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**KNOWLEDGE AND PERCEPTIONS OF PRESCRIBERS REGARDING
ADHERENCE TO STANDARD TREATMENT GUIDELINES FOR MANAGEMENT
OF PULMONARY TUBERCULOSIS IN PAKISTAN**

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ABSTRACT

Background: Evidence suggests that most of the practitioners do not adhere to the standard treatment guidelines for treating pulmonary tuberculosis in their daily practice and are not much familiar with DOTs program. **Aim:** The main objective of the study was to assess knowledge and perceptions of prescribers regarding adherence to standard treatment guidelines for pulmonary tuberculosis and role of national TB control program in twin cities of Pakistan. **Methods:** A semi-structured questionnaire was distributed to a random sample of sample of 395 prescribers specifically treating pulmonary tuberculosis. The data were collected, computed and analyzed using SPSS, version 16 program and descriptive analysis was conducted. **Results:** The median score for overall knowledge of prescribers regarding the pulmonary tuberculosis treatment regimen was 12 (range 9-18). The results highlighted that 65.9 % of the prescribers think that NTB program is not playing any effective role and considered poor program functioning (26.5 %), less objectivity (26.5 %), lack of communication (16.2 %) and inappropriate policies (30.8 %) as the main factors contributing towards ineffectiveness of the program in Pakistan. The prescribers were of the view that promoting awareness among community (24.3 %), proper DOTS implementation (28.1 %), adherence to STG's (18.5%) and appropriate screening of patients (9.8 %) are few of the

measures that should be taken for effective TB control in Pakistan. **Conclusion:** The results of the present study concluded that although the knowledge of prescribers working in public and private healthcare facilities regarding standard treatment guidelines was moderately good but they had negative perceptions regarding the effectiveness of the program in the country.

Keywords: Prescribers, national TB control program, standard treatment guidelines, tuberculosis, Pakistan

INTRODUCTION

Tuberculosis (TB) remains a major public health problem globally for centuries. Pulmonary tuberculosis has been estimated to be accounted for one third of the world's total population [1]. The incidence of this infection is alarming mainly due to increase in the number of HIV patients, elderly population and the emergence of resistance to anti-tuberculosis drugs worldwide [2]. Misinterpretation of early symptoms and frequent use of antibiotics in the treatment of the disease always encounters risks of inappropriate prescribing practices resulting in drug resistance and increased healthcare costs. STGs are one of the tools to support effective clinical practice and promote the rational use of drugs [3]. Treatment guidelines are designed with the collective opinion of a wide group of recognized national experts and are used as a reference for appropriate treatment choices [4].

To enable reliable, therapeutically effective and cost effective use of drugs rational prescribing in accordance with the standard treatment guidelines is required. This can

influence positively on patient compliance and outcomes of therapy [5]. Evidence suggests that practitioners in developing countries are not equipped with sufficient knowledge and training to carry out proper case management of TB. A good number of these practitioners do not adhere to the norms of standard treatment guidelines for treating tuberculosis in their daily practice and are not much familiar with DOTs program [6-12]. A study conducted in Iran showed that although most of the prescribers were aware of the correct diagnostic criteria for TB but were not familiar and adhering with the standard treatment guidelines [13]. Another study from South Africa, highlighted the need for adherence to STG's for improving prescribing practices resulting in better treatment outcomes [14].

Pakistan is ranked fifth amongst the twenty two countries designated as highly burdened by TB in the Eastern Mediterranean Region [15]. It also accounts to have the fourth highest prevalence of multidrug-resistant TB

