people in the study area. The effectiveness of DOTS in curing the disease has been stated by Rahman (2010) in his study. The study states that Directly Observed Treatment Short course (DOTS) is very important strategy for providing anti TB treatment to sputum positive TB cases and has already been proved with a high cure rate. DOTS strategy is designed to enhance strict adherence to anti-TB treatment as well as to increase treatment success rate.

4.3 Income and Expenditure Relationship Tuberculosis

In an attempt to detect whether Tuberculosis has any relation with income of the TB affected sampled families in East Sikkim the Chi-square (χ^2) test of independence of attributes have been applied. Similar attempt was made for studying the relationship between expenditure and Tuberculosis of the TB affected sampled families in East Sikkim.Under the null hypothesis of independence of attributes, the statistic given by

$$\chi^2 = \sum_i \left(\frac{(E_i - E_0)^2}{E_0} \right) \qquad (i)$$

follows Chi-Square distribution with (r-1) (c-1) degrees of freedom, where E_i is the observed frequencies, E_0, the product of the sum of row i and the sum of column j divided by total number of observation, is the expected frequencies, and r and c are the number of rows and columns respectively.

The Hypothesis fitted for studying the independence of attribute between incidence of TB and income, expenditure were;

H_0: Tuberculosis has no relation with income

H_0: Tuberculosis has no relation with expenditure

The estimated results of the Chi-square (χ^2) test statistic has been presented in following Table

Table: 4.3

Test of Independence of Attribute

Variables	Income	Expenditure
Tuberculosis	80.480*	79.200*
	(0.0000)	(0.0000)

Source: Self estimate based on field survey, (Jan-Mar 2014), East Sikkim

Note: * χ^2 significant at .01 percent level
Figures in the parenthesis are the significance level of the respective estimates

From the above results we can reject the null hypotheses; it means incidence of Tuberculosis in the sampled families is not independent of income of the

household. Similarly, the expenditure of the household in the sampled families has significantly related with the disease as observed in the estimated values of Chi-square statistics. The present findings are consistent with the findings Rajeswori et al., (1999), Gurung et al., (2012).

4.3.1 Impact of Tuberculosis on Family income

The explanatory variables in the model has been incorporated to understand the change in the impact of social (literacy, family size) and economic (fixed income earner or variable income earner) factors on family income from pre TB situation to post TB situation. Other explanatory variables have not been chosen for the existence of collinear relationship amongst them (as in Table: Appendix 1). The study expects family size to predict positively with the family income as long as the majority of the family members are wage earner. Literacy is expected to related positively with an income. More the person is literate; more will be the probability of higher income. Similarly, work status is also expected to predict positively with an income. Permanent service means stable income; temporary service implies instability in income. For the purpose of analysis, following ANCOVA[12] (Covariate) regression model was fitted;

$$PY_i = \alpha + \beta\ NFM_i + \gamma\ D_{1i} + \theta\ D_{2i} + U_i \qquad (ii)$$

Where,

PY_i is the pre T.B income across the i^{th} family

NFM_i is the number of family member in the i^{th} family

D_{1i} is the literacy level in the i^{th} family such that

$D_{1i} = 1$ if the person is literate; $= 0$ if the person is illiterate

D_{2i} is the work status in the i^{th} family such that

$D_{2i} = 1$ if the person is a fixed income earner (permanent service); $= 0$ if the person is daily wage/variable wage earner (temporary service)

[12] Model where the explanatory variables are binary as well as cardinal in nature

U_i is well behaved error term that is $U_i \sim IIND\ (0, \sigma^2 I_n)$

i is the 100 TB affected families under consideration

$$POY_i = \alpha + \beta\ NFM_i + \gamma\ D_{1i} + \theta\ D_{2i} + U_i \qquad (iii)$$

Where,

POY_i is the post T.B income across the i^{th} family

The results of the above fitted equation ii and iii is presented in following Table

Table: 4.4: Impact of T.B on Income

Endogenous Variable	Monthly family income (Pre Tuberculosis)	Monthly family income (Post Tuberculosis)
Constant	-8471.72 (0.2697)	-7369.02 (0.3183)
Number of family member in the i^{th} family	2146.35* (0.0028)	2014.43* (0.0035)
Literacy level in the i^{th} family	11046.95*** (0.0845)	10464.52*** (0.0894)
Work status in the i^{th} family	7734.016* (0.0071)	6706.10** (0.0149)
F Statistics	5.391433* (0.001796)	4.854685* (0.003456)

Source: Self Estimate based on data compiled from Primary Survey (Jan-Mar 2014), East Sikkim

Note: *** significant at .10 percent level, ** significant at .05 percent level, * significant at .01 percent level

Figures in the parenthesis are the p-value of the respective estimates

Refer to Table 4.4 it can be observed that the slope coefficient on number of family members in the i^{th} family has been found to be statistically significant at 0.01 per cent level. An unit increase in the family size on an average leads to Rupees 2146.35 increase in the pre Tuberculosis income of the sampled families in the study. Holding the number of family member constant, the coefficient of literacy has been found to be statistically significant at 0.10 per cent level. Thus, one unit change in literacy on an average will increase the pre Tuberculosis income by Rupees 11046.95 across 100 families and the unit change in work status also increases the pre Tuberculosis income by Rupees 7734.01 on an average among the sampled families

of the study area. The coefficient of nature of service has been found to be statistically significant at 0.05 per cent level. Holding the number of family member constant if we add the two dummy, which means, mean family income will increase by Rupees 18781 for a literate and permanent worker in the samples household. The estimated overall significance[13] ($F_{3, 96}$) has been found to be statistically significant at 0.01 per cent level which indicates that family size, literacy level and nature of service jointly has significant explanatory influence on the income of the sampled household in the pre Tuberculosis phase of the sampled household in East Sikkim.

Again referring Table 4.4 to observe the post Tuberculosis scenario, the slope coefficient on number of family members in the ith family has been found to be statistically significant at 0.01 per cent level. An increase in the family size by one unit on an average results to Rupees 2014.43 increase in the post Tuberculosis income of the surveyed families. There is a significant positive influence of literacy level on the income of the TB affected household in the study area. A per cent change in literacy level helps to increase the income of the families by Rupees 10464.52 on an average. Again work status (transition from casual to fixèd basis), on an average, increases the post Tuberculosis income by Rupees 6706.10 for the families surveyed. Literacy level and work status has also been observed to be statistically significant at 0.10 per cent level and 0.05 per cent level respectively. Thus literacy and work status has important influence on income across the sampled families of the present study. Considering the number of family member as constant if we add the two dummy, the literate and permanent worker increases the mean family income by Rupees 17171 in the sampled household in the post Tuberculosis period. The intercept term has not been found to be statistically significant. The estimated overall significance[14] ($F_{3,96}$) has been found to be statistically significant at 0.01 per cent level which indicates that family size, literacy level and nature of service jointly has significant explanatory influence on the income of the sampled household in the post Tuberculosis situation.

