Tanzania Journal of Health Research
Volume 20, Number 1, January 2018
Doi: http://dx.doi.org/10.4314/thrb.v20i1.9

Provider initiated HIV testing and counselling in tuberculosis-HIV collaborative activities: effect on knowledge and perception of tuberculosis patients in Garhwal, Uttarakhand in India

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Abstract
Background: The burden of tuberculosis (TB) is so closely linked to the HIV epidemic that prevention of HIV must become a priority for TB programmes, just as TB care and prevention should be a major concern of HIV/AIDS programmes. The objective of this study was to assess the effect of TB-HIV collaborative activities on knowledge regarding the two diseases and their co-infection among diagnosed TB patients in Garhwal region of Uttarakhand in India.
Methods: A cross sectional study was conducted among 346 patients registered under the Revised National Tuberculosis Control Programme (RNTCP) at selected District Microscopy Centres (DMCs) in four out of seven randomly selected districts of Garhwal region. Information related to socio-demographic profile of the patients, their health variables, knowledge about TB-HIV co-infection and knowledge about access points for care of TB-HIV co-infection was obtained.
Results: The median age of respondents was 33 years, with a slight predominance of males (56.9%). About one fourth of the respondents were illiterate and 60% had a monthly family income of India Rupees 3,000-7,499 (US$=47. 1 - 117.7). While knowledge about preventing transmission of TB by use of a handkerchief was good (97-98%), knowledge regarding proper disposal of sputum was inadequate (11-12%). Knowledge about various modes of transmission of HIV ranged from 44% to 47% with males having better knowledge. Knowledge about asymptomatic period (5.8%) and window period (0.2%) was dismal. More than half (55.2%) were ignorant about symptoms of HIV/AIDS. Ignorance about TB- HIV co-infection was high (92%).
Conclusion: Knowledge of patients registered under RNTCP was lacking with respect to both TB and HIV infection as well as about co-infection, with ignorance rates being higher among females. The findings highlight the fact that the patients were left un-informed and un-educated even after having an interaction with the health care workers at two different places, which should not be missed, for educating patients on relevant issues related to TB, HIV & co-infection.

Keywords: Tuberculosis, HIV/AIDS, co-infection, collaborative activities, knowledge, India

Introduction

Tuberculosis (TB) has been reported to be the ninth leading cause of death worldwide, with an estimated 1.3 million deaths in HIV negative people and additional 374,000 deaths among TB-HIV co-infected people in 2016 (WHO, 2017). Most of the estimated number of incident cases of tuberculosis in 2016 occurred in the World Health Organization South-East Asia Region (WHO, 2017). TB-HIV together combine fatally leading to extremely high death rates (15-18%) reported among HIV infected TB cases notified under by the Ministry of Health in India (MOHFW, 2013). Globally, 12% of the 9.6 million new TB cases in 2014 were HIV positive. Recent statistics indicate that India holds the second position after South Africa with 87,000 HIV positive incident TB cases (WHO, 2017).The nationwide estimated HIV seroprevalence among TB patients rose from 4.85% in 2007 to 5.7% in 2013, with India being

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categorized under countries with concentrated HIV epidemics (TB India, 2011, 2014). The nature of HIV epidemic is undergoing a change in India. The six high prevalence states account for only 31% cases whereas the 10 states previously known to have low prevalence, which also included Uttarakhand, together account for 57% cases in 2011 (WHO, 2015). The burden of TB is so closely linked to the HIV epidemic that prevention of HIV must become a priority for TB programmes, just as TB care and prevention should be a major concern of HIV/AIDS programmes (Faussett *et al.*, 2002). Early detection of TB-HIV cases and prompt provision of Anti-Retroviral Treatment (ART) and Anti-TB Treatment (ATT) are key interventions to reduce mortality rates significantly (MOHFW, 2013).

The WHO Interim Policy on TB-HIV recommends HIV testing among TB patients as an entry point for integrated HIV-TB care and surveillance, with an additional aim of reducing the burden of HIV in patients with presumptive and diagnosed TB (WHO, 2004). National Framework for Joint HIV/TB Collaborative Activities is a joint national policy first developed in 2007 and revised in 2009 and 2013. It was developed with the intention to ensure early detection and prompt linkage of TB and HIV cases to care, support and treatment. Four pronged strategy, which include prevention, early detection of TB/HIV, prompt treatment and management of special TB/HIV cases, was adopted for mitigating the effects of TB HIV co-infection. Under this, provider initiated HIV testing and counselling (PITC) among TB patients along with provision of HIV prevention education for patients with presumptive or diagnosed TB cases have been listed as important activities, amongst others, to be undertaken to reduce burden of HIV among TB patients (MOHFW, 2013).