(MDR-TB) worldwide [16]. In 1993, WHO declared TB as a global emergency and the DOTS strategy was endorsed by Government of Pakistan in the country [17]. In 1994, the Ministry of Health in collaboration with WHO revised the TB control policy and national guidelines were drafted. Pakistan was declared I of the 16 countries without an appropriate NTP in 1998. Since then, although a steady progress has been made in TB case detection and treatment success rate but Pakistan is still far away from meeting the targets related to Millennium Development Goal (MDG) by 2015 [18]. Studies conducted in Pakistan have reported poor knowledge of prescribers regarding national standard treatment guidelines as one of the main reasons for this slow progress. Most of the prescribers in Pakistan diagnose and treat tuberculosis by their own choices rather complying with standard treatment guidelines [15, 19, 20]. Most of the researches related to TB are conducted in two provinces of Pakistan i.e. KPK and Sindh. Keeping in view the federal administrative and regulatory structure of the country and due to location and operation of TB control program in the capital city, the two main cities of Pakistan namely Islamabad (federal capital) and Rawalpindi (twin city) were selected for the present study. The rationale of the study

was to assess that NTP being majorly operational in these two cities whether the program has been successful in promoting awareness and adherence among prescribers working in public and private healthcare facilities regarding national standard treatment guidelines and role of NTP. Thus the main objective of the study was to assess knowledge and perceptions of prescribers regarding adherence to standard treatment guidelines for pulmonary tuberculosis and role of national TB control program in twin cities of Pakistan.

METHODOLOGY

Study design

A descriptive, cross-sectional study design was used to evaluate the knowledge and perceptions of prescribers regarding adherence to standard treatment regimen for pulmonary tuberculosis in the 2 major cities of Pakistan: Islamabad (the national capital) and Rawalpindi (its twin city). Approval was obtained for the study from the Ethical Committee of Hamdard University. Moreover in Pakistan, questionnaire-based studies do not need any Ministry of Health endorsement. Despite that, prior information was sent to the Ministry of Health, Government of Pakistan for the execution of this research among prescribers practicing in the twin cities. Beside this, approval for the data

collection was also taken from MS of the respective hospitals.

Sampling of facilities and respondents

This study was conducted from June to August 2015. The study population included prescribers from Islamabad and Rawalpindi. Calculations of sample size were performed using Raosoft sample size calculator to determine the size of sample that represents the population of registered prescribers [15]. Considering the current population of registered prescribers ($N = 5615$), a sample size of 395 was required to achieve 95% confidence level with 5% margin of error. A sample of 395 prescribers specifically treating pulmonary tuberculosis was selected randomly from the 2 cities. The prescribers were contacted and given an explanation of the purpose of the study, and their verbal consent to participate in the study was obtained. None of the prescribers refused to participate in the study.

Study tool

A questionnaire was developed through focus group discussions by using the national standard treatment guideline for treatment of pulmonary tuberculosis as a reference. Two focus group discussions were carried out at different time intervals with 4 different groups of experts including clinicians, specialists, physicians and doctors from academia. Each group

comprised 3–4 participants for the development, finalization, face and content validity of the data collection tool. Pilot testing was carried out on 38 prescribers (10%) of the total sample size before beginning the final study. A Cronbach alpha value of 0.653 confirmed the reliability and internal consistency of the questionnaire.

The questionnaire comprised of 5 sections. The first section included information regarding prescriber's demographic characteristics: gender, city, sector (public/private), type of health facility, profession and years of experience. In the second section, perceptions of prescribers regarding current treatment practices for pulmonary tuberculosis in the country were explored. In the third section the perceptions of prescribers regarding contributing factors towards lack of adherence to STGs were explored, including patient-related factors, availability and accessibility of the guidelines for reference, prescriber's experience/personal preference and lack of guideline enforcement. Sections 2 and 3 of the questionnaire included a set of statements in which respondents were asked to indicate their level of agreement using a 5-point Likert scale where 1 = strongly disagree, 2 = disagree; 3 = neutral, 4 = agree and 5 = strongly agree was used.

In the fourth section, the knowledge of prescribers regarding standard treatment regimens for pulmonary tuberculosis and effective dosage of anti-TB drugs was assessed. Responses were assigned as 1 = yes/correct and 2 = no/incorrect. The composite score range was 9–18 and a lower score indicated better knowledge. In the last section, the perceptions of prescribers regarding the effectiveness of national TB control program in management and control of pulmonary tuberculosis in Pakistan were explored.