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[13] $F= (R^2/k-1) / (1-R^2/n-k)$ where, k is the number of parameter in the regression equation, n is the number of families = 100.

[14] $F= (R^2/k-1) / (1-R^2/n-k)$ where, k is the number of parameter in the regression equation, n is the number of families = 100.

If we compare the impact of the above considered exogenous variables on pre TB family income and post TB family income, it clearly shows that the TB has negatively influenced the family income in the study area. One unit change, on an average, in family size was increasing family income by Rupees 2146.35 in a pre TB situation and one unit change of a same variable, on an average, was increasing the family income by Rupees 2014.43 in a post TB situation. There is a loss of Rupees 132 in a family income after being trapped under the disease. Likewise taking literacy and working status into account it can be understood that income of the TB affected households has fallen in the outbreak of TB. Hence, it reflects that there is a significant burden of Tuberculosis in the area under consideration as it leads to the loss in family income of the household. The income fall forces households to adopt coping strategies which further exacerbate their economic situation. Present study is in line with the study by Dey (2006) which has explained that TB hinders socio-economic development and imposes substantial costs to households. Similar studies were found in the study report by WHO (2009) which has shown burden of illness are a shock to the household economy and affects current and future decisions adversely.

4.3.2 Impact of Tuberculosis on Family expenditure

The explanatory variables in the model have been incorporated to understand the change in the impact of social and economic factors on family expenditure from pre TB situation to post TB situation. Other explanatory variables have not been chosen for the existence of collinear relationship amongst them (as in Table: Appendix 1). The study expects income predict positively the total expenditure. As income increases expenditure will rise. For the purpose of analysis, following ANCOVA[15] (Covariate) regression model was fitted;

$$PE_i = a + b\,PY_i + c\,M_i + dD_i + U_i \qquad (iv)$$

Where,

PE_i is pre TB family expenditure for the ith family

PY_i is pre TB family income for the ith family

M_i is medical expenditure for the ith family

[15] Model where the explanatory variables are binary as well as cardinal in nature

D_i is housing status of ith family such that

$D_i = 1$ if Own house ; = 0 if rented house/office quarter

$$POEi = a+b\ POY_i+ c\ M_i+d\ EL_i+ U_i \qquad (v)$$

Where,

POEi is post TB family expenditure for the ith family

POY_i is post TB family income for the ith family

EL_i is expenditure on electricity post TB for the ith family

a,b,c,d are the intercept and slope coefficients respectively

From the results as presented in Table 4.5, the slope coefficient on family income pre TB in the ith family has been statistically significant at 0.01 per cent level. An unit change in pre TB family income, on an average, leads to Rupees 0.817 increment in the family expenditure of the surveyed families. Exogenous variable such as medical expenditure and housing status is also found to be statistically significant both at 0.10 per cent level. Holding the pre TB family income constant, as the medical expenditure increases by an unit, the pre TB family expenditure increase by Rupees 0.089 across 100 families on an average and housing status increases the pre TB expenditure by Rupees 0.086 on an average for the 100 families surveyed. About 83 per cent variation in monthly family expenditure pre TB is explained by pre TB income, medical expenditure, housing status and expenditure on electricity and remaining 17 per cent is unexplained and the model has been observed to be good fit.

Income, medical expenditure, expenditure on electricity has been found to have significant influence over post TB family expenditure in the sampled household of East Sikkim. The slope coefficient of post TB family income is observed to be statistically significant at 0.01 per cent level. As the post TB family income increases by one unit, on an average, the family expenditure goes up by Rupees 0.875. Other two variables i.e. medical expenditure and expenditure on electricity both are found to be statistically significant at 0.10 per cent level. A unit change in medical expenditure increases the post TB family expenditure on an average by Rupees 0.121 where as an unit change in expenditure on electricity, on an average, results in increase of post TB

expenditure by Rupees 0.115. About 89 per cent variation in monthly family expenditure post TB is determined by post TB income, medical expenditure, housing status and expenditure on electricity and remaining 11 per cent is undetermined. The value of R-squared also signifies that the model is good fit. The estimated overall significance ($F_{4,95}$) has been found to be statistically significant at 0.01 per cent level which indicates that pre TB family income, medical expenditure, housing status of the ith family and expenditure on electricity jointly has significant explanatory influence on the expenditure of the sampled household in the pre Tuberculosis situation. The overall significance has been found to statistically significant at 0.01 per cent level in a post TB situation. This indicates that post TB family income, medical expenditure, housing status of the ith family and expenditure on electricity jointly has significant explanatory influence on the expenditure of the sampled household in the post Tuberculosis situation.

Table: 4.5

Impact of T.B on Expenditure

Endogenous Variable	Monthly family expenditure (Pre Tuberculosis)	Monthly family expenditure (Post Tuberculosis)
Constant	240.199 (0.890)	53.571 (0.979)
Pre T.B family income	0.817* (0.000)	NA
Post T.B family income	NA	0.875* (0.000)
Medical expenditure	0.089*** (0.087)	0.121*** (0.063)
Housing status of ith family	0.086*** (0.081)	-0.012 (0.752)
Expenditure on electricity	0.036 (0.608)	0.115*** (0.048)
R^2	0.830	0.893
Adjusted R^2	0.804	0.874
F Statistics	32.194* (0.000)	46.702* (0.000)

Source: Self Estimate based on data compiled from Primary Survey (Jan-Mar 2014), East Sikkim

Note: *** significant at .10 percent level, ** significant at .05 percent level, * significant at .01 percent level

Figures in the parenthesis are the p-value of the respective estimates

There is obviously an extra burden of Tuberculosis on expenditure as expenditure will genuinely increase when one suffers from the disease. The nature of

the disease, its management and treatment presents substantial economic burden to affected households. The result from Table 4.5 also indicates the economic burden of TB in the form of rise in family expenditure of the surveyed households in East Sikkim. Similar study was attempted by Ray, et al., (2005) where they found that TB patients incurs economic loss both in terms of direct and indirect costs, more so in lower socio-economic group.

