FINANCIAL BURDEN OF PULMONARY TUBERCULOSIS (TB) IN PAKISTAN

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ABSTRACT

Objectives: To calculate the direct and indirect costs of pulmonary tuberculosis treatment and explore the effects of treatment expenditures on socioeconomic attributes. **Materials and Methods:** A mix mode cross sectional study was designed in the form of a survey which was conducted in Pakistan. The research instrument consisted of a survey questionnaire. The target population for the study comprised of newly diagnosed smear positive pulmonary tuberculosis patients. The data thus gathered was entered in to the SPSS version 20 (Statistical Package for Social Sciences version 20). **Results:** The mean direct cost of treatment was found to be PKR 1714 and mean indirect cost was reported to be PKR 3445. The mean total cost of anti pulmonary TB treatment was PKR 5159. Family income was directly proportional to the average total cost of treatment and indirect costs were observed to be higher than direct costs. **Conclusion:** To minimize the financial burden of pulmonary tuberculosis on patients in terms of direct and indirect costs, it is important to understand and scrutinize the factors precipitating the ailment and aggravating the consequences.

KEYWORDS: Tuberculosis; Pulmonary Tuberculosis; Direct cost; Financial Burden; Pakistan; Pharmacoeconomics.

INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by *Mycobacterium tuberculosis*. It mainly affects the lungs, but others organs of the body can also be affected. (Pace, 1997; Alchamo, 2004) TB is also identified as the leading cause of death throughout the world as studies indicate that the *Mycobacterium tuberculosis* infects approximately one-third of the total population of the world each year and leads to more than 10 million new cases each year. (Behera, 2010; Gantz & Brown, 2005).

Tuberculosis not only affects the people in terms of health, but also adds to social isolation and burden patients in terms of financial and economic perspectives. By considering this, it has been recommended that the pulmonary TB program or the method by which TB is treated should be socially and economically effective. (National TB Control Programme; Ministry of Health, 2009). The patients, who receive treatment, are required to bear non-medical costs such as transportation and food cost, cost for lost productivity and hospitalization. These expenses are a burden on patients, society and healthcare system, and it is known that the insufficient resources and inappropriate regulation of tuberculosis treatment have caused patients not to receive proper treatment. (Colebunders & Bastian, 2000; Larbaoui, et al., 1970; Oxlade, et al., 2012; Mathur, et al., 1994; Swingler, et al., 2005).

The people affected with the pulmonary TB experience significant social isolation since it has been identified they are deemed to encounter dishonour, disgrace and discrimination from the society and the people around them. In the consequence of such insecurity from the society leads to a delay in treatment of the pulmonary tuberculosis thereby making it more complicated to treat. (Axelrod & Diringer, 2008; Bope & Kellerman, 2011; Hass & Prez, 1995; Karakitsos D, 2008).

In Pakistan, it is a major health concern and is identified as fourth leading cause of death. Pakistan is a developing country with the increasing population of 180 million people and approximately 1.5 million people suffer from the disease. (World Health Organization, 2012; Yadav, et al., 2012; Khan & Malik, 2003) In addition to this, World Health Organization (WHO) identified that Pakistan ranked eighth behind China, India, Bangladesh and Indonesia in terms of estimated number of pulmonary TB cases with an occurrence of 175/100,000 persons. (World Health Organization, 2012). The situation of the health care system of the country is in dire as it is financially starved and incapacitated to serve an increasing population. (Atta Abbas, 2013) Pakistan spends a minimal 2.2% of GDP on its health sector

which render the health sector financially crippled. (Rogers, 2012) As a consequence, majority of the patients see the private sector as a treatment option however, private sector encompass direct medical costs.

The study was carried out with the aim of calculating the direct and indirect costs of pulmonary tuberculosis (TB) treatment and exploring the effects of treatment expenditures on socioeconomic attributes of the affected patients.