Data collection

Two teams, one in each city, with 10 data collectors in each team, were trained by the group of experts including the principal investigator. The questionnaire was hand-delivered to prescribers by the data collectors. Informed and verbal consent for participation was taken from the respondents. Respondents were assured about the confidentiality of information verbally and were shown an undertaking signed by the principal investigator. The questionnaire was self-completed by the prescribers and was collected from them on the same day.

Data analysis

The data were computed and analyzed using SPSS, version 16 program and descriptive analysis was conducted. The results of each item in the questionnaire

were reported as percentages and frequencies. The Kruskal–Wallis test ($P \leq 0.05$) was used to compare the knowledge scores of prescribers about standard pulmonary tuberculosis regimens by profession, length of experience and type of health-care facility, and the Mann–Whitney test ($P \leq 0.05$) was used to compare the knowledge of prescribers by gender, sector and city.

RESULTS

Background characteristics

Out of 395 prescribers, 74 % were male while 26 % were female. Just over two-thirds (67.4 %) of the total prescribers were working in the public sector, while 32.6 % were from the private sector. A total of 58.9 % were working in tertiary health-care facilities (providing specialized health care in large research and teaching hospitals), 8.4 % in secondary health-care facilities (Tehsil headquarters and district headquarter hospitals), 1.4 % in basic health units (providing primary health care services including health protection and promotion services) and 31.3 % were from private clinics. Of the total prescribers 44.6 % were house officers, 28.1 % medical officers, 23.2% specialists and 4.1 % general practitioners. Regarding the experience of the prescribers, 51.8 % had working experience of < 1 year, 25.4 % had

1–5 years, 20.7 % had 6–10 years and 2.1 % had > 10 years (Table 1).

Opinions regarding management of pulmonary tuberculosis in Pakistan

The results highlighted that 14.9 % of the prescribers were satisfied with the currently available drugs for the treatment of TB and 38.5 % agreed that prescribing anti-TB drugs before performing a diagnostic test was beneficial in the management of pulmonary tuberculosis. More than half of the respondents 54.7 % agreed that prescribing from the STGs was cost-effective. The great majority of prescribers (81.3 %) agreed that there was a need for more educational programs to increase knowledge and awareness about the available treatment guidelines for pulmonary tuberculosis (Table 2).

Factors affecting lack of adherence to standard treatment guidelines

A majority of prescribers were of the view that patient-related factors (65.4 %), availability of STGs for reference (52.9 %), lack of awareness of prescribers regarding STGs (57.7 %), prescribers' experience (50.6 %) and lack of enforcement of STGs (58.7 %) were the main factors contributing towards lack of adherence to STGs in the management of pulmonary tuberculosis in Pakistan (Table 3).

Prescribers' knowledge about standard treatment regimens

Nearly half of the prescribers were aware of the correct standard treatment regimens for treatment of pulmonary tuberculosis. Prescribers knew the treatment regimen for correct course duration of anti-mycobacterial agents for the treatment of newly diagnosed case (64.5 %), correct course duration of anti-mycobacterial agents for the treatment of retreatment case of tuberculosis (58.5 %), best anti-mycobacterial option in intensive and continuous phase for the treatment of newly diagnosed case (57.5 %) and best anti-mycobacterial option in intensive and continuous phase for the treatment of retreatment case of tuberculosis (53.1 %). On the other hand, prescribers were aware about the correct dosage for isoniazid (65.8 %), rifampicin (59.8 %), ethambutol (62.8 %), pyrazinamide (60 %) and streptomycin (60 %) (Table 4).

The composite scores for knowledge were taken into account when assessing the knowledge of prescribers for the whole therapeutic regimen. The median score for overall knowledge of prescribers regarding the pulmonary tuberculosis treatment regimen was 12 (range 9-18). Significant differences ($P < 0.05$) were found among the knowledge scores of prescribers working in different cities. Prescribers working in Rawalpindi had significantly better knowledge. While

no significant differences ($P < 0.05$) were found between the genders, sector, different level of experience, profession and location (Table 5).

