Original research article

Lifestyle changes among Tuberculosis patients attending the Central Chest Clinic Colombo

M.G.B. Senanayake[1*] , S. Samaraweera[2]

Abstract

Background

Tuberculosis (TB) is an infectious air borne disease and it is a major public health problem. The disease is more commonly seen in under developed countries. Association of TB with stigmatization and its impact on lifestyle of the patient is an important aspect that worth exploring.

Objective

To describe the influence of the disease on their lifestyle among tuberculosis patients attending the Central Chest Clinic Colombo

Methods

This was a descriptive cross sectional study. The study population consisted of all diagnosed tuberculosis patients, who were above the age of 15 attending to Central Chest Clinic Colombo. The total sample size comprised of 266 Tuberculosis patients, who have completed the first two months of treatment course to assess the impact of the disease on their lifestyle. Systematic sampling was conducted by considering the total number of clinic attendees and the duration of data collection. An interviewer administered questionnaire was used to collect data.

Results

Tuberculosis is associated with the lower socio economic status and linked with poverty. It is common in people with lower level of education and unemployment. More negative lifestyle changes were commonly seen in the socially disadvantaged group of patients which could further worsen their social status. More lifestyle changes had significant associations with male sex, low education level, employment, low income level, retreatment and infective patients, residing within the CMC area and substance abuse (alcohol, smoking, narcotic drug use). The stigma associated with the disease had a major impact on patients' lifestyles as it has influenced to the family interactions, marital status and social interactions.

Conclusion

Tuberculosis is associated with poverty, low socio economic status; they change their lifestyle more negatively making them more vulnerable to social disadvantages. Not only the medical treatment, but also the lifestyle aspects of the TB patients need to be considered in patient management.

Key words: Tuberculosis, lifestyle, chest clinic

1. National STD/AIDS Control Programme, Ministry of Health, Nutrition and Indigenous Medicine
2. National Programme for TB Control and Chest Diseases, Ministry of Health, Nutrition and Indigenous Medicine
*Correspondence: buddhikasena@yahoo.com
DOI: 10.4038/jccpsl.v22i1.8087

Introduction

Tuberculosis (TB) is an infectious air borne disease and it is a major global public health burden. Individuals with the active disease can spread the infection to at least ten people every year (1). It is a bacterial disease and caused by Mycobacterium tuberculosis (2). When the infected bacilli involve the lung parenchyma, it is known as pulmonary tuberculosis. TB of any organ of the body other than lung parenchyma is known as extra pulmonary TB (3). TB is endemic in most of the under developed countries and is a leading cause of death. More than nine million people are developing active TB every year and it causes approximately two million deaths. Infection with TB is present in nearly about two billion people which constitutes one third of the world's populations (4).

The increasing trend of TB is due to the disease association with poverty, inequity and most of the new cases are from South East Asian region. It constitutes around 35% of new cases globally (1). TB control activities are targeted to achieve Sustainable Development Goals (SDG) in 2030 and the ultimate aim is to eliminate TB by 2050. The National Programme for Tuberculosis Control and Chest Diseases is the responsible government institution for the prevention and control of TB. There were 9643 notifications of all forms of TB, which accounted for 46.4 notifications per 100,000 population in the year 2009. Majority of new cases were detected from the western province and from that Colombo district tops the list with 88.3 new cases per 100,000 population. (5). Main strategy for TB prevention is the treatment of patients with anti – TB drugs and to interrupt the disease transmission (6).

Socially and economically vulnerable people have high probability getting the burden of the disease (7). Since TB is a chronic disease, which needs continuous treatment for six months, it directly affects the patients‟ day to day lifestyle events. The stigma associated with the disease has an influence on patients‟ lifestyle. The disease per se causes lethargy and loss of energy. This has a direct impact on patients‟ routine work. Patents with pulmonary TB are advised to stay away from their job and crowded places for the first two months of the treatment. It increases the risk of losing their job and income.

Patients with TB are at risk of losing their loved once and their normal living environment. Family members, neighbours and relatives may tend to avoid their company, which causes extensive mental harassment for the patients. Their recreational activities and social gatherings will come to a standstill resulting a feeling of social exclusion (8). The change of dietary pattern and their daily habits such as smoking, alcohol intake may have to be changed in rapid stretch according to medical advice. This would result in severe psychological distress and lead into severe mental trauma.