4.3.3 Family Income and Indebtedness Status

In an attempt to study the pattern of indebtedness status across the TB affected sampled families, present study took family income in both pre and Tuberculosis situation and the number of family member. Other explanatory variables have not been chosen for the existence of collinear relationship amongst them (as in Table: Appendix 1). The study anticipates income to relate negatively with indebtedness as lower the income higher will be the possibility of indebtedness. For the purpose of analysis, following multiple regression model has been fitted.

$$PID_i = a+b\ PY_i+ c\ NFM_i + U_i \qquad (vi)$$

$$POID_i = a+b\ POY_i+ c\ NFM_i + U_i \qquad (vii)$$

Where,

PID_i is the pre TB indebtedness

$POID_i$ is the post TB indebtedness

a, b and c are intercept and slope coefficients

Refer to Table 4.6 it can be observed that increase in pre TB monthly family income by one per cent, on an average, decreases indebtedness by Rupees 0.0018 across the sampled families of the study area. The estimated coefficient of pre TB monthly family income has been found to be statistically significant at 0.01 per cent level. 62 per cent variation in pre TB indebtedness has been determined by pre TB family income and number of family member, remaining 38 per cent being unexplained. The coefficient of number of family member has not found to be statistically significant. The intercept term has found to be statistically significant at 0.05 per cent level. The overall significance ($F_{2, 97}$) has been found to statistically significant at 0.01 per cent level in a pre TB scenario. This indicates that pre TB

family income and number of family member jointly has significant explanatory influence on the indebtedness status of the sampled household in the pre Tuberculosis scenario. The estimated slope coefficient of post TB monthly family income has been found to be statistically significant at 0.01 per cent level. It can also be observe that one per cent change in monthly family income in the post TB situation, on an average, has resulted to decrease in the indebtedness of the sampled household by Rupees 0.0013 across the TB affected sampled families in East Sikkim.

Table: 4.6

Family income and Indebtedness Status

Endogenous Variable	Indebtedness (pre Tuberculosis)	Indebtedness (post Tuberculosis)
Constant	8265.93**	892.84**
	(0.0519)	(0.0651)
Monthly family income pre Tuberculosis	-0.18161*	NA
	(0.000)	
Monthly family income post Tuberculosis	NA	-0.13663*
		(0.000)
Number of family member	41.597	54.625
	(0.617)	(0.550)
R^2	0.6250	0.5421
Adjusted R^2	0.6132	0.5327
F Statistics	53.335*	57.40*
	(0.000)	(0.000)

Source: Self Estimate based on data compiled from Primary Survey (Jan-Mar 2014), East Sikkim

Note: *** significant at .10 percent level, ** significant at .05 percent level, * significant at .01 percent level

Figures in the parenthesis are the p-value of the respective estimates

About 54 per cent variation in post TB indebtedness is explained by the post TB monthly family income and number of family member, rest of the 46 per cent is found to be unexplained. The intercept term is also found to be statistically significant at 0.05 per cent level (Refer to Table 4.6). The overall significance ($F_{2, 97}$) has been found to statistically significant at 0.01 per cent level in a pre TB scenario. This indicates that post TB family income and number of family member jointly has significant explanatory influence on the indebtedness status of the sampled household in the post Tuberculosis scenario. The result indicates that low income in the wake of

Tuberculosis has forced the families to borrow money from other sources to run the family and medical expenditure thereby raising the level of indebtedness in the study area.

4.3.4 Family Expenditure and Indebtedness Status

In an attempt to understand how far family expenditure in the study area being responsible for raising indebtedness across the sampled TB affected families, present study has taken into account family expenditure in both pre and Tuberculosis situation and the number of family member for studying the relationship. Other explanatory variables have not been chosen for the existence of colinearity relationship amongst them (as in Appendix 1). The study assumes that the Indebtedness status of the family may have a positive relationship with the family expenditure i.e., higher the family expenditure greater will be the prospect of Indebtedness. The model fitted for the purpose was as follows:

$$PID_i = a+b\ PE_i + c\ NFM_i + U_i \qquad (viii)$$

$$POID_i = a+b\ POE_i + c\ NFM_i + U_i \qquad (ix)$$

Where,

PEi is the pre TB family expenditure

POEi is the post TB family expenditure

From the estimated line we can understand that the indebtedness across the sampled families in the study area in the pre TB situation was influenced by the pre Tuberculosis family expenditure. It implies that an increase in pre TB family expenditure by one per cent, on an average, has resulted to increase the debt burden of the sampled household of the study area by Rupees 0.002741. About 40 per cent variation in pre TB indebtedness is explained by the pre TB monthly family expenditure and number of family member and rest 60 per cent not being unexplained. The intercept term has not been observed to be statistically significant in the pre TB scenario. The overall significance ($F_{2, 97}$) in the pre TB stage is found to be statistically significant at 0.01 per cent level indicating that pre TB family expenditure and number of family member jointly has significant explanatory influence on the indebtedness status of the surveyed household of East Sikkim in the pre Tuberculosis

scenario. The coefficient of post TB family expenditure has been found to statistically significant at 0.01 per cent level. This is an indication that a percentage change in post TB family expenditure, on an average, will tend to raise the debt burden in the surveyed families of East Sikkim by Rupees 0.002773. The coefficient of determination holds the value of 0.65 which signifies that about 65 per cent variation in post TB indebtedness is been explained by post TB family expenditure and number of family member and the rest 35 per cent is unexplained. The overall significance ($F_{2, 97}$) is found to be statistically significant at 0.01 per cent level. This means that post TB family expenditure and number of family member jointly has significant explanatory influence on the indebtedness status of the surveyed household of the study area in the pre Tuberculosis scenario.

Refer to Table 4.6 and Table 4.7 it can be understood that Tuberculosis has lead to the burden of indebtedness among the households of the study area. Thus the debt burden of the sampled families of the study area has been caused intrusion of Tuberculosis.

Table: 4.7

Family expenditure and Indebtedness Status

Endogenous Variable	Indebtedness (pre Tuberculosis)	Indebtedness (post Tuberculosis)
Constant	653.13 (0.247)	126.29 (0.767)
Monthly family expenditure pre Tuberculosis	0.2741* (0.000)	NA
Monthly family expenditure post Tuberculosis	NA	0.2773* (0.000)
Number of family member	63.074 (0.549)	-7.053 (0.929)
R^2	0.400	0.659
Adjusted R^2	0.388	0.652
F Statistics	32.442* (0.000)	93.941* (0.000)

Source: Self Estimate based on data compiled from Primary Survey (Jan-Mar 2014), East Sikkim

Note: *** significant at .10 percent level, ** significant at .05 percent level, * significant at .01percent level

Figures in the parenthesis are the p-value of the respective estimates

Although treatment for tuberculosis has become free in India after inception of DOTs and RNTCP measures but there are various expenditure (which may include expenditure on medical and non-medical) that a family has to incur the wake of the disease. Similar study has been made by Jackson et al., (2006) which revealed that excluding income losses, direct out-of-pocket treatment costs (medical and non-medical) accounted for 55.5 percent of average annual household income in China, and most TB cases fell into heavy debt. Hence, for the present study Tuberculosis may be understood as a factor for increase in indebtedness in the study area of East Sikkim.

