EXPLORING FACTORS LEADING TO RISE OF TB AND MDR-TB CASES IN INDIA DESPITE THE REPORTED SUCCESS OF THE NATIONAL TB PROGRAMME

Utpal Das
India

"EXPLORING FACTORS LEADING TO RISE OF TB AND MDR-TB CASES IN INDIA DESPITE THE REPORTED SUCCESS OF THE NATIONAL TB PROGRAMME"

A thesis submitted in partial fulfillment of the requirement for the degree of Master of Public Health

By Utpal Das

India

Declaration: Where other people's work has been used (either from a printed source, internet or any other source) this has been carefully acknowledged and referenced in accordance with departmental requirements.

The thesis "EXPLORING FACTORS LEADING TO RISE OF TB AND MDR-TB CASES IN INDIA DESPITE THE REPORTED SUCCESS OF THE NATIONAL TB PROGRAMME" is my own work.

Signature:

49th International Course in Health Development (ICHD)
September 19, 2012 - September 6, 2013
KIT (Royal Tropical Institute)/ Vrije Universiteit Amsterdam,
Amsterdam, the Netherlands
September 2013

Organized by:
KIT (Royal Tropical Institute),
Development Policy & Practice
Amsterdam, the Netherlands

In co-operation with:
Vrije Universiteit Amsterdam/Free University of Amsterdam (VU)
Amsterdam, the Netherlands

TABLE OF CONTENTS

List of Table & Figures

Tables

Figures

Acknowledgement

Abbreviations

ACSM	Advocacy, Communication and Social Mobilization	IMA	Indian Medical Association
AFB	Acid Fast Bacilli	IRL	Intermediate Reference Laboratory
AIDS	Acquired Immuno-deficiency Syndrome	IUATLD	International Union against Tuberculosis and Lung Disease
ART	Anti-Retroviral Therapy	KAP	Knowledge, Attitude and Practices
ASHA	Accredited Social Health Activist	LT	Laboratory Technician
ATT	Anti Tubercular Treatment	MDG	Millennium Developmental Goals
BCC	Behavior Change Communication	MDR-TB	Multi Drug-Resistant Tuberculosis
BCG	Bacillus Calmette-Guerin	MIS	Management Information System
CDC	Centre for Disease Control and Prevention	MO	Medical Officer
CHC	Community Health Centre	MoH	Ministry of Health
CSDH	Commission on Social Determinants of Health	MoHFW	Ministry of Health and Family Welfare
CTD	Central TB Division	MOTC	Medical Officer-Tuberculosis Control
DALY	Disability Adjusted Life Years	NGO	Non-Governmental Organization
DFID	Department for International Development	NRHM	National Rural Health Mission
DGHS	Director General of Health Services	NRL	National Reference Laboratory
DMC	Designated Microscopy Centre	NTP	National Tuberculosis Programme
DRS	Drug Resistance Surveillance	PHC	Primary Health Centre
DST	Drug Susceptibility Testing	PP	Private Practitioner
DTC	District Tuberculosis Centre	PPM	Public-Private Mix
DTO	District Tuberculosis Officer	PRI	Panchayati Raj Institute
DOTS	Directly Observed Treatment Short-course	STC	State TB Cell
DR-TB	Drug-Resistant TB	STLS	Senior TB Laboratory Supervisor
DST	Drug Susceptibility Testing	STS	Senior Treatment Supervisor
GFATM	Global Fund against AIDS, Tuberculosis and Malaria	TB	Tuberculosis
GoI	Government of India	TU	Tuberculosis Unit
HIV	Human Immuno-deficiency Virus	UHC	Urban Health Centre
IEC	Information, Education & Communication	USAID	United States Agency for International Development
ICMR	Indian Council of Medical Research	WHO	World Health Organization
ICTC	Integrated Counseling and Testing Centre	XDR-TB	Extensively Drug-Resistant Tuberculosis

Abstract

Background: India has the world's highest number of Tuberculosis and Multi-Drug Resistant Tuberculosis (MDR-TB) cases in the world. The Revised National Tuberculosis Control Programme (RNTCP) was universally launched across India in 1992. The programme has been able to meet its main indicators every year since its conception. Yet the incidence of TB and MDR-TB is growing.

Objective: To explore the factors leading to rise of TB and MDR-TB cases in India despite the reported success of the national TB programme.

Study Method: Literature review of relevant articles related to TB and MDR-TB in India

Results & Discussion: Although RNTCP has clear policies and guidelines, they are not implemented or practiced. TB is still stigmatized in India and its incidence is high among the poor population. There are several governance issues such as lack of social protection for TB patients and no regulation of the private healthcare sector which caters to almost half of TB cases.

Conclusions & Recommendation: Increase of TB and MDR-TB in India is not a standalone disease that can be tackled by curative measures only. In the mid-20th century TB was controlled before antibiotics against TB was discovered by improving social determinants like living conditions. Even now, such an approach is required. It is an outcome of various factors including poor management. If India is to really eliminate the disease as per set goal, the Ministry of Health has to involve the private health sector, non-health sectors (for e.g. urban sector, education) and also involve the community.

Key words: Tuberculosis, Multi-drug resistant TB, India, impact of TB control, TB epidemic

Word Count: 12987

Introduction

About TB: Tuberculosis (TB) is an infectious bacterial disease caused by various strains of mycobacterium, usually more by Mycobacterium tuberculosis. It typically attacks the lungs, but can be found in many other parts of the disease such as bones, abdomen, etc. People hosting the disease in their lungs are infectious and can transmit the disease while people having the infection in other parts of the body are not capable of transmission. It is spread through air by when they cough, sneeze or through saliva[1].

Classic symptoms of active TB are chronic cough (usually with blood-tinged sputum, mild fever ranging in 99 degree Fahrenheit, night sweats and weight loss. Diagnoses of active cases are done by Chest X-rays and sputum examination while inactive cases detection can be done by skin (Tuberculin test) or blood tests. Ideal treatment is by specific antibiotics mainly Rifampicin and Isoniazid along with other drugs, but treatment varies as per the disease intensity, stage and other factors1. Vaccination against TB is done by injecting BCG (Bacillus Calmette–Guérin) at birth.

Epidemiology: Although one third of the world population is thought to be infected by TB, most cases are asymptomatic with 1 in 10 cases progressing to active disease[2].

Globally, TB, as a single infectious agent, is the second largest killer worldwide after HIV/ AIDS. 8.7 million people were affected by TB alone and 1.4 million died in 2011. Almost all the cases (95%) are from low and middle-income countries. Although TB death rate is declining each year, 2011 reported the highest incidence of cases in TB history and Multi-drug resistant TB (MDR-TB), a form of TB where the diseases is resistant to the drugs of first line treatment (explained below), is now common in almost all countries surveyed[3]. India has the highest number of TB cases in the world. Every fifth TB case is from India. Around 2 million people develop TB of which 0.87 million are infectious cases and around 330,000 deaths are reported each year from India. TB has always been a major public health problem in India2.

DOTS & Stop TB Strategy: TB treatment can be long up to 2 years. After World Health Organization (WHO) introduced the Direct Observed Therapy– Short Course (DOTS) for effective treatment of various types of TB cases in 1995, almost all countries adopted it into their National TB programmes (NTP) and later in 2006, to tackle new challenges like MDR-TB, HIV co-infection and weakened health systems, WHO introduced the Stop TB Strategy in 2006[4]. DOTS Plus is a drug regimen for the treatment of MDR-TB cases.

Relevance and importance of TB control in India: A study analyzed that RNTCP (Revised National Tuberculosis Control Programme) and non-RNTCP expenditure in India is around 222 million USD on TB control in a year (Government and OOP expenditure)[5]. People suffering from TB are not capable of contributing to the country economy to their maximum potential while at the same time; the country invests large amounts of money on TB programmes. With its high number of cases, a middle income country like India, which depends more on manpower than on technology alone for its economy, can ill afford to have such a disease and that too as an epidemic. Effective TB control will reduce public costs, decrease poverty and will contribute to economic development of the country[6].

Self-perspective: I have previously worked on the RNTCP as a TB Medical Officer and later as a Medical Coordinator for a Non-Governmental Organization (NGO) where I was required to coordinate clinical and field level activities. The RNTCP is considered as one of the most successful public health programme on a country level scale. Despite the dedication of the staff and commitment of officials, I have seen that the numbers of TB cases are never dwindling and in fact, the numbers of MDR-TB cases are rising and so I was interested to explore where the lacunae actually lie. This paper explores various components of TB control, from the strategy to the challenges, the perception of the problem by the people and how other non-health sectors influence and is influenced by the disease.

1. Country Background

1.   **Geography:** India is one of the biggest countries in the world, both in size (seventh) and population (second). It is bounded by Himalayas on north and north-east, Indian Ocean on south, Bay of Bengal on east, Arabian Sea on west and Thar Desert on northwest. It shares its land border with China, Bangladesh, Bhutan, Nepal, Burma and Pakistan. India has a diverse geographic ecology giving range of wide temperature from extreme cold to extreme heat. Moreover, central part of India has large jungles, which make accessibility an issue, and tribes with absolutely no technological provisions are still residing in these jungles.

2.   **Weather:** With such geographical variation, weather too, is varied in India and it impacts not only on culture, but also on demography and economy. There is almost no winter in majority of southern part of India while Northern India faces extreme cold and extreme warmth. Overall, tropical wet, tropical dry, subtropical humid and montane are the major climatic groupings.

3.   **Demography:** Last India census was done in 2011[7]. India's official population is 1.2 billion, second most populous country in the world after China. Population growth rate is 1.76% per annum during last decade. Sex ratio is 940 females per 1000 males. Urban population grew by 31.2% between 1991 and 2001. It is estimated by 2020, 30% of India will be living in urban areas. Currently, there are 27 million-plus cities in India[8].

4.   **Literacy:** Literacy rate in 2011 was 74.04%, 65.46% among females and 82.14% among males. But there is a wide diversity in literacy among different states, from as high as 100% (Kerala) to 42% (Bihar)[7].

5.   **Culture:** India has different regional (North, South, East, West) cultures and has no national language. Hindi has the largest number of speakers and English is used extensively for education and business and all administrative purposes. According to 2011 census, 80% of population is Hindu followed by Islam, Christianity, Sikhism, Buddhism and Jainism.

6.   **Government:** India is the world's largest democracy constituting of 30 states/ provinces and 5 union territories (UT). All states have elected legislatures and governments while Union Territories are administered centrally. India has a parliamentary system governed under the Constitution of India. Traditionally, India has been described as "quasi-federal" as it has a strong centre and weak state governments, but since 1990s, India is becoming more federal as a result of strong economic changes.

7.   **Economy:** Indian economy is third largest by purchasing power parity and 10th largest by market exchange rate although it is ranked 140th in per capita GDP. Since 1990s, with opening of several trade policies, especially foreign trade and free market and direct investment inflows, India's economy has accelerated and now considered as a newly industrialized country. Annual average GDP growth rate is 5.8% since 1990 and reached its peak in 2011 at 6.1%. India has a strong labour force of 487.6 million workers. Of total GDP, 56% is made up from service sector, 26% from industrial sector while 18% from agricultural sector. Industrial sector is mainly made up of textiles, communications, chemicals, pharmaceuticals, steel, transport, mining, etc., majority of which requires working in large size factories. India ranks high in banking, IT and innovation, even ahead of several advanced countries.

Economic growth shows an uprising and growing purchasing power in middle class. It is projected that by 2030, India will have a middle class population of 580 million. More than 400 million has elevated north of poverty line since 1985. However, still 33% of population earns below $1 per day while almost 70% of population earns below $2 per day[9]. This shows wide diversity between middle and lower class. Due to this, India continues to face extreme poverty, malnutrition, inequity in health and corruption.

8.   **Indian Health Scenario:** As mentioned above, despite economic growth, India faces strong challenges in public health due to huge population of poor people suffering from inequity of healthcare. India has world's highest number of Tuberculosis and Leprosy cases[10] and significantly large numbers of HIV and Malaria cases[10]. India is also home to highest number of Diabetes cases and has a high number of obesity, cancer and chronic obstructive diseases[10]. Basically, all

diseases, communicable or non-communicable, that are considered epidemic, are present in huge number in India. Due to its sheer size, in absolute numbers, India has the world's highest maternal mortality and very high child mortality.

Table 1: INDIA: Country Profile
North of the equator between 6° 44' and 35° 30' north latitude and
68° 7' and 97° 25' east longitude.
Seventh-largest country by geographical area of 3,287,240 sq km
Second most populous country in the world with 1.2 million people.
Population density of 382 per sq. km
51.5% males and 48.5% females
Sex ratio: 940 females for every 1000 males.
30 states and 5 Union Territories
640 districts,
5924 sub-districts & 7936 Towns
0.641 Million villages as per census 2011 data
Decadal growth of 17.64%in last decade
Literacy rate is 74%, in males 82% and in females 65%
No of Govt. hospitals 12760,
CHCs 4510, PHCs 23391, Sub-centers 145894
Beds in Government Sector, 576793;
Population per Government Hospital Bed 2012.
No of medical colleges 314; Blood banks - 2445, Eye Banks - 586,
Diverse socio-economic, cultural, political conditions
Large unregulated private sector in health care
Source: RNTCP Annual Status Report 2013, **www.tbcindia.nic.in/pdfs/TB%20India%202013.pdf**

1.8.1.**Expenditures on Health:** Total expenditure on health as % of GDP is around 4% and has been since many years as listed in table below. Despite economic changes since 1990s, all major indicators have been almost unchanged. Private insurance is very low at less than 5% and thereby shows a staggeringly high out of pocket (OOP) expenditure of almost 86% as of 2011.

1.8.2. **Indian Health System:** India has a universal healthcare system. Almost all public systems are similar in all states with a Primary Health Care (PHC) unit as basic facility having at least 1 Medical Officer. Above the PHC are Community Healthcare Centers (CHC) with 5-10 medical officers and roughly 5-7 PHC referring their cases to 1 CHC. Above the CHC are District Hospitals (DH) and there is 1 DH in all districts of India. DH also acts as tertiary care units. Beside these, there are additional PHC, First Referral Units (FRU), and specialized hospitals for Cancer, TB, Eye care, etc. The system in urban areas slightly differs with PHC replaced by Urban Health Centre (UHC) and CHC replaced by Municipality hospitals. Additionally there are many government-run big hospitals (more than 100 bedded) in cities. Outpatient Department (OPD) services are free in all these hospitals.

Public health system is run parallel to a huge private health sector and both urban and rural population use these services more as they find it more satisfying and competent. Private sector is preferred in 70% households in urban and 63% households in rural areas, but it differs state to state with economically better states seeking less private services. Reasons for preference are poor quality of service in public sector, distance, long waiting times and inconvenient operating hours[11]. Despite these 2 sectors, there are only 6.5 physicians and 10 Nurses/ Midwives per 10,000 populations[10].

Table2: Selected Ratio Indicators for Expenditures on Health 1995-2011					
Indicators/ Year	**1995**	**2000**	**2005**	**2010**	**2011**
Total expenditure on health (THE) as % of GDP	4	4.3	4.2	3.7	3.9
External resources on health as % of THE	1.3	0.5	1.4	1.3	1
General government expenditure on health (GGHE) as % of THE	26	26	22.1	28.2	31
Private expenditure on health (PvtHE) as % of THE	74	74	77.9	71.8	69
GGHE as % of General government expenditure	7.6	7.4	6.8	6.8	8.1
Social security funds as % of GGHE	16.7	18.3	18.6	19	16
Private insurance as % of PvtHE	1.1	1.1	1.8	4.7	4.7
Out of pocket expenditure as % of PvtHE	91.4	91.8	90.3	86	86
Source: http://apps.who.int/nha/database/StandardReport.aspx?ID=REP_WEB_MINI_TEMPLATE_WEB_VERSION&COUNTRYKEY=84678					

1.8.3. **National Rural Health Mission (NRHM):** Government of India (GoI) launched this mission in April 2005. The goal of the mission is to provide effective healthcare to rural people especially in 18 least developed states and with weak infrastructure. NRHM is integrated to public health system and its goals are aligned to achieve Millennium Development Goals (MDG). Focus is towards mother and child health, family planning and also infectious diseases such as HIV and TB. NRHM has met tremendous success and credit goes to "community involvement" approach and a huge network of volunteer workers besides infrastructure

Table 3: WHO estimated burden of tuberculosis in India, 2011		
	Number (Millions) (95%CI)	Rate Per100,000 Persons (95%CI)
Incidence	2.3 (2.0–2.5)	185 (167–205)
Prevalence	3.1 (2.0–4.6)	256 (161–373)
Mortality	0.32 (0.21–0.47)	26 (17–39)
	Number (Millions) (95%CI)	Percent (95%CI)
HIV among estimated incident TB patients	0.11 (0.075–0.16)	5% (3.3–7.1%)
MDR-TB among notified pulmonary TB patients	0.064 (0.044–0.075)	5.3% (3.6–6.2%)
Notified New pulmonary TB patients	0.021 (0.015–0.027)	2.1% (1.5–2.7%)
Notified Re-treatment pulmonary TB patients	0.043 (0.039–0.048)	15% (13–17%)
Source: RNTCP Annual Status Report 2013, **www.tbcindia.nic.in/pdfs/TB%20India%202013.pdf**		

strengthening. It has also bought traditional practices like Ayurveda, Yunani, Siddi and Homeopathy to mainstream public health sector.