Although, World Health Organization (WHO) established guidelines and management options have a positive impact on treatment outcomes; the overall TB case burden has not reduced as expected. Reduction of prevalence and death rates of TB along with the current figures are definitely inadequate to reach the TB related SDGs and Stop TB partnership targets. The TB elimination target cannot be achieved in 2050; even the Stop TB strategy results reach the expected level. It will be 100 times greater than the elimination target level (9).

This clearly shows the need to accelerate the current preventive strategies and to come up with innovative additional evidence based interventions and actions to control the disease. The specific reasons to have high TB caseloads in several urbanized regions are also needed to be addressed (9). Especially in lower and middle income countries the prime concern is to be

given to the social and lifestyle aspects of the TB patients and it should move along the diagnosis, treatment and control activities. Interventions that lie beyond health sector such as social protection, job security and urban planning are important elements that needs urgent attention (10).

The strategic plan for TB control developed by Sri Lanka have identified that conventional passive case finding is not the effective method for prevention and control. Therefore innovative strategies have to be developed addressing lifestyle changes as a main mode of intervention for a comprehensive prevention package. Lack of documented research evidence on lifestyle dynamics on TB patients in Sri Lankan context (11) have made policy makers to encourage research on this vital area. The relationship between stigma and lifestyle changes and how it affects the routine activities are important key elements in overall case management. Therefore this is an initial step to identify the lifestyle changes due to the disease itself. The main objective of this study is to describe the influence of tuberculosis on the lifestyle of the patients attending to the Central Chest Clinic Colombo.

Methods

A descriptive cross sectional study was carried out. The study population consisted of all diagnosed tuberculosis patients attending to Central Chest Clinic Colombo. A patient attending the Central Chest Clinic Colombo for the management of tuberculosis during the study period was considered as the study unit.

Patients who were residing out of Colombo district, patients below the age of 15 years and those who have not completed at least two months of treatment of anti-TB drugs were excluded. It is believed that immediately after the diagnosis and commencement of treatment would not capture all changes in the lifestyle of these patients. Therefore, only patients who were diagnosed at least two months ago were included in this study. Two hundred and sixty six (266) patients with TB were identified as participants for this study. Systematic sampling was adopted as the sampling method where every third (3rd) TB patient identified from the daily clinic attendance register was selected. An Interviewer administered questionnaire was used to collect data.

The questionnaire was designed after thorough literature survey and the studies carried out in Sri Lanka and other countries. Inputs from the programme managers, clinicians treating the TB patients were also taken into consideration. Discussions were carried out by the Principle Investigator (PI) with patients to determine the real social and lifestyle issues that can occur as a result of the disease itself. The questionnaire was reviewed by a panel of experts consisting public health professionals, respiratory physicians, sociologist and a social worker. The pre testing of the questionnaire was carried out among ten patients at the Chest Clinic in Colombo South Teaching Hospital.

Data collection was carried out for a period of four weeks starting from 1st August 2011 to 27th August 2011. Potential participants chosen from the daily clinic attendance register were approached by the PI. Informed written consent was obtained prior to data collection. Interviews were carried out in a separate location within the clinic, which did not disturb the routine clinic proceedings. Data analysis was carried out by using the SPSS 17.0 statistical package. Descriptive data were presented as frequencies and proportions in cross tables. Categorical data were summarized using the proportions with 95% confidence Intervals. Significance of association was performed using Chi Square for categorical variables and the P value is considered as significant at 5% level.

Lifestyle changes of the study participants due to TB were assessed using series of questions. It included six questions regarding change of the job, income level, dietary pattern, family relationships and social interactions. Magnitude of changes were assessed using a composite variable where four or more changes were considered as "More lifestyle changes" and three or lesser changes were considered as "minimal lifestyle changes". This composite variable was a un- weighted, crude variable and it was not validated. Ethical clearance was obtained from Ethics Review Committee of Faculty of Medicine, University of Colombo.

Results

The study included 266 subjects with a response rate of 100%. In this study 62.4% (n= 166) were males and the rest (37.6%; n = 100) were females. The mean age was 48 years (SD = +/- 15.5) and the median age was 49 years. From the study, 46.6% (n= 124) were residing within the Colombo Municipal Council (CMC) area and the rest (53.4%; n= 142) were outside the CMC area. The socio demographic characteristics of the study population are described in Table 1.