Prescribers' opinions regarding role of national TB control program

The results highlighted that 65.9 % of the prescribers think that NTB program is not playing any effective role in management of TB in Pakistan. The prescribers were of the view that poor program functioning (26.5 %), less objectivity (26.5 %), lack of

communication (16.2 %) and inappropriate policies (30.8 %) were the main factors contributing towards ineffectiveness of the program in Pakistan. The prescribers were of the view that promoting awareness among community (24.3 %), proper DOTS implementation (28.1 %), improved funding (19.3 %), adherence to STG's (18.5%) and appropriate screening of patients (9.8 %) are few of the measures that should be taken for effective TB control in Pakistan (Table 6).

Table 1: Background characteristics of the sample of prescribers (n = 395)

Variable	n (%)	
Gender		
Male	292 (74.0)	103 (26.0)
Female		
Sector		
Public	266 (67.4)	
Private	129 (32.6)	
City		
Islamabad	199 (50.4)	
Rawalpindi	196 (49.6)	
Type of health facility		
Tertiary hospital	233 (58.9)	
Secondary hospital	34 (8.4)	
Basic health unit	5 (1.4)	
Private clinic	123 (31.3)	
Profession		
House officer	176 (44.6)	
Medical officer	111 (28.1)	
Specialist	92 (23.2)	
General practitioner	16 (4.1)	
Experience (years) in treating TB		
< 1		
1-5	205 (51.8)	
6-10	100 (25.4)	
> 10	82 (20.7)	8 (2.1)

Table 2: Prescribers' opinions regarding management of pulmonary tuberculosis in Pakistan

Item	Prescribers' opinions (n = 395)		
	Strongly agree + agree n (%)	Neutral n (%)	Strongly disagree + disagree n (%)
Tuberculosis in patients is well controlled with currently available anti mycobacterial tuberculosis agents in Pakistan health care system.	59 (14.9)	113 (28.7)	223 (56.4)
Empirical prescribing of anti-mycobacterial before performing diagnostic test is beneficial in the management of tuberculosis.	152 (38.5)	101 (25.6)	142 (35.9)
Prescribing anti mycobacterial for tuberculosis according to the guidelines is cost effective.	216 (54.7)	85 (21.5)	94 (23.8)
There is a need for more educational programs to increase knowledge & awareness on the available guidelines.	321 (81.3)	59 (14.9)	15 (3.8)

Table 3: Prescribers' perceptions about factors affecting adherence to standard treatment guidelines (STGs) in management of pulmonary tuberculosis in Pakistan

Factor	Prescribers' opinions (n = 395)		
	Strongly agree + agree n (%)	Neutral n (%)	Strongly disagree + disagree n (%)
Patient related factors	258 (65.4)	75 (18.9)	62 (15.7)
Availability & accessibility of the guidelines for reference	209 (52.9)	115 (29.2)	71 (17.9)
Lack of awareness on guideline availability	228 (57.7)	102 (25.8)	65 (16.5)
Prescribers experience/ personal preference	200 (50.6)	129 (32.6)	66 (16.8)
Lack of guidelines enforcement	232 (58.7)	90 (22.8)	73 (18.5)

Table 5: Comparison of prescribers' knowledge scores about standard treatment regimen for pulmonary tuberculosis by demographic characteristics

Variable	Knowledge Score			
	n	Median knowledge score	Test Statistics	P-value
Gender	292			
Male	103	12	14382.50 ^a	0.245
Female		12		
Sector				
Public	266	12	16083.50 ^a	0.299
Private	129	12		
City				
Islamabad	199	13	16002.0 ^a	0.002
Rawalpindi	196	11		
Location				
Tertiary	233	12	2.836 ^b	0.418
Secondary	34	12		
Primary	5	15		
Clinic	123	13		
Profession				
House Officer	176	12	0.641 ^b	0.887
Medical Officer	111	12		
Specialist	92	12		
GP	16	10.5		
Experience (years)	205			
< 1	100	11	4.595 ^b	0.204
1-5	82	12		
6-10	8	11		
> 10		13.5		

a. Mann-Whitney test; b. Kruskal-Wallis test.