4.4 Impact of Socio-economic factors on the incidence of Tuberculosis in East Sikkim

Table 4.8 represents the frequency, percentage and average of socioeconomic and demographic characteristics of both TB affected and non TB respondents. The Table shows that an average age of the TB affected respondents have been found to be 29 years which was lower than the average age of the non TB respondents.

Table: 4.8

Comparative analysis on Social, Economic and Demographic Characteristics of TB and Non TB Respondents

		TB Respondents			Non-TB Respondents		
		Number	Percentage	Average	Number	Percentage	Average
Age		-	-	29.09	-	-	37.73
Gender	Male	55	55	-	61	61	-
	Female	45	45	-	39	39	-
Marital Status	Married	53	53	-	62	62	-
	Unmarried	47	47	-	38	38	-
Family Type	Joint	39	39	-	60	60	-
	Nuclear	61	61	-	40	40	-
Family Size		-	-	4.85	-	-	3.58
Occupational Status	Employed	52	52	-	76	76	-
	Unemployed	48	48	-	24	24	-
Number of Living Rooms		-	-	3	-	-	6
Years of Schooling		-	-	8.65	-	-	11.58
Monthly Family Income (Rupees)		-	-	15400.00	-	-	25800.00

Source: Self estimates based on the data compiled from Household Survey of T.B patients (East Sikkim)

The average age of the non TB respondents have been found to be 38 years. 55 per cent of the respondents were male and 45 per cent were female among the TB respondents while 61 per cent were male and 39 per cent were female among the non TB respondents. Hence the male respondents were higher amongst both TB and non TB cases. Table reveals that 53 per cent of the respondents were married and 47 per cent of the respondents were unmarried among the TB affected families in the study area. On the other hand 62 per cent of the respondents were observed to be married and remaining 38 per cent were unmarried among non TB respondents. The average family size of the TB respondents was found to be 5 on the other hand the average family size of the non TB respondents were found to be 4. Hence the non TB families were found to be smaller than TB affected families. The majorities of the TB respondents as well as non TB respondents were employed, but in absolute terms 76 per cent of the non TB respondents were employed and 52 per cent of the TB respondents were employed. Hence the levels of employment amongst the non TB respondents were more than TB affected sampled families of East Sikkim. The numbers of living rooms of the TB respondents were 3 on an average, whereas the number of living rooms of non TB respondents was observed to be 6 on an average which signifies the likelihood of occurrence of TB may be due to scarcity of room in the sampled families and overcrowding. The average years of schooling was observed to be 9 years among the TB respondents and it was 12 years among the non TB respondents which reveals the educational status of non TB affected families were better than TB affected families in the study area. The average monthly family income of the TB respondents was found to be Rupees 15,400 and it was Rupees 25,800 for the non TB respondents. This clearly indicates the low income level amongst the TB affected families relative to non TB families.

4.4.1 Socioeconomic Factors and Incidence of Tuberculosis

An econometric analysis of the factors effecting incidence of TB has been done by applying binary choice model. Due to binary nature of dependent variable (with or without TB), present study utilized logistic regression model to determine the factors effecting likelihood of incidence of TB using cross section data for the 200 sampled families of East Sikkim. This model provides a convenient way to estimate

the likelihood (probability) of incidence of TB, using a binary dependent variable having value '1' for TB patients and '0' otherwise. The choice of the explanatory variables in the following model is followed under the implications by Gupta et al., (2004), and Sial et al., (2012). The literature states that some of the variables like age, years of schooling, occupation, number of living rooms and average family income posses a negative or an inverse association with the incidence of tuberculosis, for the purpose of analysis, logistic regression model has been fitted as follows.

$$L_i = \ln\{\frac{P_i}{1-P_i}\} = \alpha + \beta_1 AG_i + \beta_2 GEN_i + \beta_3 MS_i + \beta_4 YS_i + \beta_5 OC_i + \beta_6 FT_i + \beta_7 NLR_i + \beta_{8A} MFI_i + U_i \quad (x)$$

Where,

L_i is the logit function

P_i = 1 probability of having Tuberculosis; = 0 otherwise

AG_i is Age

GEN_i is sex such that 1= male and 0 = female

MS_i is marital status

MS_i = 1 if the person is married; = 0 if the person is unmarried

YS_i is years of schooling

OC_i is Occupational Status,

OC_i = 1 if the person is permanently employed= 0 otherwise

FT_i = 1 if the family is joint; = 0 otherwise

NLR_i is number of living room

$AMFI_i$ is monthly family income and U_i is well behaved error term

Here, $\{\frac{P_i}{1-P_i}\}$ is the odds ratio in favour of probability of having tuberculosis. Each slope coefficient in the above equation is a partial slope coefficient and measures the change in the estimated logit for a unit change in the value of the given regressor (holding other repressors constant).

The model includes eight explanatory variables which were selected for their importance in measuring incidence of TB in the study area due to social and economic factors. The variables were age, sex, marital status, years of schooling, occupational status, type of family, number of living room and average monthly family income. The study expects age to predict negatively the incidence of TB. Higher the age lesser will be the probability of incidence of TB. Usually TB affects the more economically productive segment of the population (Geetharamani, 2000). With respect to years of

schooling, our conjecture is that the incidence of TB falls with rise in the number of years schooling. We also anticipate a negative relationship between occupational status and incidence of TB. As occupational status shifts from temporary to permanent, the incidence of TB might be minimised. The variable of family type is expected to have a positive association with the incidence of TB. There is a greater probability of occurrence of disease like tuberculosis in a joint family vis-à-vis nuclear family. The study assumes number of living rooms and average monthly family income to predict positively the incidence of TB. Our conjecture is that the likelihood of TB incidence decreases with the increase in the number of living rooms in a house as there will be less overcrowding in the family. Likewise, higher the income higher will be the ability and consciousness in the family towards better health. The result of logistic regression model is presented in following Table 4.9.