Table 1 Distribution of Socio-demographic characteristics of the study population (n=266)

Characteristic		Number	Percentage
Age (years)	15 – 24	23	8.6
	25 – 34	39	14.7
	35 - 44	40	15.0
	45- 54	68	25.6
	55 - 64	53	19.9
	≥65	43	16.2
Sex	Male	166	62.4
	Female	100	37.6
Ethnicity	Sinhalese	157	59.0
	Tamils	52	19.6
	Muslims	54	20.3
	Burgher	3	1.1
Religion	Buddhism	152	57.1
	Hindu	44	16.5
	Islam	52	19.6
	Christian	18	6.8
Level of Education	Only primary education	100	37.6
	Studied up to Grade 8 or below	63	23.7
	Studied up to GCE ordinary level	42	15.8
	Passed GCE ordinary level	45	16.9
	Passed GCE advanced level and above	16	6.0
Marital Status	Currently married	180	67.7
	Never married	54	20.3
	Widowed	17	6.4
	Divorced or separated	15	5.6
Income (Rs.)	< 10,000	42	15.8
	10,001 – 20,000	129	48.5
	20,001 – 30,000	74	27.7
	30,001 – 40,000	14	5.3
	>40,001	7	2.7
Employment Status	Employed	141	53.0
	Un employed	125	47.0

There were two divorced patients and all of them were females. The rest of them (n= 13) were separated and among them four were females and the others were males. From this study population 75.9% (n= 202) were treated for Pulmonary TB and 24.1% (n= 64) were treated for extra pulmonary TB. Sputum smear positive patients represented 73.8% (n= 149) of the total pulmonary TB patients and the remaining proportion (26.2%; n= 53) consisted of smear negative patients. The clinical characteristics of the study population are described in Table 2.

Table 2 Distribution of clinical characteristics of the study population (n=266)

Characteristic	Number	Percentage
Disease category (n=266)		
Pulmonary TB	202	75.9
Extra-pulmonary TB	64	24.1
Sputum smear positivity (n= 202)		
Smear positive	149	73.8
Smear negative	53	26.2
Treatment category (n=266)		
New	232	87.2
Relapse	16	6.0
Treatment after failure	10	3.8
Treatment after default	8	3.0

Six patients (2.3%) have not told that they are suffering from TB to their family members. All of them were males. Majority (66.7%; n= 4) were in the age group of 35 – 64 years. One patient was below 35 years and one above 65 years. Four of them were Sinhala Buddhist individuals, one Muslim and one Tamil Christian participant. Three of them were never married, two married and one participant was a widow/ widower. Five out of six participants had education up to grade 8 only. One (16.7%) was unemployed, four (66.7%) were engaged in temporary jobs and only one (16.7%) was having a permanent employment. Five out of six were taking treatment under the new category and one in the re treatment group. The rest of the patients (97.7%; n= 260) have informed regarding their disease status to the family members. The factors that influence the lifestyle changes of the study population were described in Table 3 below. More lifestyle changes were likely to be associated with male sex, low education level, unemployment, low income level, residing within the CMC area, patients on retreatment, sputum smear infectivity, alcohol, smoking, and narcotic drug use. The relationship between the factors and the type of lifestyle change is given in Table 4.

Table 3 Lifestyle changes due to the disease condition among study population

Type of change	Number	Percentage
Influence to the employment status (n = 213)		
No change in the job	41	19.2
Job changed, but in the same work place	19	8.9
Change the job in different place	27	12.7
Voluntarily stopped doing the job	59	27.7
Lost the job	13	6.1
On leave	54	25.4
Influence to the income level (n = 177)		
Income not changed	36	20.4
Lost the income partially	91	51.4
Lost the total income	48	27.1
Income improved	2	1.1
Status of family relationship (n=266)		
Living as usual	105	39.5
Living in the same home but separated from the family	99	37.2
Went to a different home, living with others (not with family members)	25	9.4
Family members left home	14	5.3
Went to a different home (living with family members)	12	4.5
Living alone	11	4.1
Frequency of recreational activities (n=266)		
Decreased than usual	167	62.8
Not changed (continued as usual)	99	37.2
Frequency of attending to social gatherings (n=266)		
Decreased than usual	219	82.3
Not changed (continued as usual)	47	17.7

Influence to the smoking habit (n=150)		
Reduced the frequency	20	13.3
Continued with the same phase	12	8.0
Intended to reduce/ stop in near future	10	6.7
Completely stopped	108	72.0
Influence to the alcohol habit (n=153)		
Reduced the frequency	31	20.3
Continued with the same phase	8	5.2
Intended to reduce/ stop in near future	15	9.8
Completely stopped	99	64.7
Change in dietary habit (n= 266)		
No change in diet	48	18.0
Lost the appetite significantly	18	6.8
Changed to different dietary habits	22	8.3
Lost the interest for certain foods	21	7.9
Improve dietary intake	157	59.0