1.8.4. **National Tuberculosis Programme:** India NTP is a vertical programme initially started at 1962. After 30 years, programme reviews indicated that only 30% of estimated TB patients were diagnosed and only 30% of those were treated. Thereby in 1992, GoI revised the programme and launched "Revised National Tuberculosis Control Programme" (RNTCP). RNTCP is based on five components of DOTS (explained later) and it was slowly scaled over years and currently, RNTCP services are available in all districts of India[12]. It has 2 main indicators as laid out by WHO to meet the Stop TB strategy goals, 70% of cases detection each year and 85% of cure rate. It has been able to achieve that since it has been revised and now considered as a public health success story. It also involves private sector and beside DOTS components, it focuses on HIV co-infection, drug resistance, and pediatric tuberculosis and has a strong management and monitoring system. Details of RNTCP are given in annexure 1. But in 2013, the indicators are to be changed and the reasons are discussed later.

> *"India has a large burden of the world's TB, one that this developing country can ill afford, with an estimated economic loss of US $43 billion and 100 million productive days lost annually directly due to this disease"*
>
> Source: Udwadia, Z. (2012). MDR, XDR, TDR tuberculosis: ominous progression. Thorax, 67(4). Accessed July, 2013, Link: http://thorax.bmj.com/content/67/4/286.extract

2. Problem Analysis & Objectives

2.1   PROBLEM STATEMENT

2.1.1 Trend: Although RNTCP has been able to reach everyone in India since 2005 and maintain its 2 main monitoring objectives, number of total TB and Multi Drug Resistant TB (MDR-TB) cases notified is increasing each year as given in Table 4 below. Rate of sputum smear positive cases has been always rising and so has the case notification rate.

Table 4: TB case notification statistics for India, 2013

Year	Total population of India covered under RNTCP (millions)	Sputum Microscopy Services				Case Notification			
		Suspects Examined		Sputum smear positive cases diagnosed		Total TB cases notified		Total sputum smear positive cases notified	
		Number	Rate	Number	Rate	Number	Rate	Number	Rate
1999	139	n/a	n/a	n/a	n/a	1,33,918	101	61,103	46
2000	241	9,56,113	421	1,48,610	65	2,40,835	106	1,31,100	58
2001	441	20,46,039	517	2,86,789	73	4,68,360	118	2,52,878	64
2002	528	25,07,455	524	3,56,409	75	6,19,259	129	3,27,519	68
2003	761	39,55,395	576	5,55,250	81	9,06,638	132	4,73,378	69
2004	920	51,28,852	599	7,11,661	83	11,88,545	139	6,15,343	72
2005	1058	56,84,860	569	7,62,619	76	12,94,550	129	6,76,542	68
2006	1105	62,16,509	566	8,34,628	76	14,00,340	127	7,46,149	68
2007	1,138	64,83,312	570	8,79,741	77	14,74,605	130	7,90,463	69
2008	1,156	68,17,390	590	9,11,821	79	15,17,363	131	8,15,254	71
2009	1,174	72,47,895	617	9,30,453	79	15,33,309	131	8,25,397	70
2010	1,192	75,50,522	633	9,39,062	79	15,22,147	128	8,31,429	70
2011	1,210	78,75,158	651	9,53,032	79	15,15,872	125	8,44,920	70
2012	1,228	78,67,194	640	9,33,905	76	14,67,585	119	8,17,234	67

Source: RNTCP Annual Status Report 2013, **www.tbcindia.nic.in/pdfs/TB%20India%202013.pdf**

Multidrug-resistant tuberculosis (MDR-TB) is defined as TB caused by *Mycobacterium tuberculosis* resistant in vitro to the effects of Isoniazid and Rifampicin, the two antibiotic drugs for the first-line of treatment. ***Extensively drug-resistant TB (XDR-TB)*** is defined as MDR-TB that is resistant as well to any one of the fluoroquinolones and to at least one of three injectable second-line drugs (amikacin, capreomycin or kanamycin).

(WHO Guidelines for the programmatic management of drug-resistant tuberculosis, 2008)

2.1.2 Size of the problem: Besides TB, India also has largest number of MDR-TB cases. As of 2012, Percentage of MDR-TB cases are 2.1 among new cases and 15 among retreatment cases. Percentage among retreatment cases is especially alarming as absolute no of cases for India is very high. Although cases of drug resistant TB have been found since DOTS was implemented, there was no state-represented surveillance data of drug resistance among patients with TB prior to 2012. A major limiting factor in conducting drug resistance studies is lack of Drug Sensitivity Test (DST) laboratories. It was expected that since RNTCP will cover entire India and maintain a high cure rate, drug resistant cases would be of low prevalence. MDR-TB has a much larger incidence rate in Russia and Eastern Europe, but in absolute numbers, India and China's combined number of cases of MDR-TB makes half of world's cases.

2.1.3 How TB resistance is developed: Rifampicin and Isoniazid are 2 main anti microbial drugs used TB treatment. Under DOTS these drugs are given for 6 months along with Pyrazinamide and Ethambutol for first 2 months. Resistance to a single drug is defined as "mono resistance" and resistance to two or more drugs is defined as "poly resistance." Cases that develop drug resistance after use of TB drugs for at least 1 month are defined as "acquired drug resistance", while new cases (patients who have never been treated previously or treated for less than 1 month) is called "primary drug resistance"[13]. Not enough study has been done establishing relationship between bioavailability of Rifampicin/Isoniazid or its quality to developing resistance.

Drug resistance can be caused by both microbial and programmatic factors. Resistance to at-least Isoniazid and Rifampicin is termed as "MDR". TB bacilli multiply within the human body and also mutates during multiplication. Some of these mutated bacilli develop resistance to drugs and this depends upon frequency of drug resistant mutants in susceptible bacillary population and quality of drugs used. From a programmatic view, failure to adhere a case to a continued stipulated treatment leads to resistant mutants becoming dominant in a patient infected with TB[14].

2.1.4 Transmission of Drug-Resistant TB: Drug-resistant TB is also transmitted like TB, through cough or sputum of an infected drug resistant TB case. However, an increased risk of infection has been found to occur when in contact with a patient with drug-resistant TB who had been previously treated and this increased risk resulted from prolonged exposure rather than increased infectiousness of drug-resistant bacilli[15].

Table 5: Statistics for estimated TB in "High Burden" Countries, 2010									
Country	Population (in '000)	Incidence (in '000)	Prevalence (in '000)	Deaths (in '000)	Estimated cases of MDR-TB	Notified cases of MDR-TB	Cases Enrolled on Treatment for MDR-TB	Estimated % of new TB cases with MDR-TB	Estimated % of previously treated TB cases with MDR-TB
India	1,224,614	2,300	3,100	320	64,000	2,967	2,967	2.1	15
China	1,341,335	1,000	1,500	54	63,000	2,792	1,222	5.7	26
South Africa	50,133	490	400	25	9,100	7,386	5,402	1.8	6.7
Indonesia	239,871	450	690	64	6,100	182	142	1.9	12
Pakistan	173,593	400	630	58	9,700	444	44	3.4	29
Bangladesh	148,692	330	610	64	5,900	184	339	4.0	21
Philippines	93,261	260	470	31	8,800	522	548	20	46
Russia	142,958	150	190	26	31,000	13,692	13,692	--	--

Source: Global Tuberculosis Control 2011, WHO, Geneva, 2011, www.who.int/tb/publications/global_report/

2.1.5 TB & MDR-TB in "High Burden" Countries: Table 5 below depicts burden of MDR-TB among new and previously treated cases in countries with highest estimated burden of MDR TB in the world. In 2010, WHO estimated that there were globally 290,000 cases of MDR-TB among those cases of pulmonary TB that were reported. It was also estimated that in total there were 650,000 cases of MDR TB among world's 12 million prevalent cases of TB. There are 27 "high burden" countries for MDR-TB. These are countries with at least 4,000 cases of MDR TB each year and/or at least 10% of newly registered TB cases are of MDR TB. It should however be noted, that these are only estimates for number of cases of MDR-TB amongst those cases of pulmonary

TB notified to WHO. There will be, in addition, many cases of MDR amongst those cases of TB, which were ether not detected and/or not notified2.

2.1.6 TB retreatment outcome statistics for India: TB retreatment is when patients need TB treatment again as they are not fully treated. That can be due to 3 reasons based on which 'treatment outcomes' are classified

- Relapsed: Patients are said to have relapsed if they become ill again after they have finished their first TB drug treatment which appeared to have been successful

- Failed: Patients who experience only a short improvement whilst on drug treatment, or who never respond to treatment at all

- Defaulted: Patients are referred to as having defaulted on their treatment if they stopped taking their first course of drug treatment before they had finished the course

The notification rate of re-treatment cases has increased by 40% over the past 13 years (1999-2012), from 18 to 25 per 100,000 population. 90% of the MDR-TB cases are from previous TB cases. Table 6 below shows notification rate of different types of TB patients. Treatment failure is the main cause of developing MDR-TB and the retreatment success rate of treatment failure is less than 60%. In any retreatment situation it is possible that the person has got drug resistant TB. This is particularly likely to be the case if the person has never responded to and has failed their initial drug treatment. Also the overall retreatment success rate is only 71%, which states that there would seem to be considerable scope for improving the drug regimes that are provided for the retreatment of TB. In case of treatment failure, TB patients need drug susceptibility testing for drug resistance and are likely to have developed MDR-TB.

Table 6: Notification rates of different types of TB patients under RNTCP, 1999-2011							
Year	New			Re Treatment			
	Smear Positive	Smear Negative	Extra Pulmonary	Relapse	after default	Failure	Others
1999	51,627	42,180	16,015	7,334	9,326	1,401	5,541
2000	93,359	73,714	28,004	12,511	20,288	3,183	9,115
2001	1,83,970	1,46,145	52,373	23,122	38,400	6,195	18,450
2002	2,43,529	1,95,798	72,288	34,143	40,767	8,684	24,578
2003	3,58,490	2,91,062	1,09,777	46,577	54,353	11,560	35,983
2004	4,65,616	3,81,656	1,44,182	62,251	67,657	16,296	51,929
2005	5,07,089	3,92,679	1,70,783	75,054	72,021	17,710	59,845
2006	5,54,914	4,01,384	1,83,719	90,153	76,699	19,496	74,270
2007	5,92,262	3,98,707	2,06,701	96,781	77,397	19,012	83,746
2008	6,16,027	3,90,260	2,20,185	1,04,210	76,583	18,434	89,995
2009	6,24,617	3,84,113	2,33,026	1,08,361	73,549	18,870	88,976
2010	6,30,165	3,66,381	2,31,121	1,10,691	72,110	18,463	91,708
2011	6,42,321	3,40,203	2,26,965	1,12,508	72,787	17,304	101,832
2012	6,29,589	3,17,616	2,34,029	1,06,463	64,782	16,400	96,567
Source: RNTCP Annual Status Report 2013, **www.tbcindia.nic.in/pdfs/TB%20India%202013.pdf**							

2.1.7 State-wise analysis of TB cases in India in 2010: Table 7 below shows the number of TB cases, (new and retreatment) in all the states of India. There are a few outliers, notably West Bengal with a very low prevalence rate while Delhi has a high prevalence and is growing. Prevalence in Chandigarh and Andaman has also gone up.

Table 7: Comparative statistics for states (RNTCP Coverage) for years 2010 & 2012

State	Population covered 2010 (in 000)	Treatment patients registered for 2010	State Prevalence 2010	Population covered 2012 (in 000)	Treatment patients registered for 2012	State Prevalence 2012	Change in State Prevalence
Andaman	500	804	161	380	844	222	61
Andhra P	84,000	114,414	136	85,300	108,727	127	-9
Arunachal P	1,200	2,360	197	1,400	2,357	168	-28
Assam	30,200	39,788	132	31,600	35,788	113	-18
Bihar	96,400	78,510	81	106,100	73,537	69	-12
Chandigarh	1,400	2,764	197	1,100	2,807	255	58
Chhattisgarh	23,900	28,658	120	26,000	27,160	104	-15
D &N Haveli	300	397	132	360	415	115	-17
Daman & Diu	300	293	98	250	330	132	34
Delhi	17,900	50,476	282	17,000	52,006	306	24
Goa	1,700	2,156	127	1,500	1,950	130	3
Gujarat	58,200	77,839	134	61,400	72,554	118	-16
Haryana	25,000	36,589	146	25,800	38,036	147	1
Himachal P	6,700	14,179	212	6,900	13,615	197	-14
J & K	11,600	13,482	116	12,800	12,662	99	-17
Jharkhand	31,000	39,465	127	33,700	36,666	109	-19
Karnataka	58,800	68,655	117	61,900	67,572	109	-8
Kerala	34,300	26,255	77	33,500	25,917	77	1
Lakshadweep	100	13	13	60	20	33	20
Madhya P	71,000	87,823	124	73,900	89,545	121	-3
Maharashtra	111,100	136,135	123	113,900	136,045	119	-3
Manipur	2,400	3,652	152	2,800	2,744	98	-54
Meghalaya	2,600	4,947	190	3,000	5,114	170	-20
Mizoram	1,000	2,310	231	1,100	2337	212	-19
Nagaland	2,200	3,904	177	2,000	3,525	176	-1
Orissa	40,400	49,869	123	42,400	49,191	116	-7
Puducherry	1,300	1,437	111	1,300	1,430	110	-1
Punjab	27,400	40,637	148	28,000	39,569	141	-7
Rajasthan	66,800	112,987	169	69,900	100,966	144	-25
Sikkim	600	1,646	274	610	1832	300	26
Tamil Nadu	67,000	82,457	123	73,200	79,576	109	-14
Tripura	3,600	2,850	79	3,700	2,557	69	-10
Uttar Pradesh	197,300	277,245	141	203,200	271,678	134	-7
Uttarakhand	9,800	14,754	151	10,300	15,329	149	-2
West Bengal	588,700	102,397	17	923,700	93,274	10	-7
Grand Total	1,176,700	1,522,147	129	1,228,500	1,467,585	119	-10

Source RNTCP Annual Status Report 2013 http://www.tbcindia.nic.in/pdfs/RNTCP%20TB%20India%202011.pdf
and RNTCP Annual Status Report 2013, www.tbcindia.nic.in/pdfs/TB%20India%202013.pdf

2.2   JUSTIFICATION

There have been studies done on MDR-TB cases and its related factors in various countries and regions. WHO, with Centre for Disease Control & Prevention (CDC) and International Union against Tuberculosis and Lung Diseases (IUATLD) conducted a study in 35 countries that have a high TB burden and found that MDR-TB had a prevalence of 2-14% in 12 of these countries2.

In another large scale study conducted by WHO, drug resistant TB was found to be as high as 40% and found that prevalence of drug resistance was directly related to proportion of previously treated cases registered and inversely related to proportion of TB cases treated under directly observed treatment short course (DOTS)[16].

In India, Indian Council of Medical Research (ICMR) conducted a study in 9 centres where MDR-TB cases are detected and found that MDR-TB has a prevalence of 0.6% to 3.2% in respect to initial drug resistance (new cases) and 6% to 30% in respect to acquired drug resistance (retreatment cases)[17].Another study found high proportions of drug resistant cases in Wardha, New Delhi, and Tamil Nadu and cases were more resistant to Isoniazid (20.9%, 50.7%, and 23.6% respectively) compared to resistance to both Isoniazid and Rifampicin (multidrug resistance, 9.6%, 33.7%, and 23.3%, respectively)[18]. A study done by 2 Public Health Specialists from Punjab mentioned that there were 3 distinct but overlapping dimensions that needed to be addressed to curb TB epidemic. These are humanitarian, public health, and economic[19].

What studies has shown that despite substantial work being done for controlling TB, disease incidence and its complications such as MDR-TB are still growing. Control efforts are still focussing on case detection and curative treatment while it seems new strategies needs to be developed if trends are to be reversed. In fact, in 2011, TB recorded the highest number of cases in history and MDR-TB has emerged as a major global public health threat. Stop TB strategy was launched in 2006 to expand success of the DOTS programme where it addressed new threats like MDR-TB and TB-HIV co-infection and through a broader health system perspective. While all these measures and initiatives have been rolled out as per plan, expected rate of decline in TB incidence has not yet materialized as planned and new threats are still emerging.

The paper wants to explore major lacunae in health systems and strategies and what could be possibly done to curb down incidence of TB and its complications.

2.3   GENERAL & SPECIFIC OBJECTIVE

The research would like to explore factors leading to an increase of TB and MDR-TB cases despite RNTCP's claimed success. RNTCP has stringent monitoring which are met each year, yet TB and MDR-TB cases are growing. The paper would like to explore if these monitoring indicators needs to be revised and formulate recommendations to help build strategies to eliminate TB.

2.3.1   General Objective:

To explore factors leading to rise of TB and MDR-TB cases in India despite reported success of RNTCP in order to help GoI modify and/or redesign the programme.