Table: 4.9

Results of Logistic Regression

Variables	Dependent variable : Likelihood and incidence of Tuberculosis							
	Model I		Model II		Model III		Model IV	
	1 Estimated coefficients	2 Odds Ratio	3 Estimated coefficients	4 Odds Ratio	5 Estimated coefficients	6 Odds Ratio	7 Estimated coefficients	8 Odds Ratio
Age	-.0432318* (.0138889)	.9576894* (.0135172)	-.024893*** (.0149757)	.9754135 (.0188364)	-.0449244* (.0144407)	.9560698* (.0151991)	-.0435421** (.0168417)	.9573923** (.0178703)
Gender	.2336328 (.3926405)	1.263181 (.4957246)	-.048941 (.4164675)	.9522373 (.3760084)	.1625874 (.4093111)	1.176551 (.47285)	.1446818 (.4700966)	1.155672 (.5084288)
Marital Status	-.1504854 (.3907944)	.8602902 (.3171772)	.0054699 (.4140967)	1.005485 (.3919337)	-.3621758 (.4080466)	.6961599 (.2707503)	.0576784 (.4701913)	1.059374 (.4479006)
Years of Schooling	-.1600636* (.0444358)	.8520896* (.0443067)	-	-	-	-	-.1466599* (.0529375)	.8635877* (.044487)
Occupation	-	-	-3.225756* (.6758221)	.0397257* (.0342665)	-	-	-2.954308* (.7049015)	.0521147* (.0401615)
Type of Family	.6672855*** (.3898748)	1.94894*** (.701152)	.5691134 (.4078852)	1.7667 (.681612)	.9206663** (.4144463)	2.510963** (1.005475)	.7590989 (.4667674)	2.13635*** (.9169376)
Number of Living Room	-.5669088* (.0989848)	.5672763* (.0728986)	-.7251744* (.1182256)	.4842401* (.0761057)	-.5107198* (.0955035)	.6000635* (.0710393)	-.6387343* (.1190254)	.5279602* (.0842129)
Average Family Income	-	-	-	-	-.0002481* (.0000584)	.999752* (.0000576)	-.0002253* (.00007)	.9997747* (.0000637)
Constant	4.356941* (1.118328)	-	5.833586* (1.39191)	-	3.781738* (1.118939)	-	8.117773* (1.703952)	-
Pseudo R-Square	0.3748		0.4457		0.4312		0.5526	

Source: Self estimates based on the data compiled from Household Survey of T.B patients (East Sikkim) January –March, 2014

Note: ** significant at .05 percent level, * significant at .01 percent level; Model I, II and III has been estimated in order to check the robustness of colinearity between variables such as years of schooling,

occupation and average family income; Figures in the parenthesis are the standard error of the respective estimates

It is evident from the table that five out of eight independent variables in our regressions are found to be statistically significant (Table 4.9). As anticipated, age has a significant negative association with incidence of Tuberculosis. The odds ratio shows that for an unit increase in age decreases the odds in favor of incidence of TB by .96 times. Our variable of schooling also yields a negative association with occurrence of tuberculosis. An additional year of schooling decreases the odds of incidence of tuberculosis by .86 times. In line with our expectation, there is a negative relationship between occupation (job status) and the incidence of TB among the sample households. This indicates that a move away from temporary job status to permanent job status reduces the likelihood of TB incidence by .05 times. Our results also shows that as the family type shifts from nuclear family to joint family, the odds of affecting with TB increases by 2.13 times. As conjectured, the number of living rooms has a negative association with the incidence of tuberculosis implying that as the number of living room increases, odds in favor of incidence of tuberculosis decreases by .52 times. We also find that a unit increase in the average monthly family income decreases the odds of occurrence of tuberculosis by .99 times. This negative relationship between income and incidence of tuberculosis highlights the fact that there could be a greater presence of people with TB among lower income households in East Sikkim. Studies by Rajeshwari (1999), Gupta et al. (2004) and Sial et al., (2012) also highlighted the significant relationship of socioeconomic factors with the incidence of TB among households. .

Chapter 5

FINDINGS AND CONCLUSION

Chapter 5

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5.1 Introduction

An attempt has been made in the present study to examine the casual relationship between socio economic factors and the incidence of Tuberculosis among the affected sampled families in East Sikkim. The study also made an attempt to understand the success of public policy such as RNTCP in controlling the incidence of tuberculosis in Sikkim in particular. The study has been undertaken with the following objectives in mind: (i) To examine the success of public policy in controlling the incidence of Tuberculosis in North East India in general and Sikkim in particular. (ii) To identify whether Tuberculosis has any significant relation with income and expenditure of the affected sampled families in East Sikkim. (iii) To examine the variation in income, expenditure pattern and indebtedness status of the household with the emergence of TB. (iv) To study the relationship between Socio Economic factors and the incidence TB in East Sikkim. The research question undertaken for the proposed objectives were as follows: (a) How far public policy has been successful in controlling the incidence of T.B in India's North Eastern state in general and Sikkim in particular? (b) How significantly TB is associated with income and expenditure of the affected families in East Sikkim. (c) Whether there has been any change in the income, expenditure pattern and indebtedness status with the emergence of TB amongst the sampled household's of East Sikkim? (d) What is the association between socioeconomic factors and incidence of tuberculosis amongst the sampled families of East Sikkim?

The study used both primary as well as secondary data for the purpose of analysis. The secondary data have been generated from the published sources. Primary data have been generated by using an interview schedule by conducting field survey amongst the sampled families of East Sikkim by personal interview method. Simple statistical and econometric tools have been used to analyse the data.

The success of public policy (RNTCP) in controlling the incidence of tuberculosis in Northeast in general and Sikkim in particular has been examined by applying simple descriptive statistics, calculating CAGR, using fixed effect and

simple regression model analysis for the period of 2003-2011. Efficient health policy and its implementation are vital for effective capacity to prevent the epidemics of diseases and the disease like tuberculosis is an upsetting public health problem which may lead to a grave socioeconomic effect on households. The major findings that have been emerged from the study and their policy implications have been presented in subsequent sections.

5.1.1 Status of Tuberculosis cases and RNTCP in Northeast India (2003-2011)

The public health policy of RNTCP (Revised National Tuberculosis Control Programme) is in implementation in all the eight north-eastern states of India, viz. Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. Amongst all these north-eastern states, the average number of population covered by RNTCP, total number of registered cases of TB under RNTCP on an average, average cured cases, average died cases, average failure cases has been recorded to be highest in Assam. Similarly, the average number of population covered by RNTCP, total number of registered cases of TB under RNTCP on an average, average cured cases, average died cases has been found to be lowest in Sikkim during the study period. The average number of failure cases after registration was at minimum in Mizoram. The total population size of these states may be one of the reasons for such differences in average values. Annual new smear positive (TB) detection rate on an average has been found to be highest in Sikkim and was lowest in Tripura.