Table 4: Prescribers' knowledge about standard treatment regimens for pulmonary tuberculosis

Drugs	Public (n = 266)		Private (n = 129)		Total (n = 395)	
	Correct n (%)	Incorrect n (%)	Correct n (%)	Incorrect n (%)	Correct n (%)	Incorrect n (%)
Standard effective dosage of anti-TB drugs for treating pulmonary tuberculosis						
Isoniazid 4-6 mg/kg daily maximum 300 mg daily	182 (68.4)	84 (31.6)	78 (60.4)	51 (39.6)	260 (65.8)	135 (34.2)
Rifampicin 8-12 mg/kg daily maximum 600 mg daily	154 (57.8)	112 (42.2)	82 (63.5)	47 (36.5)	236 (59.8)	159 (40.2)
Ethambutol 15-25 mg/kg daily	175 (65.7)	91 (34.3)	73 (56.5)	56 (43.5)	248 (62.8)	147 (37.2)
Pyrazinamide 20-30 mg/kg daily	170 (63.9)	96 (36.1)	67 (51.9)	62 (48.1)	237 (60)	158 (40)
Streptomycin 12-18 mg/kg daily	170 (63.9)	96 (36.1)	67 (51.9)	62 (48.1)	237 (60)	158 (40)
Standard treatment regimen of pulmonary tuberculosis						
2 month intensive phase + 4 month continuous phase is the correct course duration of anti-mycobacterial agents for the treatment of newly diagnosed case of tuberculosis.	173 (65)	93 (35)	82 (63.5)	47 (36.5)	255 (64.5)	140 (35.5)
3 months intensive phase + 5 months continuous phase is the correct course duration of anti-mycobacterial agents for the retreatment case of tuberculosis.	158 (59.3)	108 (40.7)	73 (56.5)	56 (43.5)	231 (58.5)	164 (41.5)
2 months HRZE+ 4 months HR is the best anti-mycobacterial option in intensive and continuous phase for the treatment of newly diagnosed case of tuberculosis.	159 (59.7)	107 (40.3)	68 (52.7)	61 (47.3)	227 (57.5)	168 (42.5)
2 months HRZES +1 month HRZE + 5months HRE is the best anti-mycobacterial option included in intensive and continuous phase in the retreatment case.	145 (54.5)	121 (45.5)	65 (50.3)	64 (49.7)	210 (53.1)	185 (46.9)

Table 6: Prescribers' opinions regarding role of national TB control program in management of pulmonary tuberculosis in Pakistan

Variable		n (%)
Do you think NTB program is playing effective role in control of TB in Pakistan?	Yes	135 (34.1)
	No	260 (65.9)
How do you think National TB program is playing effective role in control of TB in Pakistan?	Free availability of drugs	57 (42.2)
	Training of doctors by NTB	19 (14.1)
	Economical program	48 (35.5)
	Promoting awareness among community	11 (8.2)
Why do you think National TB program is playing effective role in control of TB in Pakistan?	Program functioning needs improvement	69 (26.5)
	Less objective oriented	69 (26.5)
	Lack of communication	42 (16.2)
	Inappropriate policies	80 (30.8)
Do you think MDR TB is an issue in Pakistan?	Yes	354 (89.6)
	No	41 (10.4)
In your opinion what are the major problems faced in treatment of TB in Pakistan?	Poor hygienic conditions	17 (4.3)
	Lack of adherence to STG's	93 (23.5)
	Misconceptions for disease	26 (6.4)
	Poor knowledge regarding TB	110 (27.6)
	Patients non-compliance	94 (23.6)
	Unavailability of trained staff	34 (8.5)
	Decreased quality of drugs	21 (6.1)
In your opinion which is the most effective chemo prophylactic treatment for pulmonary tuberculosis?	Isoniazid	259 (65.5)
	Pyrazinamide	27 (6.8)
	Rifampicin	17 (4.4)
	Myrin P	92 (23.3)
In your opinion which is the most effective vaccine for pulmonary tuberculosis?	Havrix	51 (12.9)
	Bacille Calmette Guerin	318 (80.5)
	Prevenar 13	26 (6.6)
In your opinion what measures should be taken for effective TB control in Pakistan?	Awareness among community	96 (24.3)
	Proper DOTS implementation	111 (28.1)
	Improve funding	76 (19.3)
	Strict adherence to STG's	73 (18.5)
	Proper screening of patients	39 (9.8)