Uttarakhand, a hilly state in North India, had endorsed this national policy and implemented it since 2011. TB-HIV Collaborative activities are provided to all level of TB care settings in Uttarakhand. TB-HIV cross referral activities has been expanded through approximate 1,621 Integrated Counselling and Testing Centres (ICTCs), 27 Anti-retroviral therapy (ART) centres and 52 linked ART centres at different medical colleges and district hospitals in the state (DOHFW, 2017). The patients therefore have two opportunities to interact with health professionals, one at Designated Microscopy Centres (DMC) and other at ICTC. It is therefore imperative that these opportunities be used to enhance the knowledge of patients regarding the two diseases and their lethal co-infection, as envisaged in the policy document.

While the indicators for monitoring the cross-referral of patients is in place and has been found to be effective as evident from increasing rates of cross-referrals, there is little information on the effect of this approach on the knowledge regarding both the diseases, individually and their combination, among patients (NACO, 2014). Enhanced knowledge regarding diseases is the first step for effective translation to prevention of diseases and its complications. The present study aimed to assess the effect of TB-HIV collaborative activities, on knowledge regarding TB, HIV and TB-HIV co-infection, among diagnosed TB patients in Garhwal region of Uttarakhand in India.

Materials and Methods

Study setting

The present study was conducted among patients undergoing treatment for tuberculosis at the District Microscopy centres (DMCs) in Garhwal region of Uttarakhand, in northern India. Uttarakhand is made up of 13 districts which are distributed in two regions i.e. Garhwal and Kumaon. Garhwal region consists of seven districts namely, Chamoli, Pauri, Uttarkashi, Dehradun, Rudraprayag, Haridwar, and Tehri Garhwal. The study was conducted for a period of 12 months. We included all TB patients attending the selected health facilities during the study period, who met the eligibility criteria (age above 18 years, non-pregnant women, patients who were not critically ill, patients who had no problem of hearing or speaking) and volunteered to participate in the study.

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Sample size and sampling

The present study is part of intramural project entitled "A study on determinants of knowledge and treatment seeking behaviour of TB patients in reference to TB-HIV collaborative activity in Garhwal, Uttarakhand", where the primary aim was to estimate the percentage of directly observed for treating tuberculosis (DOTS) patients complying with the referral to ICTC centre for HIV testing. Taking this percentage of compliance as 69% (Thomas *et al.*, 2007), and an absolute error of 5%, the sample size was estimated at 329 (Lwanga, 1991). Adding a 10% non-response to it, the sample size came out to be 361.

Stratified proportional sampling was done for recruitment of respondents in the study and selection of health facilities. The present study was conducted in Garhwal region which has seven districts which are divided into hilly and plain areas, based on their location. Two districts in hilly area were selected randomly, namely Pauri and Rudraprayag, while two districts of the plain area were Dehradun and Haridwar. Each of these districts has one or more tuberculosis units (TU) depending on the population size. One TU was randomly selected from all the TUs in each district. Each of these TUs has DMCs under them where patients are diagnosed as well as some are treated there. Two DMCs were randomly selected from each TU to recruit the patients. Therefore, a total of 8 DMCs were selected for recruitment of patients. These DMCs have different patient attendance which was obtained from previous year's record. The number of patients to be recruited at each DMC was determined on the basis of probability proportion to size based on previous year's attendance. So the DMC having higher patient attendance had more representation in the study as compared to those with low attendance. Patients who refused for participation were not counted and subsequent patients were interviewed consecutively in each DMC till the completion of required sample size.

Data collection

Data collection was done using a pre-tested questionnaire, prepared and translated in Hindi for administration to the patients and back translated for validating it. The interviewer collected information related to socio-demographic profile of the patient, their health variables, knowledge about TB-HIV co-infection and knowledge about access points for care of TB-HIV co-infection.

Data analysis

Data was entered in Microsoft Excel and analysed using data analysis tool of MS excel. For comparison of means and proportions unpaired t-test and chi-square test were used respectively. A p value of <0.05 was considered significant.