Assam has registered maximum growth in number of population covered by RNTCP (7.5 per cent per annum) and defaulted cases of TB patients (13.87 per cent per annum), whereas annual new smear positive detection rate, death cases and failure cases has been found to be growing at a highest rate in Tripura annually with the growth rate of 11.22 per cent, per cent, 13.19 per cent 10.40 per cent respectively. Again, the total number of registered cases and cured cases has recorded a highest growth in Meghalaya than any other North-eastern states of India during the period of 2003-2011. Growth rate of population covered by RNTCP, total number of registered cases and cured cases has been found to be lowest in Manipur. Mizoram has recorded minimum growth in case of annual new smear positive cases and died cases amongst

other North-eastern states. Sikkim has recorded minimum growth of -10.78 per cent per annum in terms of number of completed cases during the period of study.

5.1.2 Inter State Recovery Rate of Registered TB Cases

The total number of registered cases is positively related to cured cases in eight North Eastern states of India during 2003-2011 as revealed from the estimated parameter Thus a percentage change, on an average, in total number of registered cases of TB patient in the eight North Eastern states has increased the cured rate by .82 per cent during the 9 years period of study (2003-2011). Again a percentage change, on an average, in total number of registered cases of TB patient has increased the death rate by 0.04 per cent during 2003-2011 North Eastern states of India. Hence, it seems that individual registration under public policy like RNTCP has helped to wider extent in curing the affected patient of eight different states of India's North East during the 9 years study period, although there was some percentage of failure reported in terms of death rate.

5.1.3 Cured rate and Death Rate of TB Cases Post Registration under RNTCP (Sikkim)

The total number of cases registered under RNTCP has been found to have positive impact on the cured rate during 2003-2011. A percent change in the number of registered cases under RNTCP on an average has helped to increase the cured rate by .90 per cent in Sikkim during the study period. Cured rate of Sikkim under RNTCP has been found to be higher as compared to North-eastern region as a whole during 2003-2011. Again the death rate of registered cases under RNTCP in Sikkim revealed that a percentage increase, on an average in the number of registered cases has increased the number of death of TB patients in Sikkim by 0.05 per cent which further explains certain fraction of disappointment in controlling the epidemics of disease in the state. Thus, public policy like RNTCP has been helpful in minimizing the prevalence of TB in Sikkim although there is some ineptness in diminution of death cases due to TB.

5.1.4 Socio-economic Challenges from TB in affected Households (East Sikkim)

The average age of the respondents/patients in the surveyed TB affected families of East Sikkim has been observed to be ranging between 29 to 30 years which is a productive age group. Since majority of respondents falls in the productive age group (that is 18 to 54 years) so they remain jobless during the period of the disease which became a constraint in the income generation process for the individual and the families. The average family size of the TB affected families in the present study has been observed to be 5. Since the average number of living rooms in the sampled families has been observed to be 3 hence there has been need for sharing of room for the affected families in the study area, which is medically undesirable.

From the present study it has been observed that the patient suffering from Tuberculosis remain jobless on an average for 4 to 5 months (almost half of the year) during period under reference (one year) in the study area which results loss of income for the household and creating manpower shortage (loss of man days of work) for the economy. The affected patient in the study area has been observed to qualify 8^{th} to 10^{th} standard of educational level on an average implying that they were unable to attended higher educational level. The majority of affected patients amongst the sampled families of East Sikkim were daily wage earner who has been found to be engaged in private service for their livelihood. The average type of families amongst the affected household was nuclear family. Rented semi pucca houses have been shelter for the sampled TB affected household and they rely on rivers, ponds, streams as a source of drinking water in East Sikkim.

From the field survey it was learnt that the affected person (TB affected) used to be addicted towards smoking and drinking of alcohol initially though they have controlled their habit in the wake of the disease. As per the investigation at the household level it was discovered that there is predominance of pulmonary tuberculosis case (which affects the lungs particularly) than extra pulmonary cases amongst the TB affected respondents of East Sikkim. Regularity in education has been hampered in the outbreak of tuberculosis amongst some of the respondents who were in the studying age group. They are unable to maintain their regularity in their schoolings, colleges and other formal institutions in the wake of the disease. This implies that Tuberculosis has indirectly affected the educational career of those who

have been suffering from this disease. The distance of health service centre is an important parameter in easy accessibility to health facilities. The average distance of nearest health service centre from the surveyed TB affected families of East Sikkim has been found to be 4 to 5 kilometres which is less convenient as the patient have to travel in a state of ill health. However, there has been an observation that accredited social health activists (ASHA) have been initiated under NRHM scheme in rural areas to provide TB medicines to the affected patients at door steps as reported during the personal interview with some of the sampled families of East Sikkim.

As per the response of the sampled household number of times free medical awareness camps organized in a locality was observed to be once in a year on an average. There has been an observation of low awareness among the respondents/patients regarding transitional nature of this particular disease. The patients' reported their minimal habit of wearing the masks in public places, dusty areas etc. other than in DOTS centre implying poor awareness level amongst the affected respondents.

The average monthly family income of the affected household was reported as Rupees 15,400. The average monthly family expenditure of the affected household in the pre TB phase was Rupees 8,285. Whereas, after the intrusion of disease (Tuberculosis) the burden in terms of family expenditure has advanced to Rupees 11,500 (monthly) on an average. Thus the propensity to save can be understood to decline due to rise in expenditure in post tuberculosis phase which specifically has affected the low and middle income families in the study area. The average monthly family expenditure on education has been observed to be Rupees 1,239. After inception of public strategy like DOTS the medicine for first aid has been made free in various nations of the world including India. Thus the TB affected household reported to avail the medicine free of cost, however the treatment for the disease urges many other (direct and indirect) expenses. The average monthly medical expense of respondents in study area has been reported to be Rupees 1,705.

The incidence of Tuberculosis in the sampled families is not independent of income and the expenditure of the household as understood from the test of independence of attribute which signifies that disease like TB has a significant association with the economic status of the sampled households of East Sikkim.

The family size, literacy and work status has been observed to be positively related to family income in both pre TB and post TB period in the study area. After comparing the impact of above considered exogenous variables on pre TB family income and post TB family income, it has been found that the disease has negatively influenced the family income in the study area. A unit change in family size amongst the sampled household has helped to increase the family income by Rupees 2146 in a pre TB situation while it increased by Rupees 2014 in a post TB situation. Thus the families were reported to make an income loss of Rupees 132 after being trapped under the disease. The change in literacy in pre TB phase seems to have larger impact on the family income of the affected household than the post TB phase, likewise any change in working status also have shown smaller impact on the income of the affected household in the post TB phase than that of pre TB phase. Hence, it reflects that there is a significant burden of Tuberculosis in the area under consideration as it leads to the loss in family income of the household. The income fall forces households to adopt coping strategies which further exacerbate their economic situation. On the other side, monthly family income, medical expenditure and housing status were found to be positively related with family expenditure in pre TB period. For the post TB period, family income, medical expenditure and electricity expenditure were found to be significantly related with monthly family expenditure. After comparing the impact of different explanatory variables in the study area it has been found that the impact of medical expenditure in family expenditure was intensified in the post TB period. The study observed that TB has lead to a substantial economic burden to affected households in the form of augmented family expenditure pattern in sampled families of East Sikkim.