Discussion

Change of lifestyle is a complex, multi-faceted concept, which is influenced by various internal and external factors. Lifestyle change has not been explored much among TB patients and studies done on this concept in Sri Lanka have been rare. Nevertheless, it is necessary to explore these lifestyle aspects in the local context, considering underlying various socio-economic and cultural backgrounds. Studies would help in developing tailor- made public health interventions and strategies for preventing lifestyle impacts among TB patients in Sri Lanka. The study assessed the influence of TB on lifestyle of patients attending Central Chest Clinic, Colombo. A descriptive cross sectional study was conducted to achieve this objective and the data generated is useful for healthcare policy makers in determining the impact of lifestyle changes among TB patients due to their disease status as a public health problem (12).

The value of a cross sectional study is limited whenever there is a possibility that the disease status or its treatment may change the participants‟ behaviour. Thus, the absence of information on time relationship may render it difficult to separate effects on a dependent variable, from effects of the dependent variable (12). It is recognized as a limitation of the study. Thus, the results should be interpreted with caution. The response rate was 100%, as it was a clinic based study.

The total study sample consisted of 62.6% of males and 37.4% females with a male to female

ratio of 1.66:1, however the Male: female ratio was 0.96:1 in the district of Colombo. A similar male predominance (3.7:1) was seen in a hospital based study done in South India

(13) and the association of the disease with male sex was also proven by the case control study done by Gninafon et al (14). In the present study 37.6% of the patients had only primary education or below and 23.7% with some secondary education. According to DHS survey in 2006/7 in Colombo district there were 15.2% with below primary education and 22.3% with some secondary education or below (15). In the present study the education level below grade 8 consisted of 61.3% of the study participants. This study proves previous findings in India by Shetty et al (16) and in Sri Lanka by Tissera (17). Shetty et al (16) in their case control study have identified low education level as an important determinant of

TB. Tissera (17) in his study in Galle reported that education up to grade 8 or below had a significant association with pulmonary TB.

Tuberculosis has affected on the employment status for most of the study participants. A few (6.1%) have even lost the job. Some have taken their leaves and some stopped their work voluntarily. Majority of the participants were self-employed and the disease directly affects to them. Some have shifted to a different work place and some changed their type of job in the same work place. Needham and others (18) have mentioned that 31% had to stop their work purely due to the disease and the average duration of work absenteeism was 48 days. People working in the state sector are entitled to special leave but not in the private sector. Ideally paid leave should be granted until patient is not infective. Adjustments within the work place could be arranged to suit the patient needs. However the study revealed that the job security was threatened in some participants. The influence of the job has directly affected the income not only at individual level, but also at the family level. This is most relevant when the victim is the breadwinner of the family. The economic instability places an individual in a vulnerable position. In the present study 27.1% have lost their total income solely due to disease. A study conducted in four districts in Vietnam to identify the consequences of TB by Long et al (19) have stated that male patients were more concerned on their economy related problems. Patients with an income below the poverty line have a higher chance of developing the disease and more importantly they have taken bank loans and had sold their owned properties as a consequence of the disease (20).

Tuberculosis can directly influence the living environment. Ninety nine respondents (37.2%) have told that although they are living in the same house, the interactions between them were minimal. Some family members have left their homes (5.3%) and 4.1% were living alone. The impact of the disease towards the family relationship is too strong, that some patients have even not told about their disease condition to the family members for more than two

months. According to Macq (21), identified TB patients were neglected from the family and because of that they were hiding their disease condition from family members. This has created severe psychological trauma to them resulting depression and poor self-confidence. Although there were many lifestyle changes within the family environment, interestingly there were no significant association between the marital status and the negative lifestyle changes.

Social interactions of the patients have changed purely due to the disease. The most common reason to avoid social gatherings was the patients‟ belief that he/ she was not healthier enough to behave as usual. This reflects the strong association between the disease and the

patients‟ attitudes regarding the disease. The disease has made them weak both physically and psychologically. The causes of stigma associated with TB studied in Ghana have identified the following factors: fear of infection with TB by the others, out-dated social beliefs and practices, physical inability, blaming and shaming, association with HIV and self- stigmatization by TB patients (22). In contrary, social interactions were avoided by some participants purely to avoid bad habits like smoking and alcohol consumption which should be appreciated.