MATERIALS & METHODS

A mix mode cross sectional study was designed in the form of a survey based which was conducted in Pakistan for the time period of 6 months i.e. July 2014 to December 2014.

Research Instrument

The research instrument consisted of a survey questionnaire containing structured questions related to the demographics and cost of treatment.

Piloting and validation

The research instrument was piloted on a number of patients and validated for its suitability by experts.

Target population, inclusion/ exclusion criterion and sample size

The target population for the study comprised of newly diagnosed smear positive pulmonary tuberculosis patients. The study was conducted with sample size of 500 patients 270 (54% males) & 230 (46% females) aged 15 years and above, all other patients were excluded. The study was carried out using convenience sampling. Data collection was done in tuberculosis TB centers of the public sector as well as the private clinic/ hospitals during OPD.

Data collection and statement of consent

Structured questionnaires were given to the patients and they were asked to fill their response, non educated patients response filling was facilitated by volunteer research investigation officer. Prior to the data collection the patients were briefed about the purpose of the study and their consent was obtained.

Statistical Analysis

The data thus gathered was entered in to the SPSS version 20 (Statistical Package for Social Sciences version 20). The demographics represented as percentage (%) and sample number (N). Direct patient cost comprised of all the expenditures of patients involving cost of transportation to hospital/ clinic, food, hospitalization, consultation, diagnosis and medicines, while the indirect cost was identified as the cost of patients resulted due to time lost by the patient adopted from Sandra V Kik et al 2009. Average cost of treatment was then calculated and expressed in numerical value and mean (X).

Ethical Approval

The study was approved by the Board of Advance Study and Research (BASR) of the University of Karachi.

RESULTS

A total of 500 patients were available for their data to be recorded. The results are expressed as demographic information, cost of treatment and association of demographic variables and treatment costs.

1. Demographic information

The survey found out the majority of the target group (N = 446, 89.2%) were below the age of 54 years, however a small segment (N = 54, 10.8%) were above the age of 54 years. In terms of gender, half of the target group encompassed either gender, with numbers slightly in favor of the males (N = 270, 54%) and females (N = 230, 46% females). Majority of the patients were reported to be married (N = 302, 60.4%) and almost a fourth of the target group (N = 198, 39.6%) was observed to be single. To the question of employment, it was reported that the target group was mere divided equally as almost half of the patients were seen employed (N = 225, 45%) and unemployed (N = 227, 45.4%). Almost a tenth of the segment did not disclose their response (N = 48, 9.6%). The education profile of the target group revealed a fourth of the un-educated patients (N = 217, 43.4%) and those educated to secondary i.e. Matriculation (N = 217, 43.4%). A slightly more than tenth of the target group was reported to be educated above the level of secondary education (N = 66, 13.2%). Finally, the family income was asked and it was observed that the majority earned less than 15000 PKR (N = 373, 74.6%) followed by almost a fifth between 16000 PKR to 25000 PKR (N = 83, 16.6%) and a tenth more than 25000 PKR (38, 8.8%). The results are expressed in table 1.

Table 1 Summary of demographic information

S.No	Attributes	Sample (N)	Percentage (%)
1	Age		
1.1	Younger than 54 years	446	89.2%
1.2	Older than 54 years	54	10.8%
1.3	Total	500	100%
2	Gender		
2.1	Male	270	54%
2.2	Female	230	46%
2.3	Total	500	100%
3	Social status		
3.1	Married	302	60.4%
3.2	Single	198	39.6%
3.3	Total	500	100%
4	Employment		
4.1	Employed	225	45%
4.2	Unemployed	227	45.4%
4.3	No answer	48	9.6%
4.4	Total	500	100%
5	Education		
5.1	Secondary education (Matriculation)	217	43.4%
5.2	Above secondary education (Matriculation)	66	13.2%
5.3	Un-educated	217	43.4%
5.4	Total	500	100%
6	Family income		
6.1	Less than 15000 PKR	373	74.6%
6.2	Between 16000 PKR to 25000 PKR	83	16.6%
6.3	More than 25000 PKR	38	8.8%
6.4	Total	500	100%