Ethical considerations

Ethical clearance for conducting the study was obtained from the Institutional Ethical Committee of All India Institute of Medical Sciences, Rishikesh. Patient information document was provided to all the respondents and informed written consent was obtained by all the participants before starting the interview.

Results

A total of 346 (male= 197; female=149) respondents participated in the study. Analysis of socio-demographic characteristics of the participants revealed that the mean and median age of the respondents was 36.7 years and 33 years, respectively with a range of 18-80 years. There was a slight predominance of male patients (56.9%). About one fourth of the respondents were illiterate and only 3% had a professional degree. The percentage of illiteracy of the spouses was slightly higher (28%).

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Table 1: Distribution of socio-demographic characteristics of respondents

Socio-demographic characteristics		Number	%
Education of the patient	Illiterate	90	26.0
	Primary school pass	55	15.9
	Eight class pass	57	16.5
	High school pass	60	17.3
	Intermediate pass	41	11.8
	Graduation/ diploma	34	9.8
	Professional Degree and above	9	2.6
Education of the spouse	Illiterate	97	28.0
	Primary school pass	94	27.2
	Eight class pass	33	9.5
	High school pass	42	12.1
	Intermediate pass	35	10.1
	Graduation/ diploma	25	7.2
	Professional Degree above	15	4.3
Income of family per month in US dollars	<15.46	1	0.3
	15.46-46.36	4	1.2
	46.38 – 77.28	70	20.2
	77.30- 115.93	135	39.0
	115.95- 154.58	1	0.3
	154.60- 309.18	95	27.5
	>309.19	2	0.6
Occupation	Unemployed	155	44.8
	Employed	68	19.7
	Studying	42	12.1
	Homemakers	81	23.4
Type of ration card	Below Poverty line (BPL) card	143	41.3
	Above Poverty line (APL) card	153	44.2
	Not present	50	14.5

About 60% of the respondents reported having a monthly family income of US$46.38– 115.93; while 28% had a family income of more than US$154.6 per month. About two fifth of the respondents had a 'Below poverty line' (BPL) card. The percentage of unemployed patients was quite high (45%); only 20% were employed currently; the rest were homemakers (23.4%) and students (12.1%) (Table 1). Three fifth of the respondents stayed in a nuclear family while the rest had a joint family with a median family size of 5 members. A total of 205 (59.2%) of the respondents stayed in a nuclear family while the rest (40.8%) had a joint family with a median family size of 5 members. In terms of religion, Hindu accounted for the majority (88.4%) of the respondents, followed by Muslims (10.7%), Sikh (0.6%) and Christians (0.3%). Eight-four (24.3%) were scheduled caste, 4 (1.2%) scheduled tribe, 62 (17.9%) other backward caste and 196 (56.6%) general.

Analysis of the details of treatment under DOTS revealed that three fourth of the respondents were registered under category 1 of DOTS treatment under Revised National Tuberculosis Control Programme (RNTCP), while the majority of the rest were under category 2 (24.3%). About 46% of the category 1 patients were new sputum smear positive, while another 47% were classified as extra-pulmonary not seriously ill at the time of registration for DOTS. Relapse and failure contributed to about 42% and 57% of category 2 patients respectively. Approximately 10% of the patients had a past family history of tuberculosis. More than 90% of the patients did not suffer from any other diagnosed illness other than TB; only a few were under treatment for diabetes (4%).

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Assessment of knowledge about various preventive methods of transmission of TB showed that knowledge about the use of a handkerchief while coughing or sneezing in prevention of TB transmission was present in 97-98% of females and males. The need of starting the treatment as early as possible and taking regular and complete treatment was also known to more than 85% of the respondents. However, the knowledge of proper disposal of sputum was not good (11-12%). Also, 14% of females and 23% of males stated the need of isolating the TB patient for preventing the transmission. Other methods stated were keeping separate utensils and abstaining from smoking and alcohol.