DISCUSSION

Pakistan national tuberculosis programs (NTPs) has tried its level best to expand DOTS coverage nationwide, providing access to standardized TB care through public sector health facilities during the past few years. However, less attention has been devoted to private sector TB care although 60% to 80% of TB patients choose to seek treatment from private providers at significant out-of-pocket expense and with unknown treatment outcomes. The Stop TB Partnership Strategy 2006–2015 aims to engage

directly with private sector providers to ensure patients have access to high-quality DOTS services from all TB care providers [21, 22]. Collaborative public-private sector interventions to implement the DOTS strategy, known as PPM (public-private mix) DOTS, and dissemination of the evidence-based international standards of tuberculosis care are being used to link private providers to NTPs. These strategies are being scaled up in Pakistan; however, progress is slow, with limited and varying success. The results of the present study are quite encouraging as they showed that

more than fifty percent of the prescribers working in either public or private healthcare facilities were aware of the correct standard treatment regimens for treatment of pulmonary tuberculosis. They were aware of the effective dosage regimen of individual anti-TB drugs. No differences among the knowledge of different genders of prescribers, working in different sectors, healthcare facilities and with different level of experiences were reported. However, significant differences were found working in different cities. Prescribers working in Rawalpindi had significantly better knowledge. This might be due to the fact that more prescribers trained by NTP are working in the healthcare facilities located in Rawalpindi. These results do not reflect that this better knowledge would also be translated into better adherence with STG's. The results of the study are in line with another study conducted in Iraq which reported that a significant proportion of prescribers possessed good knowledge but had negative attitudes and practices towards adherence to standard treatment guidelines [13].

The results of the current study showed that majority of prescribers were of the view that patient-related factors, availability of STGs for reference, prescribers' experience, lack of awareness regarding STG's and their enforcement were the

main factors contributing towards lack of adherence to STGs in the management of pulmonary tuberculosis in Pakistan. Similar findings were reported from several other studies conducted in other developing countries [23-24]. The results of the present study showed that more than half of the respondents agreed that prescribing from the STGs was cost-effective and on need for more educational programs to increase knowledge and awareness about the available treatment guidelines for pulmonary tuberculosis. Similar findings were reported from studies conducted in India and Ethiopia which highlighted that physicians need frequent education and training to enhance their knowledge, attitude and behaviour towards treatment of tuberculosis [8, 25].

The results of the present study highlighted that majority of the prescribers were not satisfied with the currently available anti-TB drugs and considered multi drug resistant TB as biggest concern at present for the treatment of TB. The results are in line with another study conducted in Addis Ababa which reported irrational use of the few available anti-tuberculosis drugs which can lead to multi-drug resistance tuberculosis [26]. The respondents in the present study considered isoniazid as the most effective chemo prophylactic treatment and Bacille Calmette Guerin as

the most effective vaccine for pulmonary tuberculosis. Similar findings of were reported from other studies [27, 28].