2. Cost of treatment

The data thus gathered was analyzed for the cost of treatment and it was observed that the mean direct cost of treatment was found to be 1714 PKR. Majority of the target group (N = 420, 84%) had anti pulmonary TB treatment costing less than 2500 PKR however slightly more than a tenth of the group (N = 60, 12%) had treatment costing between 2500 PKR to 5000 PKR and very few (N = 20, 4%) more than 5000 PKR. The mean indirect cost was reported to be 3445 PKR. Majority of the population segment (N = 405, 81%) did not bear any indirect cost. Slightly greater than a tenth of the segment under investigation (N = 60, 12%) bore an indirect cost between 2500 PKR to 5000 PKR followed by some (N = 20, 4%) bearing cost greater than 5000 PKR and very few (N = 15, 3%) bearing less than 2500 PKR. The sum of mean direct and mean indirect cost of treatment yield mean total cost of treatment

and the mean total cost of anti pulmonary TB treatment was found to be 5159 PKR. The results are tabulated in table 2.

**Table 2 Summary of cost of Anti Pulmonary TB Treatment**

S.No	Type of treatment costs	Sample (N)	Percentage (%)	Cost of treatment Mean (X)
1	Direct cost			
1.1	0 PKR (Nil)	0	0	
1.2	Less than 2500 PKR	420	84%	1714 PKR
1.3	Between 2500 PKR to 5000 PKR	60	12%	
1.4	Greater than 5000 PKR	20	4%	
1.5	Total	500	100%	1714 PKR
2	Indirect cost			
2.1	0 PKR (Nil)	405	81%	
2.2	Less than 2500 PKR	15	3%	
2.3	Between 2500 PKR to 5000 PKR	60	12%	3445 PKR
2.4	Greater than 5000 PKR	20	4%	
2.5	Total	500	100%	3445 PKR
3	Total cost of treatment			
3.1	Direct cost	1714 PKR		
3.2	Indirect cost	3445 PKR		
3.3	Total	5159 PKR		

3. Association of demographic variables and treatment costs

The association between demographics and treatment costs were analyzed and it was observed that the average total cost in patients of age less than 54 years was PKR 5802 and further reduced to PKR 4283 in older patients. In terms of gender, average total cost was significantly higher in males i.e. PKR 5724 as compared to the females which was reported at PKR 4283. Social status association revealed a reduction in average total cost of married patients i.e. PKR 4943 which was high in unmarried or single patients i.e. reported at PKR 6201. In case of employment, a characteristic association was obtained as the average cost of treatment was reported to be higher in employed patients i.e. PKR 6135 as compared to the unemployed ones i.e. PKR 4945. Association of level of education revealed that the cost was significantly lower in patients educated to level higher than secondary i.e. PKR 4528 followed by those educated to level of secondary i.e. PKR 5274. The average cost of treatment was seen highest among uneducated patients i.e. PKR 5468. The association of family income revealed a directly proportional relationship as the income increased the average cost of treatment also increased. For the patients with an average income less than PKR 15000, an average treatment cost of PKR 4477 was reported. For those with family income ranging between PKR 15000 to PKR 25000, the average cost of treatment increased