The relation between indebtedness status and family income across the TB affected sampled families in pre TB and post TB stage revealed that family income is negatively related with indebtedness as the estimated parameter is found to be statistically significant in both the periods. But the impact of income has been obtained marginal in demoting the indebtedness of the family in post tuberculosis situation. The estimated parameter of family size is not found to be statistically significant in both the stages. Thus, the result indicates that low income in the wake of Tuberculosis has forced the families to borrow money from other sources to run the family and medical expenditure thereby raising the level of indebtedness in the study

area. Similarly, the relation between indebtedness status and family expenditure across the sampled families in pre TB and post TB stage revealed that family expenditure has been observed to be positively associated with indebtedness status as the estimated parameter is found to be statistically significant in both the periods. However, the family expenditure seems to have greater impact on the indebtedness status of the affected households of East Sikkim in the post TB situation. Although treatment for tuberculosis has become free in India after inception of DOTs and RNTCP measures but there are various expenditure (which may include expenditure on medical and non-medical) that a family has to incur the wake of the disease. Similar study has been made by Jackson et al., (2006) which revealed that excluding income losses, direct out-of-pocket treatment costs (medical and non-medical) accounted for 55.5 percent of average annual household income in China, and most TB cases fell into heavy debt. Hence, for the present study Tuberculosis may be understood as a factor for increase in indebtedness in the study area of East Sikkim.

5.1.5 Impact of Socio-economic factors on incidence of Tuberculosis in East Sikkim

The logistic regression model estimated to study the socioeconomic factors effecting likelihood of incidence of TB using cross section data for the 200 sampled families (100 TB affected families, 100 non TB families) of East Sikkim revealed that five out of eight independent variables, viz. age, years of schooling, occupation, number of living room and average monthly family income in our regressions were found to be statistically significant. The explanatory variables which were found to be significant have a negative association with incidence of Tuberculosis amongst the sampled families in the study area. The odds ratio shows that for an unit increase in age decreases the odds in favor of incidence of TB by 0.96 times. This explains that incidence of disease like tuberculosis is more likely to prevail among the younger and economically productive segment of the sampled households of East Sikkim. Similarly, an additional year of schooling decreases the odds of incidence of tuberculosis by 0.86 times. This further explains that an education plays a crucial role to create awareness in the society which further discourages the incidence or prevalence of disease like TB. The number of living room has negative association with incidence of TB as number of living room increases, odds in favor of incidence

of tuberculosis decreases by 0.52 times. The study observed that a unit increase in the average monthly family income decreases the odds of occurrence of tuberculosis by 0.99 times. This negative relationship between income and incidence of tuberculosis highlights the fact that there could be a greater prevalence of TB among the lower income households of East Sikkim.

It has been observed that the public policy like RNTCP has helped to a great extent in controlling the epidemics of tuberculosis in North Eastern region of India in general and Sikkim in particular but there has been some sort of the disappointments in terms of number of default cases, failure cases, death cases, failure in completing course of the drug still present as the outcome of the treatment. Such factors have stood as a major challenge for the overall success of public policy like RNTCP in controlling the epidemics of the disease for a state like Sikkim. In an attempt to understand whether tuberculosis deteriorates socio-economic status of the household or poor socioeconomic status leads to the prevalence of the disease amongst the sampled households of East Sikkim. It has been observed that the outbreak of the disease has brought social and economic challenges for the affected sampled families of East Sikkim, but the prevalence the disease has also been supported by low socio-economic status, low level of awareness and overcrowded living conditions in the study area.

5.2 Policy implications of the Study

The support of public policy such as RNTCP in controlling the epidemics tuberculosis of amongst the North-Eastern states of India during 2003-2011 is not ignorable though there were report of some of the failure of the policy in terms of rising rate of death cases amongst the registered patients due to the disease and failure cases in Tripura, high detection rate of the disease in Sikkim, negative growth of completed cases in Sikkim, high prevalence of failure cases, death cases, defaulted cases in Assam which are still challenges for the success of RNTCP in the region. The health department should find out the reasons for un-seriousness attitude of the affected household towards RNTCP and taking measures in those directions. Initiatives are necessary for raising the level of education in the study area which in turn will help in improving the awareness level amongst the citizens of East Sikkim. Setting up of public health care centre in the remote rural area will help the needy to

travel less in the course of treatment. Regular consoling to the affected patients is desirable to help the patient to come out of social and psychological stigma of the disease. Public initiative in organising awareness and medical camp in every quarter of a year will be helpful for the affected families of East Sikkim. Socioeconomic securities in the form of public insurance or disability benefits could be helpful for TB affected low income families.

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Appendix I

Section: A – Factor Analysis for Scale Variables (Based on Partial Correlation Matrix)

Normally there exist multicoliearity[16] amongst the explanatory variables in a regression model. So it is important to undertake some test prior to studying the casual relationship between the cross sectional variables of the study. For the initial data the factor analysis with principal component method has been attempted to detect the strongly co-linear variables of the study.

The study also conducted Kaiser-Meyer-Olkin[17] (KMO) test for detecting the pattern of multicolinearity amongst the variables. The KMO index compares the values of correlations between variables and those of the partial correlations. If the KMO index is high (≈ 1), the principal component analysis can act efficiently; if KMO is low (≈ 0), the principal component analysis is not relevant.

The overall KMO index is computed as follows.

$$KMO = \frac{\sum i \sum j \neq i \; r_{ij}^2}{\sum i \sum j \neq i r_{ij}^2 + \sum i \sum j \neq i a_{ij}^2} \qquad (i)$$

Where,

$$\text{Partial correlation A} = (a_{ij}),\ a_{ij} = -\frac{v_{ij}}{\sqrt{v_{ii} \times v_{jj}}}$$

By applying factor analysis for the initial data the present found the determinant value of the entire scale variable as not positive definite. This indicates existence of multicolinearity among the scale variables in the matrix. The partial correlation coefficient for some of the variables shown high degree of multicolinearity

[16] Rank (x) ≠ k, x is the data matrix on all scale variables, k is the order of the matrix