The present study depicted an interesting finding that the results highlighted that nearly two-third of the prescribers were not satisfied with role of NTP in Pakistan. They considered poor program functioning, less objectivity, lack of communication and inappropriate policies as the main factors contributing towards ineffectiveness of the program in Pakistan. Similar misunderstandings and negative perceptions regarding performance of national TB control program in Korea were reported [29]. The results of the present study highlighted that NTP can play its role efficiently by improving its functioning and policies, creating awareness among community, encouraging strict adherence to STG's among prescribers and promoting appropriate screening of patients for effective TB control in Pakistan. Similarly need of revamping the national TB control program by providing adequate laboratory facilities, promoting better understanding of TB and its cure among the masses and improving the quality of care provided to TB patients was highlighted by a study conducted in India [30].

CONCLUSION

The results of the present study concluded that the knowledge of prescribers working

in public and private healthcare facilities regarding standard treatment guidelines was moderately good but still need for improvement exist. This calls for improving awareness and adherence of public as well as private practitioners to standard treatment guidelines in order to strengthen the currently implemented public private mix model for control of TB in the country. The study showed negative perceptions of prescribers regarding effectiveness of NTP. This indicates high time for NTP to revamp itself and overcome its deficiencies to address the questions raised on its effectiveness in order to achieve the ultimate goal of TB control in Pakistan.

REFERENCES

- [1] Lienhardt C, Ogden JA. Tuberculosis control in resource-poor countries: have we reached the limits of the universal paradigm? *Trop Med Int Health*. 2004;9(7):833-41.
- [2] Langendam MW, van der Werf MJ, Huitric E, Manissero D. Prevalence of inappropriate tuberculosis treatment regimens: a systematic review. *Eur Respir J*. 2012;39(4):1012-20.
- [3] Ngamvithayapong J, Uthaiworavit W, Yanai H, Akarasewi P, Sawanpanyalert P. Adherence to

- tuberculosis preventive therapy among HIV-infected persons in Chiang Rai, Thailand. *Aids*. 1997;11(1):107-12.
- [4] Nahid P, Pai M, Hopewell PC. Advances in the diagnosis and treatment of tuberculosis. *Proceedings of the American Thoracic Society*. 2006;3(1):103-10.
- [5] Shah S, Sadiq H, Khalil M, Noor A, Rasheed G, Shah S et al. Do private doctors follow national guidelines for managing pulmonary tuberculosis in Pakistan? *East Mediterr Health J*. 2003 ;9(4):776-88.
- [6] Shirzadi M, Majdzadeh R, Pourmalek F, Naraghi K. Adherence of the private sector to national tuberculosis guidelines in the Islamic Republic of Iran, 2001-02. *East Mediterr Health J*. 2003;9(4):796-804.
- [7] Singla N, Sharma P, Singla R, Jain R. Survey of knowledge, attitudes and practices for tuberculosis among general practitioners in Delhi, India. *Int J Tuberc Lung Dis*. 1998;2(5):384-9.
- [8] RamBihariLal Shrivastava S, Shrivastava S, Ramasamy J. Knowledge and practices about Revised National Tuberculosis Control Program among clinicians of a medical college in India: A cross-sectional study. *Prog Health Sci*. 2013;3(1):94-103.
- [9] Nojoomi M, Mokhberal-Safa L, Jamali A. Study of Knowledge and Attitude of Private General Physicians of Karaj City Regarding National TB Programs–2002. *Tanaffos*. 2003;2(6):67-73.
- [10] Mala G, Moser A, Dinant GJ, Spigt M. Why tuberculosis service providers do not follow treatment guideline in Ethiopia: a qualitative study. *J Eval Clin Pract*. 2014;20(1):88-93.
- [11] Kiefer EM, Shao T, Carrasquillo O, Nabeta P, Seas C. Knowledge and attitudes of tuberculosis management in San Juan de Lurigancho district of Lima, Peru. *J Infect Dev Ctries*. 2009;3(10):783-8.
- [12] Irani AD, Shahraki AH, Ghaderi E, Nasehi M, Mostafavi E. Lack of optimum practice among health care workers regarding tuberculosis in Iran: A knowledge, attitude, and practice study. *Am J Infect Control*. 2015;43(5):e7-12
- [13] Hashim D, Al Kubaisy W, Al Dulayme A. Knowledge, attitudes and practices survey among health