Table 2: Knowledge and perception about modes of transmission and effects of HIV infection

Variables	Males (197)						Females (149)						P-value
	Yes		No		Don't know		Yes		No		Don't know		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Mode of transmission of HIV													
Unsafe sex	111	56.3	0	0	86	43.7	51	34.2	1	0.7	97	65.1	0.00
Transfusion of infected blood	111	56.3	0	0	86	43.7	51	34.2	1	0.7	97	65.1	0.00
Use of used or unsterilized syringes	111	56.3	0	0	86	43.7	51	34.2	0	0.0	98	65.8	0.00
Mother to child transmission	103	52.3	2	1.0	92	46.7	49	32.9	2	1.3	98	65.8	0.0
Eating food in the same utensil of an HIV infected person	1	0.5	106	53.8	90	45.7	2	1.3	47	31.5	100	67.1	0.00
Shaking hands with an infected person	1	0.5	106	53.8	90	45.7	0	0.0	50	33.6	99	66.4	0.00
Mosquito bite	29	14.7	66	33.5	102	51.8	9	6.0	36	24.2	104	69.8	0.00
Smoking and drinking alcohol	0	0.0	104	52.8	93	47.2	0	0.0	48	32.2	101	67.8	0.00
Other means of transmission	1	0.5	6	3.0	190	96.4	2	1.3	3	2.0	144	96.6	0.59
Effects of HIV infection													
Immunity decreases	76	38.6	1	0.5	120	60.9	42	28.2	0	0.0	107	71.8	0.08
Becomes weak	108	54.8	0	0	89	45.2	50	33.6	1	0.7	98	65.8	0.00
Dies slowly	109	55.3	0	0	98	49.7	49	32.9	0	0.0	100	67.1	0.00

It was also observed that only 56% of the male respondents had knowledge about various modes of transmission of HIV. While the awareness about eating food in the same utensils, shaking hands with infected persons and smoking in not serving as modes of transmission was present in about half of the male respondents. The others did not know that these modes did not lead to HIV transmission. Mosquito bite was reported by about 15% of the male respondents and 6% of females to be serving as a mode of transmission and only one third of the respondents correctly knew that it did not transmit the disease agent. The corresponding proportions of knowledge in female respondents were lower as compared to males. However, the misconception regarding mosquito bite as a mode of transmission was less common in females (Table 2).

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The effect of HIV infection in leading to decreased immunity was known to only about two-fifth of males, while the corresponding figures were even lower for females. It was known by only about half of the males and one third females that a person with HIV infection becomes weak and dies slowly in the absence of a treatment (Table 2). More than 90% of respondents did not know that HIV infection may not produce symptoms, but still spread for a variable period of time. While 41.6% of males knew that if a person is tested negative at one point of time, he may test positive later on, only 30% of females had this knowledge. The most common source of information regarding HIV was media, although its role in spreading awareness was comparatively less among females (Table 3).

Table3: Knowledge about course of HIV infection among the respondents

Variables	Males (197)		Females (149)		χ^2 value	P-value
	No.	%	No.	%		
Asymptomatic period after HIV infection						
Up to 1 year	9	4.6	2	1.3	1.91	0.16
Up to 5 years	2	1.0	5	3.4	1.31	0.25
Up to 10 years	1	0.5	1	0.7	0.27	0.60
Don't know	185	93.9	141	94.6	0.00	0.95
If a person is negative for HIV, will he remain so for the rest of his life						
Yes	1	0.5	0	0.0	6.47	0.04
No	82	41.6	44	29.5		
Don't know	113	57.4	105	70.5		
Source of information regarding HIV						
Media	144	73.1	83	55.7	10.61	0.001
Health personnel	9	4.6	6	4.0		
Friends	2	1.0	1	0.7		
Patients	0	0.0	1	0.7	-	-
Family	0	0.0	0	0.0		
Others	3	1.5	7	4.7		

It was also observed that only 27% of males knew that a treatment of HIV was available, another 28% were of the view that there is no treatment for HIV; the rest 45% did not have any knowledge about the same. The females had poorer knowledge regarding availability of a treatment of HIV (14%). On enquiry about the place where the treatment for HIV may be available, 53% of males quoted a government hospital whereas about 10% of both males and females cited private hospitals. About 46% males and 66% of females did not know about any place where a treatment for HIV could be available. 18 men and 15 women told that the treatment is available at both places. The proportion of both males and females stating the availability of treatment at every government hospital and specific hospitals was similar (28% and 72%, respectively). About two thirds of both males and females having knowledge about the availability of treatment at a government hospital knew that it is available free of cost (Table 4). Assessment of the attitude of patients towards HIV infected people revealed that only about 6% of males and one female stated that it is shameful to be diagnosed of an HIV. The reason stated was that it happens to bad people (8 out of 11 males). About 53% of males and 37% of females held a view that it is not shameful, while the rest did not express any opinion regarding it. Enquiry about the opinion regarding social exclusion of an HIV infected person revealed that 58% of males and 38% of females were of the view that there would be no social exclusion, while the rest did not have any opinion. Only two males stated that there would be a social exclusion, since it is communicable and it happens to bad person.