to PKR 8658 and PKR 10923 for patients with family income greater than PKR 25000. Graph 1 reveals a linear relationship between the two variables.
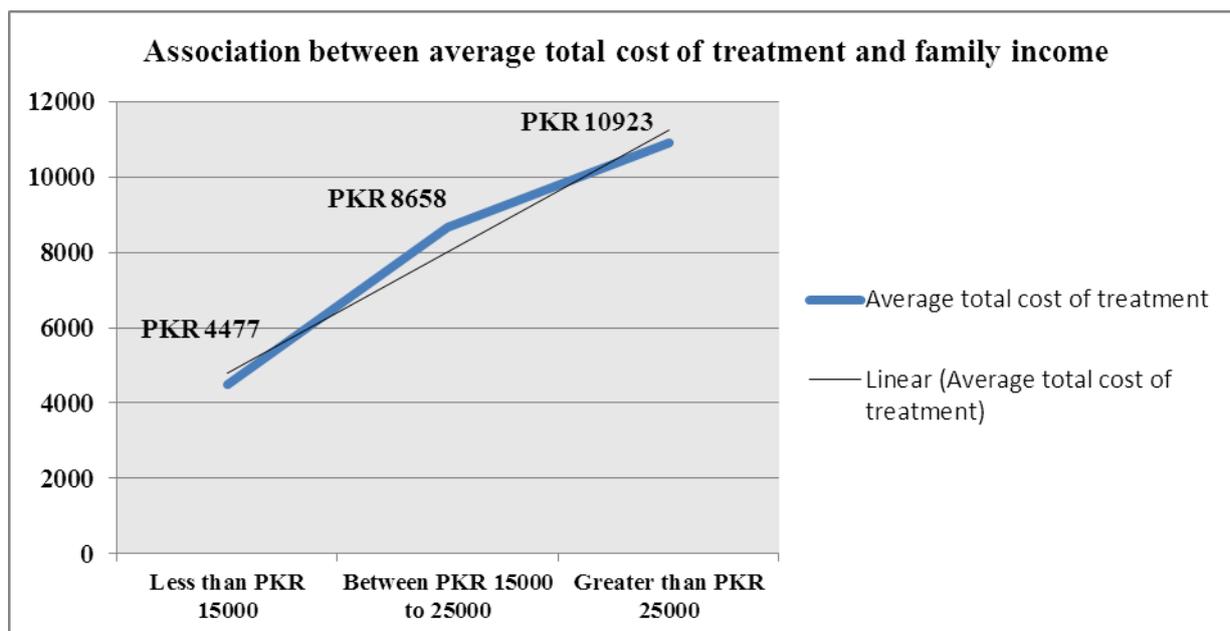
Graph 1 Linear relationship of family income and average total cost of treatment.

Furthermore, a summary of all the associations of demographic variables and treatment costs are tabulated in table 3.

Table 3 Summary of association of demographic variables and treatment costs

S.No	Demographic Variables	Sample (N)	Average Cost Direct (PKR)	Sample (N)	Average Cost Indirect (PKR)	Average Total Cost (PKR)
1	Age					
1.1	Younger than 54 years	446	2336	70	3466	5802
1.2	Older than 54 years	54	861	3	3422	4283
2	Gender					
2.1	Male	270	1957	49	3766	5724
2.2	Female	230	1391	34	3042	4432
3	Social status					
3.1	Married	302	1657	51	3286	4943
3.2	Single	198	2440	32	3762	6201
4	Employment					
4.1	Employed	225	2325	38	3810	6135
4.2	Unemployed	227	1682	33	3263	4945
5	Education					
5.1	Un-educated	217	2431	31	3038	5468
5.2	Secondary Education (Matriculation)	217	1739	45	3535	5274

5.3	Above secondary education (Matriculation)	66	1280	7	3248	4528
6	Family income					
6.1	Less than PKR 15000	373	1708	65	2769	4477
6.2	Between PKR 15000 to 25000	83	2975	16	5683	8658
6.3	Greater than PKR 25000	38	2390	2	8533	10923

DISCUSSION

Pulmonary TB is a burden not only on the health but patient pocket as well. Numerous studies have calculated treatment costs throughout the world. (Steffen R. et al 2010) The present study has drawn attention to the trend of expenditure of newly diagnosed smear positive pulmonary TB patients in terms of its direct and indirect costs as well as the total costs for whole course of therapy by the TB patients in Pakistan. Direct patient cost comprises of all the expenditures of patients involving cost of transportation to hospital/ clinic, food, hospitalization, consultation, diagnosis and medicines, while the indirect cost is the cost of patients resulted due to time lost by the patient (Sandra V Kik et al 2009).