- care workers and tuberculosis patients in Iraq. 2003. *East Mediterr Health J.* 2003 ;9(4):718-31.
- [14] Rowe K, Makhubele B, Hargreaves J, Porter J, Hausler H, Pronyk P. Adherence to TB preventive therapy for HIV-positive patients in rural South Africa: implications for antiretroviral delivery in resource-poor settings? *Int J Tuberc Lung Dis.* 2005;9(3):263-9.
- [15] Naseer M, Khawaja A, Pethani AS, Aleem S. How well can physicians manage Tuberculosis? A Public-Private sector comparison from Karachi, Pakistan. *BMC Health Serv Res.* 2013;13(1):439.
- [16] Organization WH. Global tuberculosis control: WHO report 2010. World Health Organization; 2010.
- [17] Shiffman J, Beer T, Wu Y. The emergence of global disease control priorities. *Health Policy Plann.* 2002;17(3):225-34.
- [18] Organization WH. Guidelines for the programmatic management of drug-resistant tuberculosis-2011 update. 2011.
- [19] Mushtaq M, Majrooh M, Ahmad W, Rizwan M, Luqman M, Aslam M et al. Knowledge, attitudes and practices regarding tuberculosis in two districts of Punjab, Pakistan. *Int J Tuberc Lung Dis.* 2010;14(3):303-10.
- [20] Khan A, Badini Z, Parkash J. Prescribing Practices of Consultants at Karachi, Pakistan. *J Pak Med Assoc;* 2001;51(2):74-7.
- [21] Garner P, Smith H, Munro S, Volmink J. Promoting adherence to tuberculosis treatment. *Bull WHO.* 2007;85(5):404-6.
- [22] Bell C, Duncan G, Saini B. Knowledge, attitudes and practices of private sector providers of tuberculosis care: a scoping review [Review article]. *Int J Tuberc Lung Dis.* 2011;15(8):1005-17.
- [23] Xu W, Lu W, Zhou Y, Zhu L, Shen H, Wang J. Adherence to anti-tuberculosis treatment among pulmonary tuberculosis patients: a qualitative and quantitative study. *BMC Health Serv Res.* 2009;9(1):169.
- [24] Zhou C, Chu J, Liu J, Tobe RG, Gen H, Wang X et al. Adherence to tuberculosis treatment among migrant pulmonary tuberculosis patients in Shandong, China: a

- quantitative survey study. *PloS one*. 2012;7(12):e52334.
- [25] Yimer SA, Holm-Hansen C, Bjune G. Assessment of knowledge and practice of private practitioners regarding tuberculosis control in Ethiopia. *J Infect Dev Ctries*. 2011;6(01):13-9.
- [26] Shimeles E, Aseffa A, Yamuah L, Tilahun H, Engers H. Knowledge and practice of private practitioners in TB control in Addis Ababa. *Int J Tuberc Lung Dis*. 2006;10(10):1172-7.
- [27] McShane H. Tuberculosis vaccines: beyond bacille Calmette–Guérin. *Philosophical Transactions of the Royal Society B: Biological Sciences*. 2011;366(1579):2782-9.
- [28] Pineda NIS, Pereira SM, Matos ED, Barreto ML. Chemoprophylaxis in the prevention of tuberculosis. *J. bras. Pneumol*; 2004;30(4):395-405.
- [29] Hong Y, Kwon D, Kim S, Chang S, Kang M, Lee E et al. Survey of knowledge, attitudes and practices for tuberculosis among general practitioners. *Int J Tuberc Lung Dis*. 1995;76(5):431-5.
- [30] Verma R, Khanna P, Mehta B. Revised national tuberculosis control program in India: the need to strengthen. *Int J Prev Med*; 2013;4(1):1.