[17] Measure of Sampling Adequacy Test

was ($r_{xy} > 0.3$). The partial correlation coefficient has been observed to be less than 0.3 so we can predict that age of the affected patients has no multicolinearity relationship with other scale variables of the study. Number of living rooms in the house has been found to be correlated with family expenditure on cereals and pulses, family income post TB, family income pre TB, total family expenditure pre TB, total family income post TB and family size. Variables such as age, number of months patient remained out of work/jobless, Distance of nearest health service centre, sleeping/resting duration of the patients, number of times patient eat in a day, number of times free medical camps organized in a locality, family expenditure on beedi, cigarette, alcohol, intoxicants, total family expenditure post TB and family size were not in a correlation with other variables i.e. ($r_{xy} < 0.3$).Variable named premium paid for insurance (yearly) is related with family expenditure on cereals and pulses, monthly income both pre and post TB, family expenditure pre and post TB. Another variable called family expenditure on cereals and pulses (monthly) is found to be correlated with expenditure on vegetables and fruits, medical expenses, expenditure on electricity, family income pre and post TB, monthly expenditure pre and post TB both. Our next variable, family expenditure on vegetables and fruits is found to be related with expenditure on education, medical expenses, electricity expenditure, family income pre and post TB, family expenditure pre and post TB. Expenditure on education is related with medical expenditure, electricity expenses, family income pre and post TB, family expenditure pre and post TB. Medical expense is correlated with expenditure on electricity, family expenditure pre and post TB. Monthly family income post TB is found to be in a correlation with monthly family income pre TB, monthly family expenditure pre and post TB. Monthly family income pre TB is correlated with monthly family expenditure pre and post TB. monthly family expenditure pre TB is correlated with monthly family expenditure post TB. Whereas, the scale variables such as monthly family expenditure post TB and family size was not found to be correlated with any other scale variables. So, after the detection of strong multicolinearity between the scale variables of the study it was decided to drop the variables that were exhibiting strong colinearity.

The variable's dropped for the while studying the colinearity relationship has been presented in Table A as follows.

Table: A

Test of Co-linearity

Scale Variable	Variables Dropped	Determinant	KMO Test
All Scale Variable	Without dropping any Scale variable	Positive Indefinite	
Number of Living Room	ECP, MIPOT,MIPT, MEPT, MEPOT, FS	0.095	0.683
Premium paid for insurance	FECP,MIPOT,MIPT, MEPT, MEPOT,	0.073	0.682
Monthly family expenditure on cereals and pulses	FEVF,MME, MEEL, MIPOT,MIPT, MEPT, MEPOT	0.184	0.520
Monthly family expenditure on vegetables and fruits	MEE, MME, MEEL, MIPOT,MIPT, MEPT, MEPOT	0.160	0.521
Monthly expenditure on education	MME, MEEL, MIPOT,MIPT, MEPT, MEPOT	0.110	0.555
Monthly medical expenses	MEEL, MEPT, MEPOT	0.001	0,708
Monthly expenditure for electricity	MIPOT,MIPT, MEPT, MEPOT	0.023	0.643
Monthly family income post Tuberculosis	MIPT, MEPT, MEPOT	0.007	0.699
Monthly family income pre Tuberculosis	MEPT, MEPOT	0.000	0.725
Total Monthly Family Expenditure pre Tuberculosis	AGE, NMPRJ, NOTFMC	0.000	0.821

Source: Self Estimate based on data compiled from Primary Survey (Jan-Mar 2014), East Sikkim

Note: *Number of Living Room (NLR), Premium Paid for Insurance (PPI), Expenditure on Cereals and Pulses(FECP), Monthly family expenditure on Vegetables and fruits(FEVF), Monthly expenditure on Education(MEE), Monthly medical expenses (MME), Monthly expenditure for electricity(MEEL), Monthly family Income pre T.B(MIPT) , Monthly family income post T.B(MIPOT), Total monthly expenditure pre TB (MEPT), Total monthly Expenditure post TB(MEPOT), Family Size (FS), Age (AGE), No. of months patient remained jobless/workless (NMPRJ), Number of times free medical camps organized in a locality (NOTFMC)*

All Scale Variable (Age, Number of living rooms, Number of months patient remained jobless/workless, distance of nearest health service centre, Sleeping/Resting duration, How many times you eat a day, number of times free medical camps organized in a locality, Yearly premium paid for insurance, Monthly family expenditure on cereals and pulses, Monthly family expenditure on vegetables and fruits, Monthly expenditure on education, Monthly medical expenses, Monthly expenditure on electricity, Monthly family expenditure on beedi, cigarette, alcohol and intoxicants, Monthly family income post T.B, Monthly family pre T.B, Total family expenditure post T.B, Total family expenditure pre T.B, Family size).

While discussing the pattern of colinearilty of number of living rooms with all other variables of the study, it has been found that the problem of multicolinearity has been minimised by dropping variable such as ECP, MIPOT, MIPT, MEPT, MEPOT, FS because post dropping these scale variables the KMO test has given a

satisfactory[18] result and the determinant is also found to be positive definite as in Table A. Similarly, while checking the pattern of co- linearity with premium paid for insurance present study found satisfactory result in terms of determinant value and KMO test after dropping variables such as FECP, MIPOT, MIPT, MEPT, MEPOT. The problem of multicolinearity has been solved as the KMO test result is greater than 0.5 with the determinant value being positive definite. While considering the case for monthly family expenditure on cereals and pulses, variables such as FEVF, MME, MEEL, MIPOT, MIPT, MEPT, MEPOT has been dropped in order to exclude multicolinearity. The result found to be satisfactory after dropping. Initially, Monthly family expenditure on vegetables and fruits was correlated with other scale variables such as MEE, MME, MEEL, MIPOT, MIPT, MEPT, and MEPOT. So, all these variables were dropped in order to solve the multicolinearity issue and the post dropping scenario is observed satisfactory in terms of the determinant value and the KMO test of sampling adequacy test. The monthly expenditure on education has been observed to have strong co linearity with MME, MEEL, MIPOT, MIPT, MEPT, and MEPOT. The problem of multicolinearity has been minimized after dropping such co-linear variables. Monthly medical expenses have been found to be exhibiting co linearity with MEEL, MEPT and MEPOT. The relationship has been demolished after dropping such collinear variables.

As per the initial primary data, the monthly expenditure for electricity has also been observed to be correlated with variables such as MIPOT, MIPT, MEPT and MEPOT. The result has been satisfactory post dropping the correlated variables (as in Table A). Likewise, scale variables such as monthly family income post Tuberculosis and monthly family income pre Tuberculosis were detected to be in a correlation with MIPT, MEPT, MEPOT and MEPT, MEPOT respectively. Detected correlation has been minimized later on by dropping the variables. Finally, total monthly family expenditure pre Tuberculosis is attained free from multicolinearity issue after dropping the scale variables coded as AGE, NMPRJ, and NOTFMC (refer to Table A).

[18] KMO test > 0.5