In most of the studies the direct and indirect costs were calculated as percentage (%) of annual family income. (Gurung GN et al 2012) The total cost of tuberculosis treatment estimated in south India was Rs.3211 (3.8% of annual family income), which was found much less when compared to previous studies (Ramya Ananthakrishnan et al 2012). The total cost of tuberculosis patients as percentage of household income due to which tuberculosis patients fell into heavy debts ,was 15% in Thailand, 40% in India, 55.5% in China, and 0.2-30% in Africa (Jackson S et al 2006, Sandra V Kik et al 2009, Ukwaja KN et al 2012, Ramya Ananthakrishnan et al 2012).

In China, where TB treatment is set as 'free TB service policy, the total direct and indirect cost were CN¥ 3024 and CN¥ 2615.2 respectively which produced heavy financial burden on patients (Pan HQ et al 2013). Similarly in Tanzania the direct cost was US$ 103 whereas indirect cost was ranging from US$ 154 to US$ 1384 which represent high economical burden on families. (Wyss K et al 2001) In Tajikistan, the mean spending of tuberculosis patients and their household was US$ 396. (Ayé R 2011) One of the study conducted in three different continents revealed that the mean total patient cost is identical to one year individual

salary. (Mauch V et al 2013) The out of pocket expenses of pulmonary tuberculosis patients were found high and disastrous (Umer NA et al 2012) and these expenditures were associated with treatment delay or stay in hospitalization. (Ayé R 2011).

The present study on smear positive pulmonary tuberculosis calculated the average direct cost of patients which was reported to be less than the indirect costs. This increasing trend of indirect cost is due to the frequent visits of the patients to the health facility to collect pills which have a tendency to take them off from their work place and render them viable to deduction in salary. On the other hand, patients also lose their precious and productive time in the same.

The average total cost of the treatment reported in the current study is almost equal to the cost calculated 10 years ago, there should be increment in the total average cost of therapy, however the same cost is due to the difference in duration of therapy and number of visits to the diagnostic and pill collection centers which were located separately in 2002 and hence increase the number of visits of patients along with the cost. The current study costs were calculated for 6 months period and patients availed diagnostic and drug collection services at the same place which reduced the number of visits and hence the cost.

Although the pulmonary tuberculosis medicines and consultation are free in Pakistan, there are certain expenses like; the income loss, costs of travel and hospital stay which unfortunately do not have compensation. It is reported that these expenses sometimes exceeds from the available resources of the individual and families which ultimately results in treatment noncompliance (Johansson et al 1999).

In the present study males were found to face more expense i.e. PKR 5723.64 of TB treatment as compared to females, as they play pivotal role in the economy of the family, particularly bread earning for the whole family and these expense bring financial intricacy to them and it is the most common reason of noncompliance in this context. However female also mentioned the financial bearings of noncompliance (Johansson et al 1999). Pulmonary tuberculosis is most common in patients aged from 15 to54 years, which is considered as the economically productive age of the individual. The expenses faced by patients of this age group are high and raise the economic cost for society, which impede the development of individual as well as society over the long run. (Rajeswari et al 1999).

The indirect cost of the current study among employed persons is more than the direct costs which encores the findings of the study conducted in India which reported that work days lost in TB are high. (Rajeswari et al 1999) The total average cost of employed patients is more than unemployed this might be due to the health condition which stops them to join their job effectively and results in income loss. Another reason can be the noncompliance to the treatment because they might not be able to follow up the treatment effectively or visit the doctors and unable to undertake the pharmacotherapy in due course of time.