2.3.2   Specific Objectives:

1.   To explore the main factors contributing to the rise of TB and MDR-TB cases
2.   To analyse the current programme response and explore whether the current major RNTCP indicators enough to justify the success of the programme
3.   To formulate recommendations to RNTCP for appropriate intervention strategies tackling the rise of TB and MDR-TB cases in India

3. Methodology

3.1 STUDY METHOD

Methodology applied was literature research. RNTCP yearly reviews were studied for trends and all statistics. Guidelines and relevant reports and articles from official website of TB Control India, WHO, IUALTD, Stop TB Partnership were studied. Search engines like Google and specialized online search engines like Pubmed and Google Scholar were used for searching online materials and libraries like Cochrane Library, VU Library, KIT Library were visited to find particular journals and publications which generated interest after being referred from or sources.

3.2 SEARCH STRATEGY

Literature search was done using different database search engines as mentioned using keywords. In general, Google Scholar and PubMed were used for results and discussion section. For example, in Google Scholar, top 3 pages (30 listings) were viewed and abstracts read and prioritized. With Booleans, PubMed on an average shows 30-40 listings. At times, specialized library search yielded various documents and reports on Tuberculosis and successful case studies but was not significant in Indian context and thereby limiters were increased to other countries. Most relevant documents were on top list of almost all search engines, which helped shaped this document and they are listed in Annexure 5.

Search Delimiters: Years 1990 onwards, Language – English, Country – India, Russian Federation, South Africa, China, America

3.3 KEYWORDS

Table 8: Keywords and search engines used for different chapters		
Chapter	**Keywords Used**	**Search Engines & Particular Websites**
1. Background	• India OR "Country Overview" • "Economy of India" • "Expenditures on Health" OR India • "Overview of RNTCP"	Google WHO Wikipedia RNTCP
2. Problem Statement	• Tuberculosis OR India OR Epidemiology AND Statistics • Tuberculosis Statistics • "Impact of TB Control" • "TB Epidemic" OR World AND India • "Drug Resistant TB" OR India AND Prevalence/ Incidence • "MDR TB" OR "High Burden Countries" • "TB treatment outcome" AND "India"	Google Scholar PubMed RNTCP WHO Stop TB Partnership
3. Methodology	• "Conceptual Framework" AND "Determinants of Health" • "Conceptual Framework" AND "Determinants of Tuberculosis" • "Conceptual Framework" OR Tuberculosis	Google Google Scholar
4. Results	• Governance OR Tuberculosis • "Macroeconomic policies" OR Tuberculosis • "Public policies" OR Tuberculosis • "Social Policies" OR Tuberculosis	Google Google Scholar PubMed RNTCP Stop TB Partnership

	• "Social Protection" OR Tuberculosis • Social Class Gender Ethnicity OR Tuberculosis • Education Occupation Income OR Tuberculosis • "Living and Working Conditions" AND Tuberculosis OR INDIA • "Biological Factors" AND Tuberculosis • "Psychosocial Factors" AND Tuberculosis • "Private Public" OR Tuberculosis AND India	
5. Discussion	Same as used in Problem Statement and Results Additionally, • "Urban Sector" AND Tuberculosis OR India • "Large Scale Industry" AND Tuberculosis OR India • "Community Participation" AND Tuberculosis	Same as above

3.4 CONCEPTUAL FRAMEWORK

Conceptual framework is an essential tool in order to explore, describe and analyse information systematically. The paper started out working with Dahlgren and Whitehead model as it was felt that Tuberculosis and its impact was largely related to social determinants of health. Dahlgren and Whitehead model was preferred as it focuses more on Individual, Social, Cultural and Economic factors. But later during results and discussion section, it was felt that inability of RNTCP to control MDR-TB or to reduce TB incidence was also due to many factors related to the health system, both intrinsic and extrinsic. These factors couldn't be completely captured through this model and so finally the framework used on WHO Commission on Social Determinants of Health (CSDH) was used as it captures both perspectives, demand and supply, through its indicated determinants. In a manner, social determinants that were affecting the impact of TB programmes were also due to insufficient effort from government in tackling issues like inequity, accessibility, etc. The same fact was supported by CSDH and it strongly advocated action from policy makers on social determinants of health to achieve national health priorities and reduce health inequities[20].

Based on initial assumption and past experience, a problem tree was designed to help root out the main factors that might be contributing to the epidemic. The problem tree has been attached as an annexure (Annexure 4).

CSDH Framework, Link: WHO Conceptual Framework for Action on SDH (PDF Version)

For the first time, this framework positions health system as a social determinant. It basically focuses on two types of social determinants (structural and intermediary) and how it impacts on health and how the impact can influence these determinants into a cycle. Among structural determinants, there are 2 sub sets of determinants, Context (Socioeconomic & Political) and Position (Socioeconomic) and both sub sets influence each other. Structural determinants influence intermediary determinants. These intermediary determinants influence health seeking behaviour and thereby have an impact on equity (based on services available, whether accessible, etc.) in the population health and wellbeing. This impact, will of course, influence structural determinants, for example, an overall worsening of health and wellbeing will only deteriorate socioeconomic and political structure. According to the framework, structural determinants are those that "generate or reinforce social stratification in society and that define individual socioeconomic position".
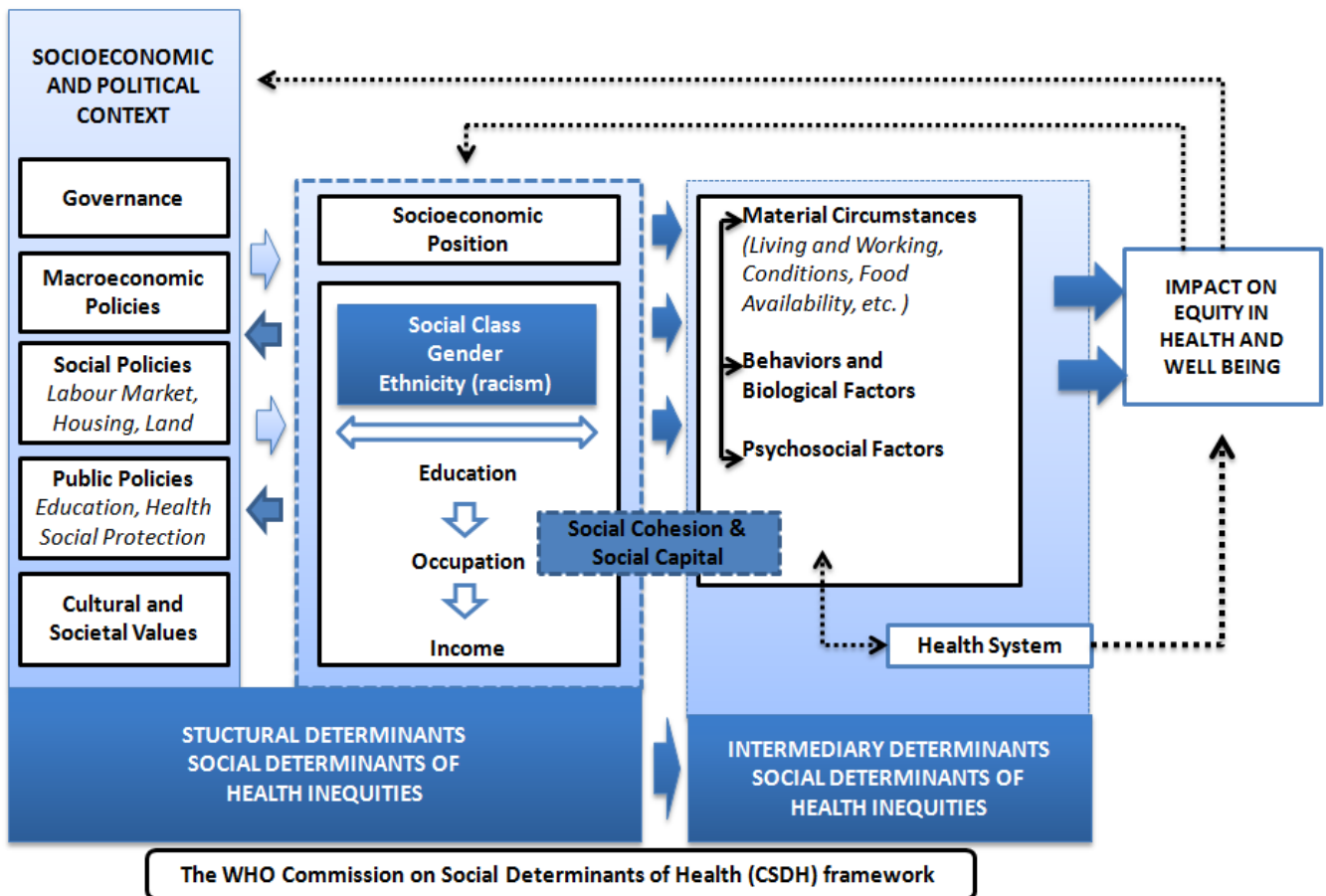
FIGURE 2: THE WHO COMMISSION ON SOCIAL DETERMINANTS OF HEALTH FRAMEWORK

The Commission explained that inequity and inequality in health is largely due to "circumstances in which we grow, live, work and age" and "systems put in place to deal with illness"[21]. It focuses on how determinants can shape outcomes and that health systems are only a part of it and efforts need to be inter-sectoral and not dependent on just one sector.

The chapter on results and discussion takes each factor mentioned in the framework and analyses its current status and/or scenario in India and what are the related policy and programmatic gaps.

4. Results

As literature review was on progress, it was found that rise in TB and MDR-TB cases are closely associated. Most reviews focused more on constant threat of TB, which thereby also indicates threat of MDR-TB if TB is not controlled in the first place. Content of these reviews clearly stated that MDR-TB is a public health threat, but **MDR-TB is not a standalone disease** and to curb its potential threat, the growing incidence of TB has to be considered primary.

The paper discusses threat of TB incidence and focuses on MDR-TB along with it. This chapter discusses each determinant and explores its (1) current status in India, (2) policy or programmatic gaps (if any) and (3) successful lessons around the world that can be applied to Indian settings.

4.1 STRUCTURAL DETERMINANTS

4.1.1   Socioeconomic and Political Context

4.1.1.1 Governance: As per first mandate of DOTS Plus framework, political and administrative commitment has not been lacking as government has constantly supported all districts with autonomous power and adequate finance for resource utilization. Impact of a programme largely depends on its governance. For instance, in Kerala, studies has shown how it has reduced inequalities to improve health status of the population in last 40 years by the communist party which has governed throughout the years while states like Bihar has suffered due to constant changing of guard[22]. RNTCP is a vertical programme run and funded centrally and as such depends on central governance rather than individual states. GoI is fully committed to TB control and it has increased its investment in health through NRHM by 8% over previous year.[23] GoI fully understands the threat of MDR-TB and 2013 Annual Report also states amount of additional money that will be invested in research for new drugs. Despite the commitment, India is still having an increase in disease incidence which is largely due to administrative issues and human resource management. A study in India found "lack of horizontal coordination; decentralization, community involvement and public accountability" in Indian public health system and the same applies to RNTCP[24].

In early 1990s, TB increased in Russia and Eastern Europe and also in sub-Saharan Africa although for different reasons. While in former Soviet Union region had to blame their economic decline and failure of health system with other factors such as poor living standards and mixing of prisoners and civilians[25], in Africa, it was mainly due to spread of HIV[26]. As such importance of governance is clearly evident in the field of TB.

There are clear guidelines for each activity and policies for governance are transparent and available on RNTCP website (www.tbcindia.nic.in). But main issues as mentioned above remain and have been discussed in details in next chapter.

4.1.1.2 Macroeconomic Policies: While there may not be any significant issues related to governance (at least visible), there is a clear need to improve macroeconomic policies. WHO states that gap in knowledge of epidemiology; control, etc. can lead to poor estimates of economic impact of TB and there has to better definition of the economic justifications and social benefits for the development of new tools. Regarding context for change, for e.g. equity of access or partnerships, GoI needs to understand the reasons for success and failure of implementation of the DOTS strategy, contribution of TB control to poverty alleviation and be able to demonstrate the effectiveness of national TB partnerships[27].Just having policies won't help unless they are backed by evidence. In 2013, there has been a sudden shortage of ATT drugs, especially Rifampicin and Isoniazid, the 2 most potent ATT drugs[28] [29]. Stop TB Partnership had already forecasted these shortcoming months ago before the crisis and has warned the government, but the government has been unable to procure the drugs because of poor administration initiative (for e.g. GoI "failed to sign tax exemption and port clearance documents to allow importation of the shipment from its manufacturer in Japan")[30]. This shortage has not only led to TB patients on DOTS shifting their focus to private sector on the hopes of continuing their treatment, but the

possibility of MDR-TB rises due to the gap in treatment. Additionally, second line drugs which are usually used to treat MDR-TB cases, especially Kanamycin has faced a severe drug shortage and this can only lead to worsening the existing scenario[31].

In RNTCP history, it's the first time such an incident has happened on national level. Policies are transparent but there is a need to improvise them to address such issues so as they do not repeat again.

In Kenya, International Monetary Funding (IMF) supports HIV and TB programme and a report analysis showed that IMF's macroeconomic policies were for scaling up public funding, but in practise were found to be restrictive and limits government's potential fiscal space[32]. Another similar study done for Eastern Europe and Russian federation yielded similar results[33].

4.1.1.3 Social Policies *(Labour Market, Housing, Land)*: In many countries, there are policies for labour market where supply (job seekers) and demand (jobs offered) are specifically matched to cater a certain group of individual, especially disadvantaged groups, to enhance worker's skill. Unemployment insurance (insurance coverage for unemployed population), early retirement scheme, etc. are typical passive programmes supporting labour market. Job creation especially for disadvantaged groups, in the form of community or small public programmes, or job creation targeted at younger, older or disabled people suffering from TB are befitting policies for such people.

Although India has a strong labour market policy and many policies focus on rural and backward population to promote labour market[34], unfortunately, these policies cater to people who are in the labour market. Majority of TB patients are unemployed and so cannot reap benefits of these policies. National Rural Employment Guarantee Act (NREGA) enacted on 2005 guarantees a hundred days of employment each financial year to adult members of rural household living below poverty line and especially targeting women[35] but again usually TB patients are not in a physical condition to contribute towards labour field and so do not benefit from such schemes. There is no insurance coverage for unemployed population and these acts as a hindrance to the TB population. Likewise, there are no specific housing and land policies that benefit the TB population.

Even as early as 1900, New York changed its social policies when it noticed that doctors didn't report active TB cases; and due to associated stigma, the city opened several public sanatoria by 1910 for TB patients and nurses visited homes of those diagnosed[36]. Again in early 1990s, when New York had an increase in TB incidence, it was related to social policies and how unemployment played a factor to it[37]. Government of Philippines has strong social policies for labour and TB cases are effectively benefiting from these policies and are not discriminated against[38] and their results are more impressive than India[39].

4.1.1.4 Public Policies *(Education, Health, Social Protection)*: Vincent Navarro has written many documents citing how social determinants of health is conditioned by approaches to public policy[40]. His study for the state of Kerala shows improvement of health status of population through reduction of inequalities[22]. A country's public policies are reflected how it incorporates not only its employment and labour policies, but also social safety nets and to what extent health and social services and or related resources are available to citizens[41]. Benzeval, Judge and Whitehead[42] mentions 3 obligations to tackle inequity and social injustice in any country (1) ensure that resources are distributed between areas in proportion to their relative needs; (2) respond appropriately to health care needs of different social groups; and (3) take lead in encouraging a wider and more strategic approach to developing healthy public policies at both national and local level.

For India, although it seems government is doing all it can to ensure equity, it also depends on how collaborating factors are contributing to it. For example, drug development is regulated by pharmaceutical bodies, which in turn depends on pharmaceutical companies. These companies don't make an investment unless they see potential benefits in market[43].

4.1.1.5 Cultural and Societal Values: Social stigma related to Tuberculosis is particularly important in Indian context, as stigma is not only related to the patient, but also to his/her family. Even early studies done in 1992[44] have shown that patients that have started on ATT do not adhere to treatment. So if a patient was already suffering from TB, non-adherence will likely lead to development of drug resistance. A contributing factor is that once a patient is put on DOTS, s/he is expected to visit TB clinic 3 days each week and in a rural setting, it becomes apparent that s/he is suffering from TB. Due to stigma, usually s/he stops treatment or becomes irregular. Also, there is a twin problem, delay in seeking treatment and also irregular or interrupted treatment. A major factor in socio-cultural component is 'health culture' of patients that is how a patient perceives about TB is related to flow of information from nearby people including friends and relatives. A patient even from affluent society remains silent on his/ her status as TB is often seen as a poor man's disease and could show the patient in a poor societal status. Studies have shown that there is a causal link between impacts of TB control, its local relevance and how it is perceived linking culture, gender and its illness.[45].

4.1.2 Socioeconomic Position

4.1.2.1 Social Class, Gender and Ethnicity: According to the yearly RNTCP reports, constant trends have shown that two thirds of the cases are male. Although there is no official estimate of male female break up among MDR-TB cases, the same trend is expected. However, In India, among females, 50% of the cases occur before 34 years of age. TB case notification for male to female has been constantly 1.8:1 and various studies have consistently demonstrated that TB is predominantly seen in more males. As TB is an infective disease and in India, males are the usual workers while the female is usually taking care of household activities, vis-à-vis the males are thereby having more contact with other people, chances of TB infect ion is higher in males than females[46]. However, operational studies have shown that males have poorer access to TB services.[47]

Studies have shown that women face greater stigma and inconvenience related to TB and its treatment, but despite that, women were more likely to access health services or even be notified under DOTS and adhere to treatment compared to men[48]. In respect to social class, once considered a poor man's disease, TB is increasingly seen among middle and higher-class population. This is usually related to stressful and demanding urban life, which leads to a low immunity due to constant exposure to stress combined with a non-active lifestyle. A study done by Indian Development Foundation, an NGO working on TB awareness found that 35% of students from affluent families are predisposed to illnesses such as TB due to reduced immunity[49].