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Table 4: Knowledge about availability of treatment regarding HIV in patients registered under DOTS

Variable	Males (197)		Females (149)		χ^2 value	P value
	No.	%	No.	%		
Treatment of HIV						
Yes	53	26.9	21	14.1		
No	56	28.4	32	21.5	14.34	0.0008
Don't know	88	44.7	96	64.4		
Place of availability of treatment for HIV						
Government hospital	105	53.3	50	33.6		
Private hospital	20	10.2	17	11.4	13.76	0.001
Don't know	90	45.7	98	65.8		
Availability at government hospital						
Every	30	28.6	14	28.0	0.005	0.94
Specific	75	71.4	36	72.0		
Payment in government hospital						
Free	68	64.8	33	66.0	0.04	0.98
Payment	6	5.7	3	6.0		
Don't know	31	29.5	14	28.0		

Table 5: Knowledge about TB-HIV co infection in respondents according to sex

Variables	Males (197)		Females (149)		χ^2 value	P value
	No.	%	No.	%		
Is there any association between TB & HIV						
Yes	13	6.6	3	2.0	5.92	0.05
No	9	4.6	3	2.0		
Don't know	175	88.8	143	96.0		
A person suffering with HIV has more chances to get TB						
True	10	5.1	5	3.4	0.73	0.69
False	2	1.0	1	0.7		
Don't know	185	93.9	143	96.0		
A person suffering with both Tb and HIV has more chances of default, relapse and treatment failure						
True	16	8.1	6	4.0	2.47	0.29
False	3	1.5	3	2.0		
Don't know	178	90.4	140	94.0		
A person suffering with both TB and HIV will have higher mortality						
True	23	11.7	8	5.4	4.15	0.12
False	1	0.5	1	0.7		
Don't know	173	87.8	140	94.0		
A person suffering with both TB and HIV will have more chances of drug resistance						
True	8	4.1	3	2.0	1.81	0.40
False	1	0.5	2	1.3		
Don't know	188	95.4	144	96.6		
Common opportunistic infections in a patient having HIV						
Tuberculosis	9	4.6	8	5.4	0.00	0.92
Fungal infection	2	1.0	1	0.7	0.05	0.80
Diarrhoea	2	1.0	4	2.7	0.58	0.44
Others	10	5.1	5	3.4	0.26	0.61

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Assessment of knowledge about TB-HIV co-infection revealed that 89% of males and 96% of females were not at all aware of it; 9 males and three females said that they are not associated. Similarly, more than 94% of respondents were not aware that a person suffering with HIV has more chance of contracting TB infection. Only 8% of males and 4% of females knew that a person suffering with both TB and HIV has more chances of default, relapse and failure of TB treatment. About 90% of respondents were unaware of the fact that a person suffering from both TB and HIV will have higher mortality. Knowledge about drug resistance in co-infection and opportunistic infections in HIV was also very poor (< 5%) (Table 5).

Discussion

The present study intended to assess the effect of PITC on knowledge regarding TB, HIV and TB-HIV co-infection among TB patients. Very few similar studies have been undertaken world over and none have been reported from India. The awareness about the use of handkerchief and initiating early treatment for preventing transmission of TB was good. However, the role of proper disposal of sputum in preventing transmission of TB was known to few. This is especially relevant in the light of the fact that public spitting is a common occurrence in India despite the laws that exist for controlling it (The Hindu, 2016). TB spreads via droplet infection and nuclei, which perpetuate with public spitting, if patients are not aware about proper disposal of sputum, as in present study (Khaliq, 2015; Ramakrishnan, 2016). This becomes more important when other factors favouring the spread of TB, such as large family size, as in present study with a median of five members, low socioeconomic status and low levels of literacy coexist (Millet *et al.*, 2013; Narasimhan *et al.*, 2013; Park, 2016;).