According to Kelly (23) active TB patients think themselves as the disease vector. This attitude makes them more isolated and tries to keep the disease as a secret. Hiding the disease status prevents contact tracing which is important towards case detection and breaking the transmission of the disease in the community. The main reason for not to reveal the disease status may be the stigma and possible social isolation and disruption to their marital life. In the current study there were 7.2%, i.e. 14 respondents who declared that their marital status has changed and all but four stated that it was due to the disease. Females in India and Malawi are more concerned for the stigma associated with TB mainly on their marriage (24).

Main social habits that are expected to stop is smoking and consuming liquor. Smoking had been completely stopped by 72% of the study participants, but 8% are still continuing the same habit without any change. This shows that 28% need further support for smoking cessation. Time bases modelling study had stated that gradual complete cessation of smoking by the year 2033, would reduce the disease burden by 14% - 52%, if the treatment coverage is maintained at 80% level (25).

Among alcoholics 64.7% have completely stopped the habit of alcohol intake. But the rest (35.3%) were still consuming alcohol. Patients require further support from health care staff to completely avoid these habits. Social roots of urban TB explored in a study done in New York City has identified that 13% of TB patients have taken excess amount of alcohol (26).

Nutrition and TB has a close relationship. One important symptom of TB patients is the significant loss of appetite. Usually the appetite is improved with anti-TB treatment and it is expected that people will improve their nutritional status subsequently. After initiation of the treatment regimen the dietary habits have also changed accordingly. Most of the study participants (59%) declared that the dietary habits were improved after treatment commencement, which was a positive aspect in relation to the treatment outcome. However, 6.8% of participants have told that their appetite was reduced after the commencement of the treatment. When appetite is losing in a patient who is on anti-TB treatment needs special attention due to the common side effect of hepatotoxicity from anti-TB drugs.

When all negative lifestyle changes are considered, male participants had more changes. Usually males were the bread winners for the families and they are more likely to interact with the society. Most of these families belong to lower socio economic group and females were traditionally looking after their children and play the supporting role for their families. They were confined to the home environment and have relatively lesser opportunity to deal with the society. The participants who were currently employed had more negative lifestyle changes. The working population has defined tasks to perform at different levels with associated responsibility. Their lifestyles are considerably affected when compared with the non-working individuals. There routine activities can be changed suddenly with the disease status and more importantly with the treatment schedule where they have to attend to a health care provider daily for a period of two months.

People who are on a retreatment regimen or having infective disease (sputum smear positive) were having more negative lifestyle changes. Patients on a retreatment regimen may have more fear about the disease, and may be taking more precautions. On the other hand, some people like defaulters may have been marginalized by the family. The re-treatment group consists of patients with relapse of the disease, treatment after failure and treatment after default. Re treatment patients have gone through the full treatment course partially or completely before and they have the disease for a long period of time compared to the new patients. Re-treatment participants may be more cautious regarding their disease status and therefore are more focused to complete their full treatment course. They may have received more health education. The occurrence of considerable lifestyle changes among infective patients and re treatment patients may also be due to mis-interpretation of health education messages received. Patients who are smoking, consuming alcohol and taking narcotic drugs have more negative lifestyle changes. These patients may have already rejected by the family especially alcoholics and drug abusers. Therefore, after the illness they are more likely to be further rejected by the family.

Conclusion

Patients with TB are mainly representing lower socio economic groups in the society. Most affected by lifestyle changes are coming from socially disadvantageous groups and may be having severe implications descending them further down the social ladder. Not only the medical treatment, but also the lifestyle aspects of the TB patients need to be considered in patient management.

Acknowledgements

Professor Saroj Jayasinghe – Professor of Clinical Medicine, Department of Clinical Medicine, Faculty of Medicine, University of Colombo, Dr. Sunil De Alwis – Director, National Programme for TB Control and Chest Diseases, Ministry of Health, Sri Lanka, Dr. Pubudu De Silva – Consultant Community Physician, and Dr. Padmal De Silva – Consultant Community Physician. Ethical clearance was obtained from the Ethics Review committee, Faculty of Medicine, University of Colombo (Reference Number - EC-11-077).

Competing interests

None declared

References

1. WHO. *Tuberculosis* - fact sheet. Geneva: World Health Organization, 2010. Available from: http://www.who.int/mediacentre/factsheets/fs104/en/.