Particular ethnic background such as scheduled tribes and scheduled castes are more vulnerable to TB and main reason behind that is due to lack of access to healthcare as these populations often live in areas away from civilization with no healthcare and additionally lack of education/knowledge also hampers health care seeking practices[50]. Studies done in North Carolina[51] and United Kingdom[52] shows that there is a definite link between ethnicity and TB, more so when ethnic minorities are disadvantaged in terms of economy, accessibility, etc.

4.1.2.2 Education, Occupation and Income: Educational leads to access to information and thereby new knowledge. Income provides access to scarce materials like specific health services. Occupation is usually the linking factor in between, so education level leads to occupation and occupational level leads to income. Occupational status also leads to power, privilege and prestige. Basically, education structures occupation and income. So, education also influences health outcomes both directly and indirectly[53].

Education leads to access to information and new knowledge. Income provides access to scarce materials like specific health services. Occupation is usually the linking factor in between, so education level leads to occupation and occupational level leads to income. Occupational status also leads to power, privilege and prestige. Basically, education structures occupation and income. So, education also influences health outcomes both directly and indirectly[53].

Educational attainment is usually seen as amount of knowledge one has by years of education and that are likely to promote healthy lifestyles. Occupation relates to social class that also indicates status and power and also relates to what kind of educational background one has. Income determines purchasing power and directly provides material resources and directly contributes to resources for good health. It is the indicator of socioeconomic status and purchasing power. Linking the 3, effect of education on income is mediated through occupation[54].

It has been established that treatment outcomes for TB are worse with those living under poverty and with low socio economic status[55]. Also yearly RNTCP reports suggest equally responsible. With education, comes migration and with migration, comes the issue of urbanization. Studies have also shown that migration[56], urbanization[57] and epidemiological transition[58] are closely linked to inequities that are seen in TB.

Annual RNTCP reports show prevalence of TB among deprived and poor. Additionally, studies regularly have shown that high-income countries enjoy better health due to better access and better resources[59].

4.2 INTERMEDIARY DETERMINANTS

4.2.1   Material Circumstances *(Living and Working Conditions, Food Availability, Etc.)***:** It has been well established that groups with certain disadvantages (rural population, poverty, accessibility issues, etc.) have often a higher exposure to intermediary risk factors for both TB and MDR-TB. People living in poorer conditions (poor community, crowded living, poor ventilation) will have a higher risk of exposure to TB through infected TB cases living in same population and certain working environments such as prison staff and inmates[60]. One would also expect malnutrition and/or similar factors, which can contribute to higher chances of getting infected by TB and MDR-TB. Working conditions, such as long working hours and inadequate ventilation will also impact disease trend in a negative way. Indoor air pollution, smoking, etc. are also risk factors that are aggravated in certain living and working conditions, especially poorer communities in an inequitable manner[61]. Urbanization, especially if rapid and not properly planned will increase risk of environmental conditions such as poor housing, air pollution, etc. New upcoming urban cities are very often poorly served by health services and it is also difficult to detect MDR-TB cases in such mobile settings. Health systems need to be adequately capacitated to reach urban poor where cases are not detected, and motivate patients to adhere to treatments. It is necessary to understand which groups are usually missed out, so specific strategies can be built to prioritize services for them. A study correlating factors of living condition (such as type of house, cooking fuel used) to prevalence of TB found people living in mud houses and using wood as cooking fuel were more affected by TB and is more prevalent in low standard of living, among those who are illiterate and belonging to backward classes[62].

4.2.2   Behavior and Biological Factors: These intermediary determinants are heavily influenced by structural determinants. For instance poverty and malnutrition owing to structural determinants such as education, income, occupation, will lead to increase susceptibility to TB infection and subsequently its outcome depending on its treatment. Patients with TB infection having low or no income will face social and economic barriers for even accessing health care facilities and that will delay or interrupt in treatment which means cases will transmit infection to more cases and may also turn to be MDR-TB case or co-infected with HIV[63].

TB cases are more seen in some ethnic groups. Prevalence in scheduled tribes and scheduled castes are more than in or backward class and general caste[*] and is particularly seen more in scheduled tribe females[62].

---

[*] The Scheduled Castes (SC), Scheduled Tribes (ST) and Other Backward Class (OBC) comprise about 16.2%, 8.2% and 34.2% respectively, of India's population according to the 2011 census. For more information on SC, ST, OBC and the caste system, please go the following government website http://socialjustice.nic.in/breif.php

More males infected by TB seek treatment compared to females. Elderly females are least likely to seek treatment. Besides economic and living condition, place of residence and ethnic identity are factors that increases vulnerability to TB. It means that a rural economically less powerful individual has less chances of getting TB than a slightly more economically stable individual living in urban slums. Access to treatment (discussed in 'Health System') can also influence material circumstances, for example, an individual recently migrating to urban area may find it difficult to locate a TB center.

4.2.3 Psychosocial Factors: There is always a fear of stigmatization with TB and this intermediary determinant is also a result of structural determinant factors such as social class, ethnicity, etc. The fear persists even if the patient seeks treatment and s/he may be deprived of social support[64]. Additionally, stress leading to depression could theoretically increase risk of TB by negatively affecting the cell-mediated immune system[65]. Even completing a scheduled dosage of ATT depends on a psychosocial factor. A study found that completion of ATT depends on different beliefs such as how motivated an individual is, perceived severity of disease, self efficacy and cost and benefit correlation. Those who had more physical symptoms tend to complete the course where as those who experienced health detoriation after starting treatment (which is a side effect of ATT) tended to stop ATT in between. There was also a strong relation established between completion and social support[66].

4.3 HEALTH SYSTEM

The CSDH framework has positioned the factor of 'Health System' in the pillar of intermediary determinants. However it states that its role is relevant through the issue of access which is a consequence of intermediary determinants although differences in access to health service is not fully responsible for "social patterning" of health outcomes. It also states that the health system can directly address inequities and additionally promote inter sectoral action to improve health.

4.3.1 Health Systems in TB Control

Currently, Non-RNTCP sector includes only private practitioners (PP) and private hospitals after government passed the law that all public system must work under RNTCP by reporting TB cases. Around 8 million patients with suspected TB are evaluated with sputum microscopy ever year and testing occurs in over 13,000 designated microscopy centers (DMCs) across India while by 2011, 40 labs were accredited for various culture/DST technologies, including 11 labs from private/NGO sectors[47].

Annually close to 41 million TB tests are conducted for initial TB diagnosis in India. 62% of annual patient spend on TB diagnosis of $222 million goes to the Non-RNTCP. A study reported that assuming all chest X-rays and tests of a patient in a private sector are done privately, per patient expenditure is ~$16 while under RNTCP, it is ~$2.5[67]. The same study, done in 2011, based on RNTCP report, Global TB and Census of India estimated TB cases total at 2,539,174 in 2011, out of which 40% (1,018,435) are from Non-RNTCP sector. Non-RNTCP TB testing is dominated by chest x-rays and serological antibody tests and smears. PCR and cultures are available in large private lab networks[68] [69]. Over 1.5 million serological tests were conservatively estimated to be done every year with a wide variation in estimated number of private labs; one estimate suggests 30,000 clinical labs, of which ~2700 have automated chemistry. Although large private laboratory networks have emerged and are growing, only about 250 labs have any form of recognized accreditation.

Therefore the Non-RNTCP private sector plays a crucial role in TB control and it is important to know performance of this sector compared to RNTCP annual performance.

4.3.1.1 RNTCP Sector: Each individual in India is eligible for free TB treatment. There are 12000 quality assured Designated Microscopy Centers (DMC) in 640 districts of India, each DMC catering to 50,000 to 100,000 population and each individual has access to TB treatment in their village/locality. All TB investigations and medications are free of charge and so accessibility and

affordability are not issues under RNTCP. Regarding quality of service, although RNTCP annually does staff performance evaluation and as per 2013 report, composite score (Human Resource, Financial Management, Drugs & Logistics, Case Finding Efforts and Quality of Services) is 59%, recent articles states that almost 90% of prescribed treatments by both RNTCP and non-RNTCP doctors are incorrect[70]. There have been recent studies showing same result (see box below).

4.3.1.2 Non-RNTCP Sector: In India, health care sector is very diverse and there are many non-MOH government departments and non-public sectors, which have their own health care facilities. Studies have shown that private sector is the first point of contact for more than half of TB patients. Grey literature review suggests that more than 40% of TB cases are treated in private sector which is never notified[67]. It was only in mid-2012 that GoI passed a law that all TB cases must be notified[71]. There are no monitoring as to what drug regimens are being followed by PP and how effective they are. It is therefore necessary to understand the role of private system in TB control.

About 1.5 million cases are registered under RNTCP and so more than a million cases are undergoing treatment privately. It is not clear how much percentage of this population are poor but high cost of ATT must have a negative impact on poorer population due to affordability which will ultimately lead to non-regularized treatment and increased chances of MDR-TB[72].

Not only the private sector, even the public sector, the staff and officials working under RNTCP are not following the drug regimen specified under DOTS. A study done in Mumbai on 105 anti TB prescriptions of private practitioners and 105 RNTCP treatment cards were analyzed. Only 9.52% prescriptions by private practitioners were correct and the RNTCP was doing even worse with only 4.76 % correct prescriptions. Factors for drug resistance were present in 67.62 % of prescriptions by private practitioners and 28.57 % of RNTCP prescriptions whereas overdosing was present in 53.33 % of prescriptions by private practitioners and 68.57 % of RNTCP prescriptions.
Source: Mishra G, Mulani J. Tuberculosis Prescription Practices In Private And Public Sector In India. NJIRM. 2013; 4(2): 71-78.

<div style="background:#b9a6c9;">## 5. Discussion</div>

Although the paper started out with objectives of finding factors leading into rise of TB and MDR-TB, literature reviews yielded facts that MDR-TB is an outcome of strategies of TB control which have not materialized as per planned and expectations and it is important to strengthen inputs (i.e. strategies) for a more productive output and outcomes.

Fuelling TB epidemiology are factors such as mobile and transient population in search of better jobs and securities, rapid urbanization and inequalities in socioeconomic sector. All these give rise to multiple risk factors of TB like food insecurity leading to malnutrition, poor housing and environment and barriers in access to adequate health services. So it is imperative that other sectors must be involved to successfully stop and reverse the trend of TB incidence. Summarizing factors from conceptual framework, it was found that interventions has to be and can be done at 3 levels, (1) health sector (2) non-health sector and (3) community.

Although interventions can be done in these levels, it has to be understood that each intervention has to be initiated by MoH/RNTCP including intervention in private health sector. This chapter deals with factors that are "structural determinants" and what are measures that are needed to be taken by MoH. Factors influencing "intermediary determinants" are such that MoH/RNTCP cannot influence much and as such discussion and later recommendations are laid out from a practical perspective where health system can intervene and effectively bring out changes.

5.1   STRUCTURAL DETERMINANTS

5.1.1   Socioeconomic and Political Context

Factors mentioned under structural determinants (Governance, Macroeconomic Policies, Social Policies and Public Policies) are discussed together as they are interrelated. As seen in results section, policies are transparent but more involvement of other sectors is necessary. But as a priority, it is imperative that "Social Protection" should be prioritized and discussion below shows how it can influence other factors. Second discussion is about involvement of 'non-health sectors' and MoH should involve at least 4 major sectors that hugely impact TB trend in India, viz. Urban Sector, Migration, Large Scale Industry and Education.

5.1.1.1 Improved Governance (to support policies): There are clear policies and guidelines in RNTCP, but several issues related to administration remains. In India, activities like decadal census, 5-year elections are met out quite effectively. This proves that India's administrative structure has the ability to carry out campaigns and programmes effectively, if provided with resources, authority and flexibility. These are centralized and control flows from central to state, state to district and RNTCP is also centrally governed. It works when the event is highly focused and has a fixed time period but when it needs collaboration and integrated activities, this approach is not best suited. Moreover, benefits of a vertical programme are evident as management is more systemic and structural, but it brings rigidity and doesn't give space to bottom ranks in terms of authority which hampers performance. Instructions are given from top order and are to be followed without proper feedback from bottom ranks due to inadequate flow of information. This leads to lack of support both ways and so more **vertical and horizontal coordination** is required. India has had a tradition of centralized planning and policy making and decentralized implementation. Funds are based on criteria such as population coverage, etc. and as such, states with a will for innovation or development 'outside the box' are constrained and there is a **lack of flexibility in spending**. Due to this **centralized policymaking**, state governments have little say/ feedback and so room for improvement is minimal.

Although government has laid out laws of reporting each notified TB case, it's not happening in reality and there has to be a more **effective enforcement of public health laws** and regulations, including regulation of private activities.

An important issue on which good governance depends is resources, both **financial and human resources.** Financially, RNTCP has no shortcoming with adequate funds already being sanctioned for 2012-2017. Human Resource management is an issue though and looking into table 8 below, RNTCP has to offer better opportunities to its staff if it needs its full cadre working full time. Rigid management and lack of incentives can lead into workers being demotivated, which will tend to result in corruption, lack of coordination, etc.

If these issues remain, irrespective of the extent to which policies and guidelines are made or highly developed technical aspects, objectives of a programme can never be met.

Table 8: RNTCP Human Resource & Training Status till December 2012			
Official/ Staff	No. of sanctioned post	Total No. in place & trained	Percentage
District TB Officer	698	567	81
Second Medical Officer at DTC	462	246	53
Medical Officer – TB Control	2564	1770	69
Medical Officers	92513	58938	64
Paramedical Staff	334689	232858	70
DOTS Plus & TB-HIV Supervisor	653	480	74
Senior Treatment Supervisor	2706	2381	88
Senior TB Lab Supervisor	2697	2387	89
TB Health Officer	3239	2650	82
Lab Technician at DMC	14107	12080	86
Data Entry Operator	698	650	93
DOT Provider	693628	484672	70
ICTC Counselors	6009	5180	86
District HIV supervisors	549	387	70
ART Medical Officer	560	418	75
Total	1155772	805664	70
Source: RNTCP Annual Status Report 2013, **www.tbcindia.nic.in/pdfs/TB%20India%202013.pdf**			

5.1.1.2 Involvement of Non-Health Sectors Social Protection is of paramount sector and MoH/RNTCP should talk with central government along with Ministry of Finance to provide social protection to TB patients. This topic is discussed separately in section 5.1.1.3. Many studies have repeatedly proven the importance of multi-sectoral approach in order to bring mentionable changes in health (mortality, morbidity) and there is evidence of developed countries bringing transition to health through involvement of non health sectors[73]. In Southern Europe and Central America, involvement of sanitation resulted in malaria control throughout 20th century and likewise urban sector and large scale industry must be involved for TB control.

The paper discusses what seems to be as 4 main sectors that must be involved for an effective TB control programme viz. **urban sector, large scale industry, migration** and **education.**

As in the world and as in India, infectious disease such a Leprosy and TB are becoming more common in urban slums since 1980s[74]. Add to that, India will have over 30% population living in urban areas by 2020[75]. India has also a large service sector (26%) and they are involved in **large scale industries** where living and working conditions are not regulated except for a few big companies. This serves as an ideal condition for not only TB, but many other communicable diseases to grow. There are no guidelines for regular health check up in these companies. Results section has mentioned how urbanization is impacting TB epidemic through close households, improper environment and non-strategic placement of health centers. Rather than that poor living conditions are an outcome of TB epidemic, it is what makes population more vulnerable to TB as it gives rise to overcrowding and poor ventilation[76]. TB cases on treatment in villages land up in urban towns in search of jobs and although there are guidelines to track such cases, in reality, they are lost and they harbor the infection and non-compliance could easily give rise to MDR-TB. These smear positive patients are main sources of spreading infection and in poor unplanned urban colonies, spread is even more[77]. TB is an environmental problem and **urban sector** needs to be involved in controlling TB epidemic. Migration is an issue as large scale industries are located in satellite cities and so it is important to sensitize Ministry of Internal Affairs to keep monitoring **internal migration**. Delhi (see Table 7) is a prime example of how urbanization and migration is increasing TB epidemic.

Another feature in urban slums is access to health facilities. In villages, usually there is one PHC or CHC which also houses TB units and it is easily findable. Once relocated in urban towns, people gets lost in the vast sea of healthcare providers of both public and private care and there are no proper or appropriate guidance for TB cases as to where to go for continuing services. Additionally, people look at health as a secondary priority whereas they are concentrating on getting jobs. Also health facilities are usually old and located in areas that are concentrated long ago while as urban slums are usually in newer areas where there are no new health facilities. These also delays in new case diagnosis, early treatment onset and reduces adherence[77].

Improving economy or reducing poverty may not be a MoH priority and are actually long term goals for Government of India, but MoH can intervene in **education department** and various studies all over world have shown how education can make a positive impact, especially for more vulnerable populations. Also it will create awareness amongst dominant males that will lead to make better and informed decisions.