In terms of education level, high indirect costs were observed as most of the patients were coming from rural areas where National Tuberculosis Program NTP inefficacies were reported in many studies. (Ali et al, 2003) In addition, most of them were on daily wages which ultimately results in income loss due to days absent from work as a result of illness. Overall cost in illiterate patients is higher followed by patients with education up to the level of secondary or matriculation, this might be due to the insufficient health education regarding infectious nature of the disease. (Ali et al, 2003).

Financial burden of the disease drag an estimated 100 million people below the poverty line each year. The monthly salary of most of the patients in the present study was PKR 15000 in which 20% expenditures were due to income loss. It is reported that income loss is the leading cause of high treatment costs (Tadayuki 2014) which is obvious in the present study as well.

CONCLUSION

To minimize the financial burden of pulmonary tuberculosis on patients in terms of direct and indirect costs, it is important to understand and scrutinize the factors precipitating the ailment and aggravating the consequences. The direct costs may be control by cost effective diagnostic tests and therapy (Ayé R ,2010 and John KR 2009) whereas the transport and food costs can be minimize by providing vouchers for transport, refunding schemes and food assistance (Tadayuki 2014). On the other hand the indirect costs may be decrease by community and job-based supervision which reduce not only the income loss but also the transport costs (Sinanovic E, 2003 and Datiko DG 2010).

Conflict of interests and funding

None

REFERENCES

1. Agarwal, 2007. Clinical Medicinie. s.l.:Jaypee Brothers Publishers. 1st ed. p# 353, ISBN 9788180619281.

2. Alchamo, E. Fundamental of Microbiology, 6th ed, 2004; 212-216.

3. Ali S. S., Rabbani F., Siddiqui U. N., Zaidi A. H., Sophie A., Virani S. J., Younus N. A. Tuberculosis: do we know enough? A study of patients and their families in an out-patient hospital setting in Karachi, Pakistan. International Journal of Tuberculosis and Lung Disease, 2003; 7(11): 1052–1058.

4. American Thoracic Society, Centers for Disease Control and Prevention. Treatment of tuberculosis and tuberculosis infection in adults and children.. American Journal of Respiration Crit Care Med, 1994; 149: 1359-1374.

5. Atta Abbas, Ken McGarry. Polypharmacy in Pakistan. 1st Edition. 2014. Lap Lambert Academic Publishing Corp. Saarbrucken, Germany.

6. Axelrod, Y. & Diringer, M. "Temperature management in acute neurologic disorders. Neurol Clin, 2008; 26(2): 585–603.

7. Ayé R, Wyss K, Abdualimova H, Saidaliev S. Factors determining household expenditure for tuberculosis and coping strategies in Tajikistan, Mar 2011; 16(3): 307-13.

8. Behera, D. Textbook of Pulmonary Medicine. s.l. 2nd ed.:JP Medical Ltd, 2010; 457.

9. Bope, E. T. & Kellerman, R. D. Conn's Current Therapy 2012. s.l.:Elsevier Health Sciences, 2011; 295-301.

10. Colebunders, R. & Bastian, I. A review of the diagnosis and treatment of smear-negative pulmonary tuberculosis. The International Journal of Tuberculosis and Lung Disease, 2000; 97-107.

11. Datiko DG, Lindtjørn B 2010. Cost and cost-effectiveness of smear-positive tuberculosis treatment by Health Extension Workers in Southern Ethiopia: a community randomized trial. PLoS One 5: e9158.

12. Gantz, N. M. & Brown, R. B., 2006. Manual of Clinical Problems in Infectious Disease. 5th ed.Philadelphia.Lippincott Williams & Wilkins, 458-462.

13. Global Tuberculosis Institute, 2012. A History of Tuberculosis Treatment. [Online] Available at:

    http://www.umdnj.edu/ntbcweb/tbhistory.htm [Accessed 13 December 2012].

14. Gurung GN, Chhetri PS, Jha N. Economic impact of pulmonary tuberculosis on patients and their families of Dharan municipality, Nepal. Nepal Med Coll J, Sep 2012; 14(3): 196-8.