2. Kumar P, Clark ML. *Kumar and Clark's Clinical Medicine.* 7th Edition ed: Saunders Ltd; 2009.

3. Warrell DA, Cox TM, Firth JD, Edward J, Benz MD. *Oxford Textbook of Medicine.* 4 ed: Oxford Press; 2003. 3623 p.

4. WHO. The *Global Plan to stop TB 2011 – 2015. Transforming the fight towards elimination of tuberculosis.* Geneva: World Health Organization, 2010.

5. National Programme for Tuberculosis Control and Chest Diseases. *Annual Report 2009.* Colombo: Ministry of Health, 2009; 66p.

6. National Programme for Tuberculosis Control and Chest Diseases. *General*

Manual for Tuberculosis control. Second edition. Colombo: Ministry of Health, 2005; 157 p.

7. Das P, Horton R. Tuberculosis - time to accelerate progress. *The Lancet* 2010; 375(9728):1755-7.

8. Getahun H. Medical and social consequences of tuberculosis in rural Ethiopia. *Ethiopian medical journ*al 1999; 37(3):147-53.

9. WHO. *Equity, Social determinants and Public Health Programmes.* World Health Organization, 2010; 220-37 p.

10. Hargreaves JR, Delia Boccia D, Evans CA, Adato M, Petticrew M, Porter JDH. The Social Determinants of Tuberculosis: From Evidence to Action. *American Journal* on Public Health 2011; 101(4):654 -62.

11. National Programme for Tuberculosis control and Chest Diseases. *Strategic plan (2012 - 2016).* Ministry of Health; 2011.

12. Abramson JH, Abramson ZH. *Survey methods in community medicine.* 2nd edition. Churchill Livingston; 1999.

13. Gupta S, Shenoy VP, Mukhopadhyay C, Bairy I, Muralidharan S. Role of risk factors and socio- economic status in pulmonary tuberculosis: a search for the root cause in patients in a tertiary care hospital, South India *Tropical Medicine & International Health* 2011;16(1):74-8.

14. Gninafon M, Ade G, Aït-Khaled N, Enarson DA, Chiang C-Y. Exposure to combustion of solid fuel and tuberculosis: a matched case–control study. *European Respiratory Journal* 2011;38(1):132-8.

15. Department of Census & Statistics. Sri Lanka Demographic and Health Survey 2006 - 07. Colombo: Department of Census and Statistics, 2009.

16. Shetty N, Shemko M, Vaz M, D'Souza G. An epidemiological evaluation of risk factors for tuberculosis in South India: a matched case control study. *International Journal of Tuberculosis and Lung Disease* 2006;10(1):80 - 6.

17. Tissera PAD. *Risk factors associated with pulmonary Tuberculosis.* Thesis (MD), Colombo: Post Graduate Institute of Medicine, 1994.

18. Needham DM, Godfrey-Faussett P, Foster SD. Barriers to tuberculosis control in urban Zambia: the economic impact and burden on patients prior to diagnosis. International Journal of Tuberculosis and Lung Disease 1998;2(10):811 - 7.

19. Long NH, Johansson E, Diwan VK, Winkvist A. Fear and social isolation as consequences of tuberculosis in VietNam: a gender analysis. *Health policy.* 2001; 58(1):69 - 81.

20. Kamolratanakul P, Sawert H, Kongsin S, Lertmaharit S, Sriwongsa J, Na-Songkhla S, et al. Economic impact of tuberculosis at the household level. *International Journal of Tuberculosis and Lung Disease* 1999;3(.7):596 - 602.

21. Macq J, Solis A, Martinez G, Martiny P, Dujardin B. An exploration of the social stigma of tuberculosis in five "municipios" of Nicaragua to reflect on local interventions. *Health policy* 2005;74(2):205 - 17.

22. Dodor EA, Neal K, Kelly S. An exploration of the causes of tuberculosis stigma in

an urban district in Ghana. *International Journal of Tuberculosis and Lung Disease* 2008;12(9):1048 - 54.

23. Kelly P. Isolation and stigma: the experience of patients with active tuberculosis. *Journal of Community Health Nursing* 1999;16(4):233 - 41.

24. Somma D, Thomas BE, Karim F, Kemp J, Arias N, Auer C, 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):856 - 66.

25. Lin HH, Murray M, Cohen T, Colijn C, Ezzati M. Effects of smoking and solid-fuel use on COPD, lung cancer, and tuberculosis in China: a time-based, multiple risk factor, modelling study. The Lancet 2008;372(9648):1473-83.

26. Anonymous. The social roots of urban tuberculosis. *Indian Medical Tribune* 1994;2(11): 3.