5.1.1.3 Social Protection: Tuberculosis affects population who are in the lowest socioeconomic status and since this population suffers from poverty leading into inaccessibility of health services, it is important to provide social protection to this population. Social protection not only reduces vulnerability to infection, but also secures livelihoods by providing families at a time where they are not able to work due to illness.

Social protection through **microfinance** has taken a global importance recently especially in lower and middle-income countries. Poverty also brings along lack of attention to health, education and nutrition, all factors that contribute to TB epidemic. This leads to a vicious cycle, as children from a poor family will be exposed as malnourished and less educated[78]. Social protection helps a family to live without fear for treatment options, which also helps m in changing their behavioral and psychosocial attitudes. It has been proven that it can contribute to economic growth through increased productivity[79].

One form of social protection, **cash transfer,** is not rolled out in India on a visible scale. However, it is practiced in Latin America and sub-Saharan Africa and there has been evidence of its impact on all three factors, education, health and nutrition[80]. Cash transfer, however, can be problematic as there might be insufficient administrative skills to handle it on a large scale and also issues like fraud, etc. In certain Latin American and South East Asian countries, cash transfers are given

indirectly to families through school fees, providing healthy food, etc.[81]. This kind of conditional cash transfer maybe initiated among TB population by providing cash to TB cases that have completed their drug regimen.

Social protection schemes could be made more easily available in TB epidemic areas and other benefit could be that there will be increased awareness among these communities. Problems of stigma related to these communities may arise and so it is important that government plays an active role in communication (discussed below).

5.1.2 Socioeconomic Position

Traditionally, both age and gender are known variables which favours adult male, making adult females more vulnerable to TB not because of the rate of infection, but due to lack of treatment. Gender disparity occurs in a society in many invisible ways. Even in affluent and educated families, males are prioritized for treatment. This is largely also related to culture as India has a patriarchal society. Inadvertently, rural female population is more vulnerable than its counterpart in urban areas and likewise for tribal women and or scheduled groups. Illiterate people are less aware about diseases and as such less likely to report it. Interestingly enough a study showed that literacy doesn't affect treatment seeking behavior[62] which may imply that once patient is aware of the disease, behavior to seek treatment depends on other factors. A study in India showed association between social support and behavior of staff to treatment completion; and a slight association between higher income and treatment adherence[66]. Overall, MoH/RNTCP cannot directly influence factors such as gender/ethnicity or income/education, yet they can prioritize programme focus to marginalized and vulnerable population. It can also sensitize concerned departments about how they could support each other.

5.2   INTERMEDIARY DETERMINANTS

As mentioned earlier, MoH or RNTCP cannot make significant impact on intermediary determinants as they are fallout of structural determinants. However, there are certain issues worth discussing as these factors ultimately influence health seeking behavior of TB patients. TB patients are significantly higher in below poverty population. A reason could be that inequality along with inequity and poverty are closely linked[82]. Poverty is the component that influences all aforesaid mentioned factors (**Material Circumstances**, for instance, living and working condition, food availability). MoH can assist different ministries in laying out policies by advocating for TB and how policies can benefit these sectors. Urban males are significantly more affected than females which maybe due to male population predominantly working outside and in rural population, there is more reporting among males compared to females.

For **Behavior and Biological factors**, females are less affected as they grow older while in children, female children are more affected by TB. While studies have shown that biologically, females maybe protected after they attain menarche[83], a likely event maybe that a younger age, a sick female child is less attended to compared to a male child because of gender disparity while with age, as men go out to work and intermingle more, chances of TB increases among men.

Among tribal population, beside lack of education and poverty, a woman's vulnerability in terms of living condition might add to the high prevalence of these population. It is important that vulnerable population (young females, scheduled tribes, illiterates) should be targeted more through existing programmes or even add specific objectives to the programmes. Besides living condition, poverty and education, biological and behavioral factors that can be associated with culture and scheduled castes and tribes have emerged as significant factors that contribute to the epidemic.

TB can only occur in a patient when s/he is exposed to TB bacilli. It is thereby a biological occurrence. But it depends on various factors before patient can become 'infected' including economic status of families. Once infected by TB, although treatment seeking behavior is related

to economic and social factors, it is also related to behavior. And behavior of a person is influenced by the community/society s/he stays and keeps.

5.3   HEALTH SYSTEM

DOTS have been successfully implemented in many countries such as USA[84], China[85], Cuba[86] and parts of India[87]. It has led into decline of TB incidence and prevalence and rapidly so in many countries such as China and some Latin American countries since 1960s, the time when countries started rolling out NTP with elements of DOTS. But at the same time, socio economic condition of the world has also improved and so it's difficult to put all the credit to DOTS programme. One recent study done by WHO in 2009[88] suggested that TB trends are more strongly associated with intermediary and structural determinants such as biological, social and behavioral factors compared to NTP performance. Also because decline rate is not fast enough to meet Stop TB Partnership goals as expected, it means that impact of DOTS is almost uncertain.

In India and as so many or countries now, after years of continuously meeting NTP indicators (high case detection and cure rate), incidence is not falling as expected and the curve has almost hit a stagnant level. Studies are being currently done in many parts of the world to find factors and one study done in Vietnam[89] explained that there has been an increase of TB cases in young men in urban and remote rural areas which may be due to internal migration or increased exposure to risk factors. Similar findings have come from Morocco, Sri Lanka and Myanmar2 [90]. Another study done in Hong Kong suggest high incidence among elderly due to high reactivation[91].

In India, case notification rate is not coming down and this might indicate that despite commitment of Government and good management of RNTCP, **TB is probably growing into certain sub groups of population.**

The most effective strategy to control TB is to stop transmission so that there are no new cases. To understand where to intervene, it is important to understand the disease pathogenesis. Probability of transmitting TB depends on several factors such as immunity level of recipient, load of TB bacilli on droplets expelled by infected person, duration of exposure, etc. An untreated patient of TB can infect 10-15 healthy individuals per year2. Four key stages of TB pathogenesis, (1) exposure to infection, (2) infected and able to transmit (3)progression to disease and seeking care and (4) access to care and clinical outcome, are recognized where interventions can be made at health system level.

The schematic diagram below is adapted from **"Social determinants of health: key to global tuberculosis control"** published in International Journal of Tuberculosis and Lung Diseases 15(6):S30–S36   http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3052350/figure/fig2/amd applies CSDH framework and shows how social determinants of health leads to 4 key stages mentioned together as "**Health Care Sector Interventions**" and what interventions can be taken by RNTCP/MoH.

All interventions can be broadly clubbed into 4 following heads:

1. **Strengthen services**
2. **Involvement of Private Sector**
3. **Advocacy, Communication and Social Mobilization (ACSM)** Including IEC (Information, Education & Counseling) and BCC (Behaviour Change Communication)
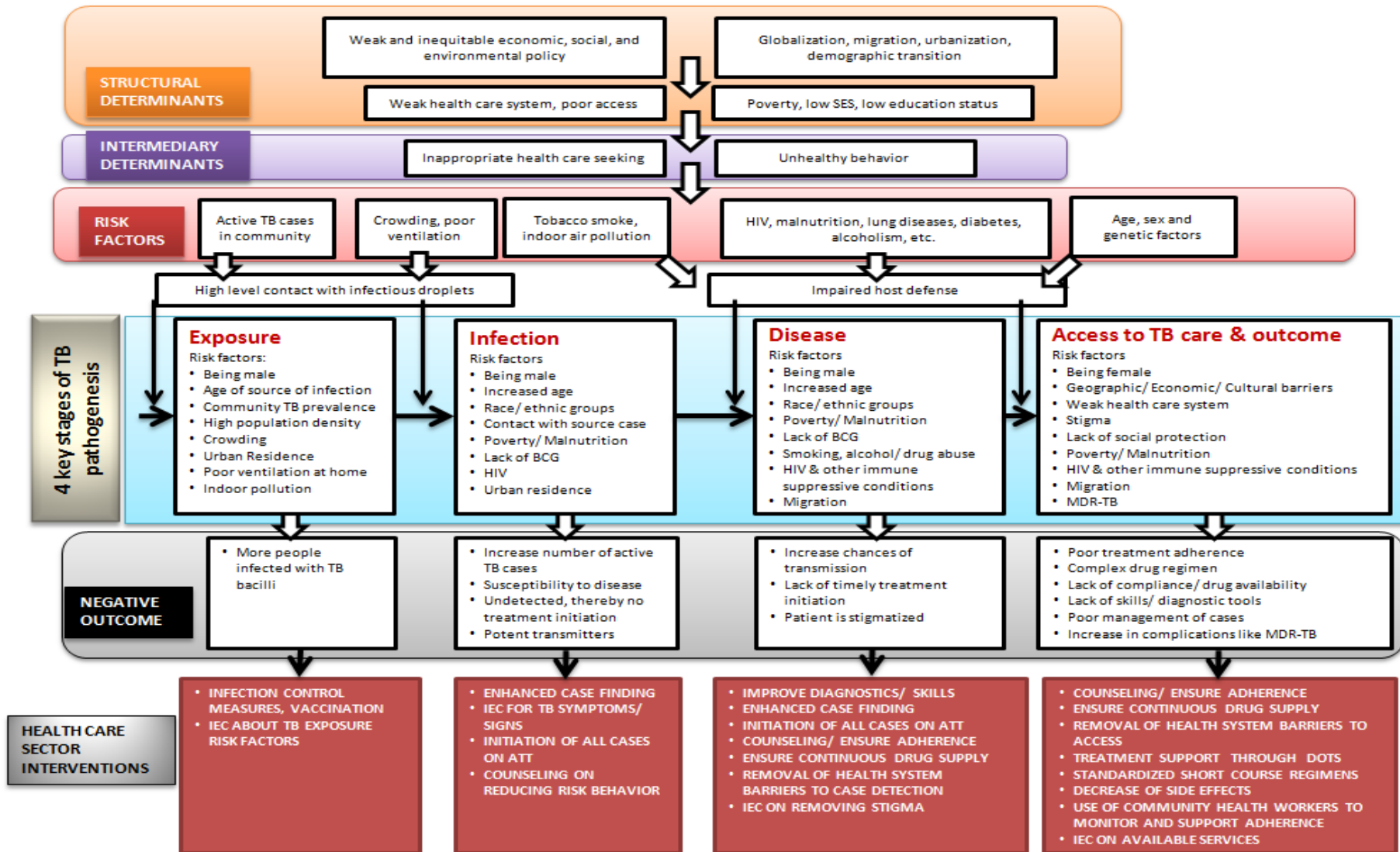4. **Community Interventions**

FIGURE 3: SCHEMATIC DIAGRAM SHOWING SPECIFIC HEALTHCARE SECTOR INTERVENTIONS AT DIFFERENT STAGES OF TB PATHOGENESIS

5.3.1   Strengthen services: Despite increased coverage of RNTCP, only 54% of sputum smear-positive cases in India are detected3. TB control can be made more effective if it follows 5 simple steps

> I.   **Early case detection**
> II.   **Improve diagnosis**
> III.   **Counseling**
> IV.   **Continuous drug supply**
> V.   **Monitoring**

Early case detection and **improved diagnosis** will help more TB cases being detected and get into treatment. **Counseling** will help not only cases to adhere to treatment but will also help in passive case detection. To complete scheduled drug regimen, it is important to have **continuous drug supply**. **Monitoring** of activities to check performance and accordingly manage the programme will yield in better programme impact.

5.3.2   Involvement of Private Sector: Private sector has to work in tandem with RNTCP. It has been well established that majority of cases going to private health care are never notified[92]. A study[93] done in western India showed that suspected cases of TB (cough symptoms) preferred private providers and cases shifted from public to private after their first visit. RNTCP clearly fails to attract patients and also fail to keep them too. But individuals with a previous history of TB prefer RNTCP which indicates that awareness about free diagnosis and treatment is a factor influencing provider choice. Reasons for non adherence to RNTCP are similar to or public services, such as distance to facilities, timings (waiting hours, opening time) and poor staff attitude[94].

In private sector, majority of diagnosis are based on Chest X Rays and very few reported sputum examination while it is clear that X-Rays are not confirmatory while sputum examination is definite[95]. But even in public care, diagnostic tests are not routinely performed and only around 27% of visits resulted in a sputum smear examination[93].

Although government has rolled out policies to collaborate with PP and many are part of RNTCP, but number is very little and majority of PP do not want to work under RNTCP as there is distrust between the sectors, lack of incentives and a regulatory mechanism. However collaboration projects between the sectors have been encouraging with results showing improved case notification; which is a prerequisite for effective TB control[96]. There is also a difference in training and knowledge in both sectors and a patient attending both, gets distrusted after getting different views on the same problem.. As such training should be universal and standard.

There are issues in both sectors. Attitude of government staff provokes patient to seek private care while high expense in private care leads to issue of affordability. Both sectors need to work together effectively and only then there will be true case notification which will help government in rolling out programmes taking actual incidence and prevalence of disease.

5.3.3   Advocacy, Communication and Social Mobilization (ACSM): TB is still seen in India as a disease that is associated with stigma and discrimination. Although stigma has lessened on a societal level, it still exists on an individual level and patients on ATT are not open to divulge their status. A big success of RNTCP goes to IEC, when in mid-90s, MoH posted hoardings on TB detection/suspicion stating "Cough for more than 3 weeks could be TB". ACSM has always been a key component of RNTCP and focus is 'health communication', to bring about awareness, changes in health perceptions and health seeking behavior and thereby increase case detection rate, treatment adherence, resulting in completion of all diagnosed TB cases in programme. Its goal also includes combating stigma and discrimination, empowering people affected by TB and community at large and mobilizing political commitment and resources for TB. In this year more than 450000 teachers and over 900000 students were reached through ACSM[97].RNTCP has well defined strategies with clear objectives, target audience, communication tools and roles &

responsibilities at each level. It further encourages need based strategy planning and implementation and encourages district specific ACSM action plans.

RNTCP is making a paradigm shift in next five years when it expects to detect at least 90% of estimated all type of TB cases and ensuring successful treatment of at least 90% new cases and 85% previously treated cases. Role of ACSM will be more significant if RNTCP is to actually achieve it. Additionally there are newer challenges like MDR-TB and HIV-TB co-infection which have to be addressed through ACSM since these categories of patients are likely to be defaulters previously, which can result in lack of motivation to complete treatment. Under RNTCP, important ACSM activities has been undertaken such as School Awareness Programme, involvement of Panchayati Raj Institutions[†] (PRI), mass media campaigns on World TB day, etc.

IEC and BCC should be at decreasing stigma and discrimination associated with disease. Only that will lead to increased case detection, as people will come out for screening. Moreover, information about drug adherence should be made a priority and benefits and adverse effects must be clear to each case. Still, in 2012, case detection rate was only 68% and combined defaulters/failure/relapse was 15% (Annual TB report 2013) which means despite best efforts, ACSM probably has not set their priorities correctly.

5.3.4   Community Interventions

5.3.4.1 Participatory Community Engagement: Due to India's varied culture, local specific programmes are more effective. PRIs need to be involved in RNTCP. For this, basic knowledge of programme and its functioning has to be explained to PRIs for their involvement. PRI is a strong government and its involvement will only enhance better performance.

PRIs are involved in all administrative and municipality actions and also as per policies are involved in health and sanitation components. But this is not the case and it leads to missed opportunities in terms of information. Some engagement does occur, but it is only vertical like telling them what to do. PRIs along with local women's group should be allowed in spreading awareness and involve and sensitize the community, which will give the community a sense of ownership and it will help in de-stigmatize the disease once community is better informed. All these will lead to easier case detection

5.3.4.2 Public accountability/ Community Monitoring: PRIs could be strengthened in monitoring government performance. Expected yearly performance of programme should be notified to PRIs (for e.g. expected number of cases to be detected). In some health components such as Family Planning and Immunization coverage, this is done and so it can be applied to RNTCP also. This monitoring will not only keep public officials in check but also keep the community involved by marking out clear roles and responsibilities for them.

> *It has to be kept in mind that finally RNTCP is a part of the government health system. There are weaknesses and inequities in the overall health service in India and they are also replicated in the delivery of TB services.*

[†] The Panchayati Raj Institute is a South Asian political system mainly in India, Pakistan, Bangladesh and Nepal. It is the oldest system of local government in the Indian subcontinent. The word "panchayat" literally means "assembly" (ayat) of five (panch) wise and respected elders chosen and accepted by the local community. Since 1993, it has been accorded constitutional status through the Constitution (73rd Amendment) Act.

6. Conclusion

TB Control strategy(s) mainly focus on early detection and effective treatment of detected cases. CSDH made a strong statement when it said, "public health achievements will largely depend on actions outside the health care sector"[98]. Even in history, TB was controlled before introduction of Isoniazid and Rifampicin when it was recognized as a "social disease" and that transmission could be cut by improving social determinants like living condition, health, nutrition, education, etc. After Second World War, BCG was introduced, but soon it was found that it had limited epidemiological impact and then after introduction of antibiotics in 1940s, TB control programmes started focusing on curative services.