15. Hass, D. & Prez, R. D. Mycobacterium tuberculosis. In: Principles and practice of infectious diseases. New York: Churchill Livingstone, 1995; 2213-2243.

16. Jackson S, Sleigh AC, Wang GJ, Liu XL. Poverty and the economic effects of TB in rural China. Int J Tuberc Lung Dis, Oct 2006; 10(10): 1104-10.

17. John KR, Daley P, Kincler N, Oxlade O, Menzies D. Costs incurred by patients with pulmonary tuberculosis in rural India. Int J Tuberc Lung Dis, 2009; 13: 1281–1287 [PubMed].

18. Johansson E.; Long, N. H.; Diwan, V. K.; Winkvist, A. Attitudes to compliance with tuberculosis treatment among women and men in Vietnam Int J TUBERC LUNG DIS, 1999; 3(10): 862–868.

19. Jong, E. C. & Zuckerman, J. N. Travelers' Vaccines. s.l.:PMPH-USA, 2004; 295.

20. Karakitsos D, K. A. Hypothermia therapy after traumatic brain injury in children. The New England Journal of Medicine, 2008; 359(11): 1179–80.

21. Kenny, K., 2011. Psychological Effects of Tuberculosis. Disease Ecology, 13 JANUARY. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1520764/pdf/califmed00246-0077.pdf.

22. Khan MA, Wallet JD, Witter SN, Imran A. and Safdar. Costs and cost-effectiveness of different DOT strategies for the treatment of tuberculosis in Pakistan. Health policy and planning, 2002; 17(2): 178-186. Oxford University Press.

23. Khan J., Malik A., Hussain H., Ali N.K., Akbani F., Hussain S.J., Kazi G.N.and Hussain S.F. 2003.Tuberculosis diagnosis and treatmentpractices of private physicians in Karachi, Pakistan Eastern Mediterranean Health Journal, Vol. 9, No. 4.

24. Larbaoui, D., Chaulet P., Grosset T., Abderrahim K., Ait-Mesbah H. The efficiency of methods of diagnosing pulmonary tuberculosis: An investigation in a chest clinic in algiers. Tubercle, 1970; 403-411.

25. Mathur, P. Sacks L, Auten G, Sall R, Levy C, Gordin F. Delayed Diagnosis of Pulmonary Tuberculosis in City Hospitals. Arch Intern Med., 1994; 306-310.

26. McDermatt, L. & Glassroth, J. Tuberculosis part 1: natural history and epidemiology. Disease a Mouth, 1997; 43(2): 131-55.

27. Mauch V, Bonsu F, Gyapong M, Awini E, Suarez P, Marcelino B, Melgen RE, Lönnroth K, Nhung NV, Hoa NB, Klinkenberg E. 2013. Free tuberculosis diagnosis and treatment are not enough: patient cost evidence from three continents, Mar 2013; 17(3): 381-7. doi: 10.5588/ijtld.12.0368.

28. National TB Control Programme; Ministry of Health, 2009. Strengthening Public Private Partnership 500,000 Young People Mobilized On World TB Day. http://ntp.gov.pk/uploads/ntp_1362564677_Report%20World%20TB%20Day%202009.pdf

29. Oxlade, O., Falzon, D. & Menzies, D. The impact and cost-effectiveness of strategies to detect drug-resistant tuberculosis. European Respiratory Journal, p. 626-634.

30. Pace, B., 1997. Tuberculosis: a global threat. JAMA, 2012; 282(7).

31. Pan HQ, Bele S, Feng Y, Qiu SS, Lü JQ, Tang SW, Shen HB, Wang JM, Zhu LM. Analysis of the economic burden of diagnosis and treatment of tuberculosis patients in rural China. Int J Tuberc Lung Dis, 2013; 17(12): 1575-80. doi: 10.5588/ijtld.13.0144

32. Rajeswari, R.; Balasubramanian, R.; Muniyandi, M.; Geetharamani, S.; Thresa, X.; Venkatesan, P. Socio-economic impact of tuberculosis on patients and family in India. INT J TUBERC LUNG DIS, 1999; 3(10): 869–877.