In 2001, Stop TB Partnership was founded with main targets of halving prevalence and number of deaths due to TB by 2015 relative to 1990 and eliminating TB (decreasing incidence of TB to less than 1 per million) by 2050. To reach midterm target of 2015, mathematical models showed that it is feasible to reach it by detecting 70% of new TB cases each year and curing 85% of m.[99] These are the targets of almost all countries NTP. However, barring HIV co-infection, it doesn't take into account risk factors, especially social factors. In 2006–2007, WHO estimated that decline in global TB incidence was less than 1% per year and to eliminate TB by 2050 incidence rate must fall by an average of 16% annually till 2050[55]. That might be only possible if massive efforts are done to scale up curative care which would reduce TB transmission, but current studies (remodeling) analyzed that if results go as per Global Plan to Stop TB, that is expected reduction in rate of incidence of 6%, global incidence by 2050 would be close to 100 cases per million, that is 100 times higher than the 2050 elimination goal[100].

In 2006, finally Stop TB Strategy was launched not only to focus on curative aspect, but also to strengthen health system and look to other sectors such as public private mix, involving community, etc. as it was evident that to reach Stop TB Partnership's targets, efforts have to be made beyond health sector. Stop TB strategy is an effort that looks beyond curative side of TB control. DOTS is still the centre of Stop TB strategy but it reflects a shift towards focussing on social determinants of TB as only that can curb or control TB and minimize risk of upcoming threats such as MDR-TB. The HIV field has used structural interventions to deal with determinants of HIV epidemiology with measurable success including mobilizing communities and empowering women[101] [102] and it is necessary that the TB community should learn from this especially since HIV itself is a determinant of TB risk in many settings.

New strategies need to focus more than the health system as health system depends largely on governance and as in 1990s; TB saw a dramatic re-emergence following breakdown of erstwhile Soviet Union and collapse of many state services in Eastern Europe[103]. The scenario is applicable to India too. RNTCP/MoH is committed to TB elimination and it has constantly achieved its set indicators. But MoH has realized that they have reached a plateau and TB cases are not decreasing. Growing incidence of MDR-TB is an indicator that RNTCP needs to revise its monitoring indicators and set new ones if India truly is to eliminate TB. It has to improve its governance and policies have to be re-written or improvised. Power from the central has to decentralize and not just on policies, but in practice. From 2013, RNTCP has set new indicators, but to achieve them, RNTCP has to involve other sectors in the programme. Also such a massive programme over such a large time has to be accepted by the community if it wants to continue its success and so community involvement is necessary as it will only then give ownership to the community which will also make the programme sustainable. Thereby it is important that strategies need to be more holistic so that they do not depend on a single (curative) component.

7. Recommendations

As per 2013 Annual Report[97], RNTCP has entered the National Strategic Plan 2012-17 as part of India's 12th 5-Year plan. The major focus (and on which vision and goal are set) is "Early diagnosis". Main objectives are 90% detection, 90% treatment rate; reduce defaulters to 5% and treatment for MDR cases, TB-HIV confection cases and paediatric TB. Again although community involvement, ACSM and PPM are mentioned, clearly it is not in their main objectives. Recommendations given here are aimed to incorporate these factors along with the focussed ones. A schematic diagram to illustrate step by step recommendation is projected below.
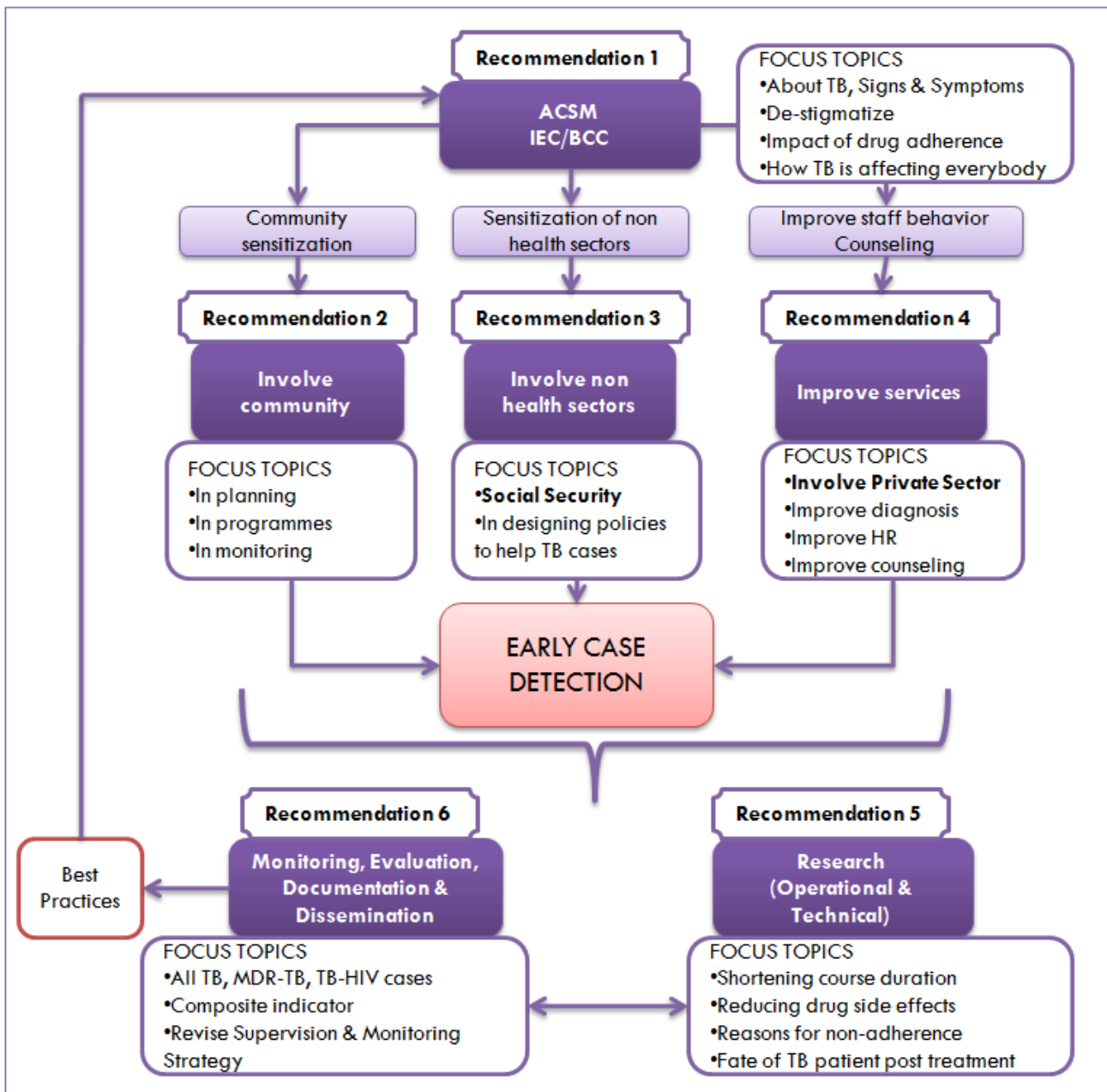

FIGURE 4: SCHEMATIC DIAGRAM SHOWING STEP BY STEP RECOMMENDATIONS

Recommendation 1: RNTCP should make ACSM as a prioritized objective

RNTCP should focus more to de-stigmatize the disease as TB cases are ostracized even among medical fraternity and culturally linked to bad behaviour, etc. 'Early Detection' is possible only when community as well as TB cases will accept the disease as a common regular disease. Extensive ACSM has to be done at all levels (Mass-media, Mid-media and local) and all stages (Country, State, and District). Each message should be specific to the audience it's catering to. Reputed national/international agencies can be recruited to assist. This will involve huge money, but will have maximum impact. But only 2.38% of total amount to be spent from 2012 to 2017 is budgeted for ACSM[97].

To achieve the main goal of early Detection' RNTCP should reach out to communities and non-health sectors, sensitize them about TB, its effect on community and country and especially BCC campaigns should be done to de-stigmatize the disease. It should also focus on adherence and its benefits. IEC should be done at both national and community level.

Time frame: 1st round of intense campaigning for first 2 years, review during 3rd year, improvised and continue till 5th year

Recommendation 2: RNTCP should involve community and give ownership

Recommendation 1 will sensitize communities. Then it should involve the communities by involving them in local planning. This will give a sense of ownership to the community which will also help to de-stigmatize the disease. With more involvement, suspected TB will be easily detected and patients won't hide their positive status. Community should also be involved in local monitoring as follow up of patients and also monitor RNTCP staff activities. Involving communities in such interventions will promote attitudes of healthy living and improved behavioral and biological factors. This recommendation can be done in accordance with next recommendation (#3) as there have been projects in Africa and Asia that has shown success of small scale community based programmes (including healthcare) implemented through urban sector that ultimately shows improvement in living conditions and thereby improving health[104] [105].

Time frame: From year 2 (midway through intense period of recommendation 1), review in year 4, continue with reviewed campaign till end of year 5

Recommendation 3: RNTCP should sensitize and involve non health sectors

TB is expensive to self (financially) and to the nation (DALY). RNTCP should negotiate with Ministry of Finance to provide social security to each TB case. Recommendation 1 will also sensitize non-health sectors, especially urban planning, large scale industry, migration and education sector. As per Millennium Development Goals, under 7th goal, to ensure environmental sustainability, it reads as improving lives of 100 million slum dwellers by 2020. Central Government can be sensitized that to achieve this goal, standard housing designs, up gradation of slums, setting up newer health facilities or reallocation of existing facilities for increasing access are interventions that urban sector needs to initiate in consultation with health department. These interventions will directly have an impact on reducing TB incidence by affecting both physical and social environment (determinants) of communities by improving housing quality.[106] Large Scale Industries can have policies for their staff for TB check up and proper management of positive cases. IEC campaigns in schools should be taken-up so that children can know about TB at an early stage of life.

Time frame: Sensitization during year 1, involve/assist in designing policies in year 2, assist in implementing policies in year 3 and 4, review and feedback on year 5

Recommendation 4: RNTCP should strengthen services and involve private sector

Involving PP is of utmost importance as was described in previous chapters. Trust has to be built so that there is uniformity in reporting of cases. Standard guidelines should be adhered by both sectors so that there is no difference of information for patient. This will also help in reducing

defaulters (patients discontinuing treatment due to affordability) and help in sustained high-quality DOTS implementation. DOTS approach has been successfully pilot tested in reducing drug resistant TB prevalence on a community level in Mexico, Peru and India. Proper and complete treatment as per standardized treatment by all providers, private and public, has been found not only efficient but also most cost effective strategy for dealing with MDR-TB. So the key challenges lies in reducing treatment default and ensuring non-interruption of treatment.

Service needs to be strengthened especially in diagnosis by increasing laboratory capacity for suspected MDR-TB cases testing. Estimates of MDR-TB are high and India currently doesn't have laboratory capacity to conduct tests on all suspected MDR-TB cases. In TB centers treating MDR-TB cases, capacity for culture and drug susceptibility testing should be expanded so that those suspected of having MDR-TB can be reliably evaluated.

RNTCP should ensure that there are no human resource management issues and there's adequate staff all throughout India and incentives should be given to staff working in remote areas. Staff should also be trained for better counseling to keep defaulters to a minimum.

Time frame: Make policies and contract PP in first 6 months of year 1, capacity building of staff and PP together during next 6 months of year 1, implement in year 2, review in year 3, revised strategy for year 4 and 5

Recommendation 5: RNTCP should encourage research on operational and technical issues

RNTCP has budgeted only 1.5% of total budget on consultancy and research for next 5 years. Despite RNTCP being 20 years old, TB cases are still stigmatized and that is a major issue for cases not coming out for treatment. Unless more operational research is done in finding out causes for stigmatization, early detection is not possible. Also research for why cases are non-adhering to treatment has to be carried out and India being a country of diverse culture, issues will be varied. Research on issues as what happens to a patient post treatment, how can a cured case be taken up as a role model in community, etc. needs to be done to actually get insight to 'cultural aspect' of the disease. In technical aspect, research should be continued to find ways to shorten treatment duration from 6/9 months. Also it is well known that a large number of defaulters cite side effects of drugs as a cause of defaulting. Research should be continued in finding ways to minimize side effects.

Time frame: Review above recommendations as per time line. From year 1, start research on mentioned issues

Recommendation 6: RNTCP should improve Monitoring, Evaluation & Documentation

For the next years, RNTCP has a new system of monitoring through composite indicators. This will enable monitoring of input, process and outcome indicator. As mentioned MDR-TB is not a standalone disease, but an outcome of inputs or lack of it. As such monitoring indicators should be evidence based with clear outcomes. There should be re-emphasized monitoring of MDR-TB, TB-HIV co-infection and Pediatric TB cases. Supervision and Monitoring strategies need to be revised if one wants to detect cases early. There have been success stories that are documented, but these needs to be disseminated throughout as best practices so that other states can follow these success stories if applicable in their context.

Time frame: Continuous throughout for all above recommendations.

While first 4 recommendations will lead to 'Early Case Detection', recommendation # 5 and #6 should be thematic across programme to evaluate the above recommendations. Documentation and dissemination of best practices will help to strengthen ACSM on next round.

8. Annexure

Annexure 1 Revised National TB Control Programme

(Adapted from the official RNTCP website http://www.tbcindia.nic.in/RNTCP.html)

Revised National Tuberculosis Control Programme (RNTCP)

About RNTCP: After pilot testing in 1993, the Government of India (GoI) has been implementing the WHO-recommended DOTS strategy for the treatment of TB via the RNTCP since 1997 as a national programme in all the 633 districts of India covering all of India (100% population, 1114 million). Phase II of the RNTCP started from October 2005 where the component of WHO recommended **Stop TB Strategy** was added which addresses newer issues to Phase I such as MDR-TB.

The objectives of RNTCP are measured through its 2 main components:

* To achieve and maintain at least 85% cure rate amongst New Smear Positive (NSP) pulmonary TB cases

* To achieve and maintain at least 70% detection of such cases

The RNTCP has been hailed as one of the most successful public health programme in the world. The directly observed treatment, short-course DOTS strategy along with the other ingredients of the Stop TB Partnership is implemented as a comprehensive package for TB control.

The five principal components of DOTS are:

1. Political and administrative commitment

2. Case detection by sputum smear microscopy

3. Uninterrupted supply of high-quality anti-TB drugs

4. Standardized treatment regimens with directly observed treatment for at least the first two months

5. Systematic monitoring and accountability

Management Structure: The programme is vertical in nature and management of the RNTCP is at five levels; National, State, District, Sub-district and Peripheral health institutions. At the central level, the Central TB Division (CTB) is the decision making body. The CTB is a part of the Directorate General of Health Services, Ministry of Health and Family Welfare (MoH&FW), GoI and is headed by a Deputy Director General (TB).

Planning, training, supervising and monitoring is more decentralized at the state level and the responsibility lies with the State Tuberculosis Officer. There is a District TB Officer (DTO) for each of the 633 districts that have the responsibility of physical and financial management. Below the DTO is sub-district Tuberculosis Unit (TU) which caters to an approximate population of 500,000, (250,000 in tribal and difficult areas). The TU comprises of a designated Medical Officer TB Control (MO TB), a Senior Treatment Supervisor (STS) and a Senior TB Laboratory Supervisor (STLS), based in either a Community Health Centre or lower.

There are about 12000 RNTCP quality assured designated microscopy centers (DMC) across the country reporting to their designated TU. They provide sputum microscopy services with each DMC covering roughly a population of 100,000 (50,000 in tribal and difficult areas). Patients are provided directly observed treatment (DOT) by either a health care worker sites called DOT-centers. These centres may be placed at any level from the BPHC and above at the Government level and through contracted NGO (Non-Government Organizations) under the Private Public Partnership (PPP). The entire course of anti-TB drugs for individual patients is packaged in a

patient wise box to ensure that treatment is not interrupted during the scheduled course of treatment.

Public Private Partnership: PPP plays an active role in the programme and its success and currently around 2500 NGOs are contracted which act as DOT-Center and/ or TU. Over 19000 private practitioners and 267 Medical Colleges are also contracted under the programme. Many other government and private sector bodies such as the Employees State Insurance, Central Government Health Scheme, Armed Forces, Corporate Sector, etc. are involved in the programme.

In New Delhi and Hyderabad, studies were conducted to understand the feasibility and effectiveness of the PPP models that are implemented under RNTCP. The study revealed that the cost to the society per patient cured was lower in Public – Private Mix (PPM) DOTS compared to the public sector. Another study conducted in Bangalore stated that even there were more cases treated under RNTCP, while the average societal cost (direct and indirect) per patient treated reduced from US$123 to US$87. These studies conclude that PPM DOTS could be cost effective and reduce the financial burden on patients and society.

Training: Training of the all the staff under RNTCP is standardized and guided through developed modules that are designed by WHO in consultation with GoI. There are separate guidelines of treatment for children and HIV cases suffering from TB. Since 2001, CTD has collaborated with the National AIDS Control Organization (NACO) for joint efforts for HIV patients suffering from TB initially in the 6 high HIV prevalence states and later has expanded to 14 states and currently efforts are made to scale up for the entire country. Specifically for this, a National TB/HIV Framework has been developed jointly under a Technical Working Group to advice on technical guidelines and related policy issues.

Results: Till 2011, RNTCP has benefitted over 10 million TB patients, with over 1 million annual registration The programme has been able to maintain its primary objectives (85% cure rate, 70% detection) each year till now and death rates under RNTCP have reduced from 29% before the launch of the programme to less than 5% among new smear positive cases.