33. Ramya Ananthakrishnan, Muniyandi M., Anita Jeyaraj, Gopal Palani, andSathiyasekaran B. W. C. 2012. Expenditure Pattern for TB Treatment among Patients Registered in an Urban Government DOTS Program in Chennai City, South India. Tuberculosis Research and Treatment Volume 2012, Article ID 747924,6 pages. http://dx.doi.org/10.1155/2012/747924.

34. Rogers, Simon. Healthcare spending around the world, country by country. The Guardian. 2012 June 30. [Online].
http://www.theguardian.com/news/datablog/2012/jun/30/healthcare-spending-world-country.

35. Sandra V Kik, Sandra PJ Olthof, Jonie TN de Vries, Dick Menzies, Naomi Kincler,Joke van Loenhout-Rooyakkers, Conny Burdo and Suzanne Verver. Direct and indirect costs of tuberculosis among immigrant patients in the Netherlands. BMC Public Health, 2009; 9: 283 doi:10.1186/1471-2458-9-283).

36. Sinanovic E, Floyd K, Dudley L, Azevedo V, Grant R, Maher D. Cost and cost-effectiveness of community-based care for tuberculosis in Cape Town, South Africa. Int J Tuberc Lung Dis, 2003; 7: S56–S62 [PubMed].

37. Steffen R[1], Menzies D, Oxlade O, Pinto M, de Castro AZ, Monteiro P, Trajman A. 2010. Patients' costs and cost-effectiveness of tuberculosis treatment in DOTS and non-DOTS facilities in Rio de Janeiro, Brazil. PLoS One. 17; 5(11): e14014. doi: 10.1371/journal.pone.0014014.

38. Swingler G. H., Toit G du., Andronikou S., Merwe L van der., Zar H J. Diagnostic accuracy of chest radiography in detecting mediastinal lymphadenopathy in suspected pulmonary tuberculosis. Arch Dis Child, 2005; 1153-1156.

39. Tadayuki Tanimura, Ernesto Jaramillo, Diana Weil, Mario Raviglione, and Knut Lönnroth. Financial burden for tuberculosis patients in low- and middle-income countries: a systematic review.Eur Respir J, 2014; 43(6): 1763–1775.

40. Ukwaja KN, Modebe O, Igwenyi C, Alobu. The economic burden of tuberculosis care for patients and households in Africa: a systematic review. Int J Tuberc Lung Dis, 2012; 16(6): 733-9. doi: 10.5588/ijtld.11.0193.

41. Umar NA, Abubakar I, Fordham R, Bachmann M. Direct costs of pulmonary tuberculosis among patients receiving treatment in Bauchi State, Nigeria, 2012; 16(6): 835-40. doi: 10.5588/ijtld.10.0774.

42. World Health Organization, 2012. Global Tuberculosis Report 2012, s.l.: World HealthOrganization. p.29.

43. World Health Organization, 2010. Global Tuberculosis Control: Surveillance, Planning, Financing, s.l. Geneva, Switzerland. Available from: http://whqlibdoc.who.int/publications/2010/97892415640 69_eng.pdf [Last accessed 2011 Feb 24].

44. Wyss K, Kilima P, Lorenz N. Costs of tuberculosis for households and health care providers in Dar es Salaam, Tanzania, 2001; 6(1): 60-8.

45. Yadav, A., Garg, S., Chopra, H. & Bajpai, S., 2012. Treatment Practices in Pulmonary Tuberculosis by Private Sector Physicians of Meerut, Uttar Pradesh: LLRM Medical College. The Indian journal of chest diseases & allied sciences, 01/2012; 54(3): 161-3.