Funding & Technical Support: The majority of funding for RNTCP is from the Government of India that also includes a World Bank credit. Additional financial support is also through other Government and International donors such as DFID, USAID and Global Fund. DFID especially provides funds for drug procurement. WHO, with USIAD and DFID provides technical support through its network of contracted Consultants that mainly provide support to field level state and district TB officers and also to the CTD through its senior Consultants mainly in the area of surveillance, quality assurance, and logistics management. It also supports through developing and providing various strategy documents, guidelines and training modules, organizing meetings at national and zonal level and research activities.

MDR-TB under RNTCP

DOTS-Plus: Since its second phase, RNTCP has expanded its services to cater to patients of MDR-TB through DOTS-Plus sites. DOTS Plus refers to a DOTS program that adds components for MDR TB diagnosis, management, and treatment. The WHO-endorsed DOTS Plus program began in 2000 on the world and in 2002, the Global Fund to fight AIDS, TB, and Malaria (GFATM) started financing TB control programs, including MDR TB. DOTS-Plus programs also strengthen the basic DOTS strategy. These are specialized sites for these patients and their programmatic management guidelines are based on international guidelines. In India, It started in 2007 in the state of Gujrat and Maharastra and by the start of 2009; it was scaled up to 7 states with a vision to have centers at all the states by 2012. There will be at least one site in each state that will have ready access to an RNTCP-accredited culture and drug susceptibility-testing (DST) laboratory. These centers besides having quality assured laboratory testing, will have facilities for testing drug susceptibility and rapid detection of MDR-TB.

DOTS Plus and RNTCP: The RNTCP views the treatment of MDR TB patients as a 'standard of care' issue. Treatment protocols for MDR-Tb are similar to internationally recommended DOTS Plus guidelines and are done in designated RNTCP DOTS Plus sites.

A new protocol for state-wide Drug Resistance Surveillance (DRS) under RNTCP was developed in 2005. RNTCP and ICMR planned to systematically carry out state-wide DRS surveys in the states of Andhra Pradesh, Delhi, Gujarat, Kerala, Maharashtra, Orissa, Uttar Pradesh, West Bengal, Tamil Nadu and Sikkim.

Updated status on PMDT for MDR-TB management (2013)

The Programme Management for Drug Resistant TB (PMDT) services for quality diagnosis and treatment of drug resistant TB cases were initiated in 2007 in Gujarat and Maharashtra. Despite the modest progress from 2007- 2009, the programme has extended drug susceptibility testing to all smear positive retreatment cases upon diagnosis, and all new cases that are smear-positive after first-line anti-TB treatment across the country by 2012. By 2015 drug susceptibility testing will be made available to all smear positive cases registered under the programme.

This is further complemented by a nationwide laboratory scale up with 43 culture & DST laboratories (Solid & LPA techniques including Liquid Culture in 33 labs) in the public health sectors by 2015.

The 12th five year Plan (2012-17) for RNTCP has the objective to provide universal access to quality diagnosis and treatment to all TB cases in the community including TB HIV and Drug Resistance TB cases.

India introduced PMDT services in all 35 states on 10th Jan 2012. As on February 2013, PMDT services were available in all 35 states of the country across 638 districts covering a population of 1089 million (92%) and are being rapidly scaled up. 46 laboratories are currently offering quality diagnostic services for drug resistant TB including 35 labs equipped with rapid molecular diagnostic techniques. 76 DR TB wards established with airborne infection control measures.

Source: 2013 Annual RNTCP Report

Annexure 2 DOTS Plus Framework

(Adapted from the official STOP TB website
http://www.stoptb.org/assets/documents/global/plan/Stop%20TB%20Working%20Group%20on%2
0DOTS%20Final.pdf

DOTS Plus Framework: The framework is organized around the same five components of the DOTS strategy, as the underlying principles are the same. The core components are comprehensive ensuring that all essential elements of the DOTS Plus strategy are included and are as follows:

1. Sustained political and administrative commitment
    *   A well-functioning DOTS program.
    *   Long-term investment of staff and resources.
    *   Coordination efforts between the community, local governments, and international agencies.
2. Diagnosis of MDR TB through quality-assured culture and drug susceptibility testing
    *   Proper triage of patients into DST testing and the DOTS-Plus program.
3. Appropriate treatment strategies that utilize second-line drugs under proper management conditions.
    *   Rational treatment design (evidence-based.)
    *   Directly observed therapy (DOT) ensuring long-term adherence.
    *   Monitoring and management of adverse drug reactions.
4. Uninterrupted supply of quality-assured anti-TB drugs.
5. Recording and reporting system designed for the DOTS Plus programs that enable performance monitoring and evaluation of treatment outcome.

Currently, RNTCP does not have sufficient quality-assured laboratory capacity to do DST in all patients. Hence, the program will use a strategy that enrolls patients with a very high-risk of MDR TB into RNTCP DOTS Plus activities and treatment with the RNTCP Category IV regimen. MDR TB suspected cases (A MDR TB Suspect is defined as a Category II patient who is smear positive at the end of the fourth month of treatment or later) are identified and investigated further for MDR TB. A confirmed MDR TB case is an MDR TB suspect who is sputum culture positive and whose TB is due to bacilli that are resistant in-vitro to at least isoniazid and rifampicin, the DST result being from an RNTCP accredited intermediate reference laboratory (IRL). For drug-resistant TB, bacteriology includes both sputum smear microscopy and culture examination. Smear microscopy and culture are performed and results reported according to international standards. For smear and culture conversion, two separate indicators, based on sputum smears and on cultures are calculated. Patients are considered culture converted after having two consecutive negative cultures taken at least one month apart.

Treatment of MDR-TB cases: The recommended duration of administration of the intensive phase (IP) is guided by smear and culture conversion. The minimal recommendation is that the IP should be given for at least 6 months. After 6 months of treatment, the patient will be reviewed and the treatment changed to the CP if the culture results from the 4th month are negative. If the culture results from the 4th month remain positive, the DOTS-Plus site Committee decides on extending the IP treatment by up to 3 months. If the 4th month culture is still awaited after 6 months of treatment, the IP is extended until the result is available, with further treatment being decided on according to the culture result when this becomes available. After a maximum of 9 months of IP treatment, the patient is initiated on the CP of treatment. The recommended duration for CP is 18 months. For follow-up culture and DST, the patient needs to go to DTC. After discharge, the patient visits the DOTS-Plus site facility only if deciding to change from the IP to the CP, at the end of treatment, at the time of the management of adverse reactions, and at the time of change of treatment due to non-response.

Annexure 3 STOP TB Strategy

(Adapted from the official STOP TB website http://www.stoptb.org

STOP TB

At the global scenario, the targets set for controlling TB are detection of at least 70% of infectious TB cases and successful treatment of 85% of detected cases as set out in the 2005 World Health Assembly. As per the 2015 Millennium Development Goals, to "target to reverse TB incidence; and associated Stop TB Partnership target of halving prevalence and deaths by 2015 in comparison to 1990". More than 20 million people have been treated under DOTS adopted by 182 countries since its inception in 1995, but still a quarter of the world population ha no access to DOTS services. Therefore the WHO has developed an enhanced strategy, STOP TB, with an altogether specialized STOP TB department. It has 6 core elements aiming to reach all TB patients

1. Pursuing quality DOTS expansion

2. TB/HIV and MDR-TB

3. Contributing to health system strengthening

4. Engaging all care providers

5. Empowering patients and communities

6. Enabling and promoting research

The WHO Stop TB Department supports the efforts of WHO Member States and helps develop policies, strategies and standards, facilitates partnerships, measures progress towards TB targets and assesses Country programme performance. The Stop TB Partnership functions under a coordinating body with a network of 400 stakeholders. It has 7 working groups to handle different components, namely

1. Advocacy, Communication and Social Mobilization

2. DOTS Expansion

3. DOTS Plus MDR-TB

4. New Drugs

5. New Diagnostics

6. New Vaccines

7. TB/HIV

The Global Plan to Stop TB 2006–2015 was launched in January 2006 building upon the Global Plan to Stop TB 2001 – 2005 and planned out the financial requirements and resources needed for the world and also region wise to meet the 2015 targets. Some of the recommendations included that TB control be incorporated into development agendas, DOTS programmes be strengthened, TB/HIV activities be expanded and TB partnerships be supported. The emergence of resistance to drugs used to treat TB, and particularly multi-drug-resistant TB (MDR TB), has become a significant public health problem and an obstacle to effective TB control.

Annexure 4 Problem Tree
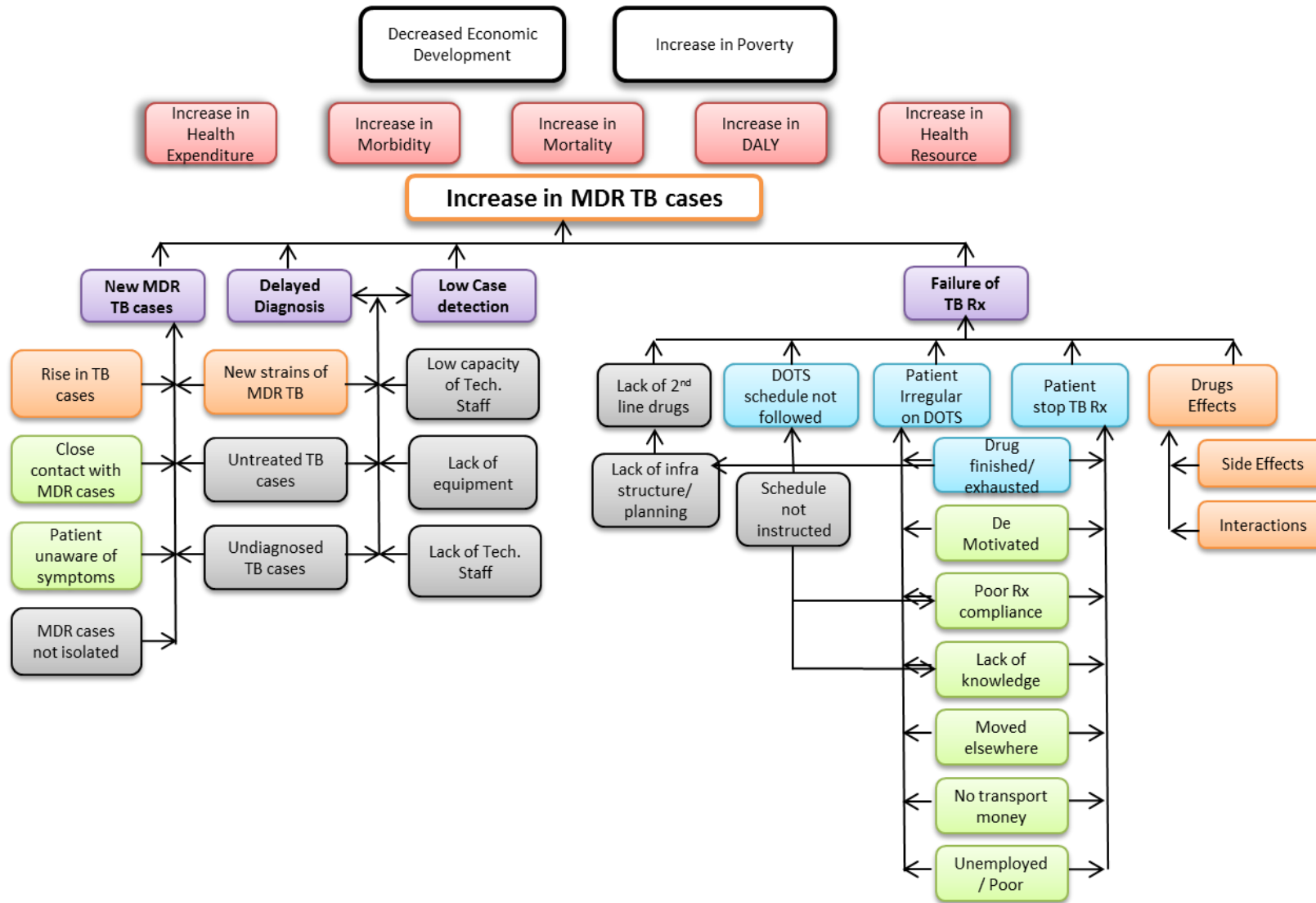
Annexure 5 List of mentionable sources

Journals/ Publications/ Reports

- **A Conceptual Framework for Action on The Social Determinants of Health**
  Social Determinants of Health Discussion Paper 2
  Debates, Policy & Practice, Case Studies
  World Health Organization, Geneva, 2010

- **The social determinants of health: key to global tuberculosis control**
  International Journal of Tuberculosis and Lung Diseases Vol. 15, No.6
  K. Rasanathan & A. Sivasankara Kurup *(Department of Ethics, Equity, Trade and Human Rights)*
  E. Jaramillo & K. Lönnroth (*Stop TB Department, World Health Organization, Geneva*)

- **The Social Determinants of Tuberculosis: From Evidence to Action.**
  American Journal of Public Health, Vol. 101, No. 4, April 2011
  James R. Hargreaves *(London School of Hygiene & Tropical Medicine)*,Delia Boccia, Carlton A. Evans, Michelle Adato, Mark Petticrew, and John D. H. Porter.

- **Drivers of tuberculosis epidemics: The role of risk factors and social determinants**
  Social Science & Medicine, Vol. 68, Issue 12, June 2009
  Knut Lönnroth, ,Ernesto Jaramillo,Brian G. Williams,Christopher Dye, Mario Raviglione World Health Organization, Geneva

- **The political context of social inequalities and health**
  International Journal of Health Services, Vol. 31, Issue 1, 2001
  Vicenc Navarro and L. Shi

- **Recent Advances in Multi-Drug-Resistant Tuberculosis and RNTCP**
  Indian Journal of Community Medicine, October 2008 October; Vol. 33, Issue 4
  Gagandeep Singh Grover and Jaspreet Takkar

Websites

- **TB Control India & RNTCP**
  http://www.tbcindia.nic.in   & http://www.tbcindia.nic.in/rntcp.html

- **WHO TB Country Profile Webpage**
  http://www.who.int/tb/country/data/profiles/en/index.html

- **Stop TB Partnership**
  http://www.stoptb.org/

- **International Union against Tuberculosis & Lung Disease (The Unioin)**
  http://www.theunion.org/

- **Center for Disease Control & Prevention TB webpage**
  http://www.cdc.gov/tb/

- **Global Health Education TB Facts**
  http://www.tbfacts.org/tb-statistics-india.html

- **TB Alert India webpage**
  http://www.tbalert.org/news_press/documents/whotbfactsheet.pdf

<div style="background:#c9b6d4">

9. References

</div>

Author/Organization, Title, Published Journal, Year, Volume, Issue, Page/Link, Date of access

1 Kumar V, Abbas AK, Fausto N, Mitchell RN, Robbins Basic Pathology (8th ed.) 2007, Saunders Elsevier, P:516–522

2 World Health Organization (2012), Global Tuberculosis Control Report 2012, WHO, WHO/HTM/TB/2012, P:3-14 www.who.int/tb/publications/global_report/ Accessed 04.05.2013

3 World Health Organization, "Epidemiology", Global Tuberculosis Control: Epidemiology, Strategy, Financing, 2009 P:6–33

4 Raviglione and Uplekar, 2006, The new Stop TB Strategy of WHO, Lancet, 367 (2006), P:952

5http://www.teachepi.org/documents/courses/tbdiagrx2/day3/TB_Diagnostics_Market_Analysis__July16_2012_FINAL.pdf Accessed on 24.02.2013

6 WHO, Geneva, Switzerland, An Expanded DOTS framework for effective Tuberculosis control, WHO/CDS/TB/2002, 2002; P:297-303

7http://www.censusindia.gov.in/2011-prov-results/indiaatglance.html Accessed on 13.07.2013

8 http://esa.un.org/unup/Country-Profiles/country-profiles_1.htm Accessed on 02.08.2013

9http://povertydata.worldbank.org/poverty/country/IND Accessed on 13.07.2013

10http://www.who.int/countries/ind/en/ Accessed on 13.07.2013

11International Institute for Population Sciences and Macro International (September 2007), Ministry of Health and Family Welfare, Government of India, P: 436–440 http://www.measuredhs.com/pubs/pdf/FRIND3/FRIND3-Vol1AndVol2.pdf, Accessed 20.10. 2012

12http://www.tbcindia.nic.in/pdfs/Tuberculosis%20Control%20in%20India-Final.pdf Accessed on 13.07.2012

13 Toman K. World Health Organization, 1979, Tuberculosis, Case Finding and Chemotherapy

14 Central TB Division, Directorate General of Health Services, Ministry of Health & Family Welfare, DOTS-Plus Guidelines 2006, Nirman Bhavan, New Delhi: Revised National Tuberculosis Control Programme; P:1–46

15 Simone PM, Dooley SW. Multidrug resistant tuberculosis. Atlanta, GA, USA: Department of Health and Human Services, Centers for Disease control and Prevention; 2000. P:1-9.

16 WHO, Geneva, Switzerland, Anti tuberculosis drug resistance in the world, The WHO/ IUATLD project on Anti-Tuberculosis drug resistance surveillance. WHO/CDS/TB/2000, 2000, 278 P:4–5

17 Singh MM. Tuberculosis: Triumphs and tragedy, Indian Journal of Tuberculosis. 2000, 47, P:129–32

18 Jagota P. Revised National Tuberculosis Control Programme, Success Story, Indian Journal of Tuberculosis, 2002, 49, P:69–73

19 Grover G.S, Takkar J. Recent advances in multi-drug-resistant tuberculosis and RNTCP. Indian J Community Med 2008, 33, P:219-23

20World Health Organization, Sixty-second World Health Assembly. Reducing health inequities through action on the social determinants of health, Geneva, Switzerland: WHO, 2009 http://apps.who.int/gb/ebwha/pdf_files/A62/A62_R14-en.pdf Accessed 22.07.2013

21 WHO Commission on Social Determinants of Health—final report, Accessed 16.02.2010 http://www.who.int/social_determinants/thecommission/finalreport/en/index.html.

22 Navarro V, Shi L. The Political context of Social Inequalities and Health, International Journal of Health Services, 2001, 31, P:1-21

23 Press Information Bureau, Government of India, Accessed 13.07.2013 http://pib.nic.in/newsite/erelease.aspx?relid=91533

24 Monica Das Gupta, Peyvand Khaleghian, Rakesh Sarwal, Governance of Communicable Disease Control Services, A Case Study and Lessons from India, World Development Report 2004: Making Services, Work for Poor People, Accessed 01.08.2013 http://citeseerx.ist.psu.edu/viewdoc/download?rep=rep1&type=pdf&doi=10.1.1.4.6267

25 D.P. Pesut, Z.B. Gledovic, A.D. Grgurevic, L.M. Nagorni-Obradovic, Tuberculosis incidence in elderly in Serbia: key trends in socioeconomic transition, Croatian Medical Journal, 49 (2008), P:807–812

26 E.L. Corbett, C.J. Watt, N. Walker, D. Maher, B.G. Williams, M.C. Raviglione et al The growing burden of tuberculosis: global trends and interactions with the HIV epidemic, Archives of Internal Medicine, 163 (2003), P:1009–1021

27http://www.who.int-rpc-meetings-TB090104.pdf, Accessed 01.07.2013
28http://ehealth.eletsonline.com/2013/06/india-faces-drug-shortage-against-rising-tuberculosis-cases/ Accessed 16.07.2013
29http://www.stoptb.org/news/stories/2013/ns13_041.asp Accessed 16.07.2013
30http://online.wsj.com/article/SB10001424127887323689204578571793339863864.html Accessed 16.07.2013
31http://www.thehindu.com/sci-tech/health/now-multidrugresistant-tb-stock-crisis-looms/article4860970.ece Accessed 16.07.2013
32 Julius Korir, Urbanus Kioko, The Centre for Economic Governance and AIDS in Africa (CEGAA), Evidence of the Impact of IMF Fiscal and Monetary Policies on the capacity to address HIV/Aids and TB Crisis In Kenya. http://www.results.org/uploads/files/Kenya_IMF_Report.pdf Accessed 21.07.2013
33Stuckler D, King LP, Basu S International Monetary Fund Programs and Tuberculosis Outcomes in Post-Communist Countries PLoS Med 2008, 5, 7, P:143.
34 On the Margins in the City: Adivasi Seasonal Labour Migration in Western India, David Mosse, Sanjeev Gupta and Vidya Shah, Economic and Political Weekly, Jul 9-15, 2005, 40, P:3025-3038
35 Alternative Labour Policy for Rural Workers, Mazhar Arif, South Asian Partnership-Pakistan, 2005, http://www.sappk.org/sites/default/files/publications/eng_publications/Alternative_Labour_Policy_for_Rural_Workers.pdf P 29, Accessed on 16.06.2013
36 Fox DM. Social policy and city politics: Tuberculosis reporting in New York City, 1889–1900. Bulletin of the History of Medicine 1975, 49, P:169–195
37http://articles.philly.com/1992-11-25/news/26007997_1_tb-aids-patients-killer-germ Accessed 20.07.2013
38 Comprehensive and Unified Policy for TB Control in the Philippines, Department of Health, Government of the Philippines, Accessed on 20.07.2013 http://www.philhealth.gov.ph/partners/providers/pdf/ComprehensiveUnifiedPolicy_TB.pdf
39http://www.who.int/tb/publications/2009/airborne/philippines/en/ Accessed on July 2013
40 Widening the aim of health promotion to include the most disadvantaged: vulnerable adolescents and the social determinants of health, Health Education Res June 1, 2010 25: P 387-394
41 Raphael D. Social determinants of health: present status, unanswered questions, and future directions. International Journal of Health Services, 2006, 36, 4, P:651-677.
42 Benzeval M., Judge K, Whitehead M, eds. Tackling inequalities in health: An agenda for action. London, King's Fund, 1995.
43 The world's most neglected diseases, Ignored by the pharmaceutical industry and by public-private partnerships, British Medical Journal, July 2002, 325, 7357, P:176–177, PMCID: PMC1123710
44 A J Rubel and L C Garro, Social and cultural factors in the successful control of tuberculosis, Public Health Rep. Nov-Dec 1992, 107, 6, P:626–636, PMCID: PMC1403712
45 Weiss M, Cultural epidemiology: an introduction and overview. Anthropology and Medicine (2001) (Supplement 1), P:5–29
46 Liefooghe R, Baliddawa JB, Kipruto EM, Vermeire C & De Munynck AO, From their own perspective: a Kenyan community's perception of tuberculosis. Tropical Medicine and International Health, 2007, P:809–821
47 RNTCP Annual Report 2011: TB India 2011, http://tbcindia.nic.in/pdfs/RNTCP/TB/India/2011.pdf , Accessed on 02.01.2013, P: 74-75
48 Balasubramanian R., Garg R.Et al. Gender disparities in tuberculosis: report from a rural DOTS programme in south India, The International Journal of Tuberculosis and Lung Disease, March 2004, 8, 3, P:323-332
49http://newindianexpress.com/cities/bangalore/article1515528.ece Accessed on July 1st, 2013
50 Chakma T, Rao PV, Pall S, Kaushal LS, Datta M, Tiwary RS, Survey of pulmonary tuberculosis in a primitive tribe of Madhya Pradesh, Indian Journal of Tuberculosis. 1996, 43, 85
51 Stout JE, Saharia KK, Nageswaran S, Ahmed A, Hamilton CD. Racial and ethnic disparities in pediatric tuberculosis in North Carolina, Arch Pediatric Adolescents Medicine, 2006,160, 6, P:631–637
52 Doherty MJ, Davies PD, BellisMA, TocqueK. Tuberculosis in England and Wales, Ethnic origin is more important than social deprivation, British Medical Journal, 1995, 311, 6998, P:187
53Singh – Manoux A, Clarke P, Marmot M. Multiple measure of socioeconomic position and psychosocial health: proximal and distal measures. International Journal of Epidemiology, 2002, 31, P:1192 -1199

[54]Lahelma E et al. Pathways between socioeconomic determinants of health. Journal of Epidemiology and Community Health, 2004, 58, P:327-332

[55] Lönnroth K, Jaramillo E, Williams BG, Dye C, Raviglione M, Drivers of tuberculosis epidemics: The role of risk factors and social determinants Accessed on 30.06.2013 http://whqlibdoc.who.int/publications/2010/9789241563970_eng.pdf P:219-242

[56]Blumberg H M, Migliori G B, Ponomarenko O, Heldal E, Tuberculosis on the move. Lancet 2010, 375, P:2127–2129.

[57]Lienhardt C, From exposure to disease: the role of environmental factors in susceptibility to and development of tuberculosis. Epidemiological Review 2001, 23, P:288–301

[58]Omran A R. The epidemiologic transition: a theory of the epidemiology of population change. Milbank Memorial Fund Quarterly, 1971, 49, P:509–538.

[59]Ecob R, Davey Smith G. Income and health: what is the nature of the relationship? Social Science & Medicine, 1999, 48, P:693-705

[60] A. Bobrik, K. Danishes, K. Eroshina, M. McKee, Prison health in Russia: the larger picture, Journal of Public Health Policy, 26 (2005), pp. 30–59

[61] H. Rieder, Epidemiologic basis of tuberculosis control, International Union Against Tuberculosis and Lung Disease, Paris (1999)

[62] Aarti Kaulagekar, Anjali Radkar, Social status makes a difference: Tuberculosis scenario during National Family Health Survey – 2, Indian Journal of Tuberculosis 2007, 54, P:17-23

[63]Kanara N, Cain KP, Chhum V, et al. Association between distance to HIV testing site and uptake of HIV testing for tuberculosis patients in Cambodia, International Journal of Tuberculosis and Lung Disease, 2009, 13, 2, P:226–231

[64]Somma D, Thomas BE, Karim F, et al. Gender and Socio-cultural determinants of TB-related stigma in Bangladesh, India, Malawi and Colombia. International Journal of Tuberculosis and Lung Disease, 2008, 12, 7, P:856–866

[65]M. Prince, V. Patel, S. Saxena, M. Maj, J. Maselko, M.R. Phillips et al. No health without mental health, Lancet, 2007, 370, P:859–877

[66] Florie Barnhoorn, Hans Adriaanse, In search of factors responsible for noncompliance among tuberculosis patients in Wardha District, India, Social Science & Medicine, 34, 3, P:291-306

[67] USAID India, Market-based partnerships for health, Tuberculosis control and care initiative. A baseline survey report, 2012

[68] Jaroslawski S, et al. Why are inaccurate tuberculosis serological tests widely used in the Indian private healthcare sector? A root-cause analysis, Journal of Epidemiology, Global Health 2012, 2, P:39-50

[69] Dowdy D, Steingart K.R, Pai M. Serological Testing versus Other Strategies for Diagnosis of Active Tuberculosis in India: A Cost-Effectiveness Analysis, PLoS Med, Accessed on 23.07.2012 http://www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.1001074

[70]Gyanshankar Mishra, Jasmin Mulani, Tuberculosis Prescription Practices In Private And Public Sector In India, http://www.scopemed.org/fulltextpdf.php?mno=36915 Accessed 24.07.2013

[71]http://articles.timesofindia.indiatimes.com/2012-05-09/india/31640562_1_mdr-tb-tb-cases-tb-diagnosis Accessed on 22.07.2013

[72]Anand, G. & McKay, B. Awakening to Crisis, India Plans New Push Against TB. The Wall Street Journal, 2012, Retrieved April 3, 2013

[73] Szreter, Simon, The importance of social intervention in Britain's mortality decline c.1850–1914: a re-interpretation of the role of public health, Social History of Medicine 1988, 1 P:1–22 http://www.nuim.ie/staff/dpringle/mg/Szreter1988.pdf Accessed on 23.07.2013

[74]Hunter JM, Thomas MO. Hypothesis of leprosy, tuberculosis and urbanization in Africa. Social Science & Medicine, 1984, 19, 1, P:27–57.

[75]Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Urbanization Prospects: The 2003 Revision. Part 1, Accessed on 18.05.2013 http://www.un.org/esa/population/publications/wup2003/WUP2003Report.pdf

[76]Canadian Tuberculosis Committee, Housing conditions that serve as risk factors for tuberculosis infection and disease. An Advisory Committee Statement (ACS), Canada Communicable Disease Report, 2007, 33, ACS-9, P:1–13

[77]Konteh FH. Urban sanitation and health in the developing world: reminiscing the nineteenth century industrial nations. Health Place, 2009,15, 1, P:69–78

[78]Grantham-McGregor S, Cheung YB, Cueto S, Glewwe P, Richter L, Strupp B. Developmental potential in the first 5 years for children in developing countries. Lancet. 2007, 369, 9555, P:60–70.

[79]Adato M, Hoddinott J. Social Protection: Opportunities for Africa. (IFPRI) Policy Brief 5, Washington, DC: International Food Policy Research Institute, 2008

[80]Adato M, Bassett L. Social protection to support vulnerable children and families: the potential of cash transfers to protect education, health and nutrition. AIDS Care. 2009, 21, S1, P:60–75

[81]Fiszbein A, Schady NR. Conditional cash transfers: reducing current and future poverty. World Bank Policy Research Report, Washington, DC: The World Bank, 2009.

[82]M Muniyandi & Rajeswari Ramachandran, Socioeconomic inequalities of tuberculosis in India, Expert Opinion on Pharmacotherapy, Informa Healthcare, July 2008, 9, 10, P:1623-1628

[83] Chakraborty A.K. Epidemiology of Tuberculosis: Current status in India. Indian Journal of Medical Research, October 2004, P:248-276 http://www.icmr.nic.in/ijmr/2004/1004.pdf Accessed on 27.07.2013

[84] T.R. Frieden, P.I. Fujiwara, R.M. Washko, M.A. Hamburg Tuberculosis in New York City—turning the tide, The New England Journal of Medicine, 1995, 333, P:229–233

[85]China Tuberculosis Control Collaboration, The effect of tuberculosis control in China, 2004, Lancet, 364, P:417–422.

[86] E. Gonzalez, L. Armas, M.J. Llanes, Progress towards tuberculosis elimination in Cuba, The International Journal of Tuberculosis and Lung Disease, 2007, 11, P:405–411

[87] R. Subramani, T. Santha, T.R. Frieden, S. Radhakrishna, P.G. Gopi, N. Selvakumar et al. Active community surveillance of the impact of different tuberculosis control measures, Tiruvallur, South India, 1968–2001, International Journal of Epidemiology, 2006, 36 P:387–393

[88]Dye, C., Lönnroth, K., Jaramillo, E., Williams, B. G., & Raviglione, M. Determinants of trends in tuberculosis incidence: an ecologic analysis for 134 countries. Bulletin of WHO, in press

[89] M. Vree, B.D. Duong, D.N. Sy, N.V. Co, M.W. Borgdorff, F.G.J. Cobelens, Tuberculosis trends, Vietnam Emerging Infectious Diseases, 2007, 13, P:796–797

[90] C. Dye, S. Ottmani, L. Laasri, N. Benchelkh, The decline of tuberculosis epidemics under chemotherapy: a case study in Morocco, The International Journal of Tuberculosis and Lung Disease, 2007, 11, P:1225–1231

[91] E. Vynnycky, M.W. Borgdorff, C.C. Leung, C.M. Tam, P.E. Fine, Limited impact of tuberculosis control in Hong Kong: attributable to high risks of reactivation disease, Epidemiology and Infection, 2008, 136 P:943–952

[92] Uplekar M, Pathania V, Raviglione M. Private practitioners and public health: weak links in tuberculosis control. Lancet 2001, 358, P:912–916

[93] G. Fochsen, K. Deshpande, V. Diwan, A. Mishra, V. K. Diwan, A. Thorson, Health care seeking among individuals with cough and tuberculosis: a population-based study from rural India, International Journal of Tuberculosis & Lung Diseases, 2006, 10, 9, P:995–1000 © 2006 The Union

[94] Jaiswal A, Singh V, Ogden J A, et al. Adherence to tuberculosis treatment: lessons from the urban setting of Delhi, India. Tropical Medicine & International Health, 2003, 8, P:625–633

[95] Uplekar M, Juvekar S, Morankar S, Rangan S, Nunn P. Tuberculosis patients and practitioners in private clinics in India, International Journal of Tuberculosis & Lung Diseases, 1998, 2, P:324–329

[96] Dewan P K, Lal S S, Lönnroth K, et al. Improving tuberculosis control through public-private collaboration in India: literature review, British Medical Journal, 2006, 332, P:574–578

[97] Annual TB Report 2013, Central TB Division, Directorate General of Health Services, Ministry of Health & Family Welfare, www.tbcindia.nic.in/pdfs/TB%20India%202013.pdf Accessed on 07.08.2013

[98]Closing the gap in a generation: Health equity through action on the social determinants of health, Final report of the Commission on Social Determinants of Health, Geneva: WHO, Accessed on 13.07.2013 http://www.who.int/social_determinants/thecommission/finalreport/en/index.html

[99] Dye, C., Garnett, G. P., Sleeman, K., & Williams, B. G, Prospects for worldwide Tuberculosis control under the WHO DOTS strategy, Directly observed short course therapy, Lancet, 1998, 352, P:1886-1891.

[100]Watt CJ, Hosseini SM, Lonnroth K, Williams BG, Dye C. The global epidemiology of tuberculosis, In: Schaaf S, Zumla A, (Eds), Tuberculosis: a comprehensive clinical reference. Philadelphia, 2009, P:17–27
[101]Blankenship KM, Bray SJ, Merson MH, Structural interventions in public health, AIDS, 2000, June, 14 (Supplement 1), P:S11–S21
[102]Sweat MD, Denison J, Reducing HIV incidence in developing countries with social and structural interventions. AIDS, 1995, 9, (Supplement 1), P: S251–S257
[103]Carvalho A C C, Migliori G B, Cirillo D M. Tuberculosis in Europe: a problem of drug resistance or much more? Expert Review of Respiratory Medicine, 2010, 4, P:189–200
[104]Sheuya SA. Improving the health and lives of people living in slums, Annals of the New York Academy of Science, 2008, 1136, P:298–306.
[105]Jahan S, McCleery R. Making Infrastructure Work for the Poor. Synthesis Report for Four Country Studies: Bangladesh, Senegal, Thailand and Zambia, United Nations Development Program, 2005
[106]Robert SA. Neighborhood socioeconomic context and adult health, the mediating role of individual health behaviors and psychosocial factors, Annals of the New York Academy of Science, 1998, 896, P:465–468.