Certain misconceptions related to isolation of the patients and keeping separate utensils existed. These need to be taken care of by health education as they may promulgate stigma. Strangely, more males as compared to females had myths about isolation which has public health implications as the males generally meet more people as compared to females due to their nature of work outside homes. The misconceptions may therefore propagate in the society faster. These misconceptions therefore need to be addressed accordingly at the health facility levels. A similar study in Thailand also reported low TB knowledge, and low HIV knowledge, which was lower than the present study (Jittimanee *et al.,* 2009). Overall, the knowledge about preventive methods were comparable to that of other studies conducted among TB patients (Hoa *et al.,* 2004; Seyoum *et al.*, 2013).

The status of knowledge about modes of transmission of HIV was poorer than that of TB, with the situation being grimmer among female patients. Ignorance about various established modes of transmission of HIV, as reported in the present study may lead to increased risk of transmission of infection in the community, given the increased chances of contracting HIV infection in a TB patient (Mayaud & Mabey, 2004). Ignorance about the modes which do not lead to transmission such as eating food in same utensil and shaking hands may perpetuate stigma against HIV infected people. Others misconceptions such as contracting infection from a mosquito bite may lead to undue apprehensiveness and concerns. A study in China has shown association between misconceptions about HIV transmission and discriminatory attitudes (Qian *et al.*, 2007). In the present study also, it was observed that about 41% of patients were ambiguous about whether it is shameful to be diagnosed with HIV or should a person be isolated after being HIV positive, which is a reflection of their ignorance about various aspects of HIV.

Knowledge about other aspects of HIV such as the window period, effect of infection, availability of treatment and related information was also lacking among the patients. It was also very disheartening to notice that knowledge about TB-HIV co-infection, to which the patients are at risk, was even more compromised. Similar findings have been reported in another study among TB patients

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in Peru, which reported overall mean level of knowledge of HIV as slightly higher but the specific mean level of knowledge on HIV transmission and prevention low (Ugarte *et al.*, 2013). It has also been reported that lack of knowledge, poor access and fear may constitute important barriers to HIV testing (Downing *et al.*, 2001; Kellerman *et al.*, 2002; Lee *et al.*, 2005).

The background characteristics of the respondents participating in the present study, which may supplement the translation of ignorance to increased risk of TB-HIV co-infection, include higher proportions of young, illiterate/ less educated patients and their spouses, low socioeconomic status, unemployment and large family size and category 2 of DOTS treatment. A few of them have been reported in other studies as well (Carvalho *et al.*, 2008; Jain *et al.*, 2000). Age and level of education were found to be correlated with overall level of knowledge in the multivariate model in the study done in Peru also (Ugarte *et al.*, 2013). Keeping these observations in mind, it becomes imperative that patient's knowledge about the various aspects of HIV and TB-HIV co-infection should be upgraded, more so in those with high risk of infections. It is important to realize that ignorance about TB, HIV and TB-HIV co-infection was observed among patients even after they have been meeting the health care staff regularly. It has been reported that regular contact with patients who are at a high risk of HIV provides a golden opportunity for health education and intervention (Narain & Ying, 2004). Inability to use this point of contact to educate the patients regarding the various aspects of HIV infections is a lost opportunity, which needs to be addressed timely. While doing this, gender differences observed in terms of knowledge have to be taken into consideration with more intensive and dedicated efforts.

An important limitation as reported in other similar studies is a lack of standard questionnaire to assess knowledge about TB, HIV or TB-HIV co-infection, which makes comparison across studies difficult. Another limitation is that the present study was conducted in selected DMCs only and therefore might be limited in terms of generalizability of results to all the health facilities, where the situation may be different despite the fact that we had tried to take a representative sample of health facilities by multistage stratified random sampling. Yet another limitation is that, since it was a health facility based study, we could not explore all the aspects of TB, HIV and TB-HIV co-infection due to paucity of time.

In conclusion, the present study brings forth important findings related to lack of knowledge about TB, HIV and TB-HIV co-infection among TB patients even after 30 years of start of National AIDS control programme in 1987 and the start of TB HIV collaborative activities since 2009, in India. It is therefore important that programme managers and health staff realize the importance of knowledge in preventing transmission of diseases and preventing discrimination. The health programmes and staff both need to put due emphasis on improving the knowledge of people and more specifically those at risk, i.e. the patients suffering with TB.

Conflict of Interest

None

Acknowledgements

The authors are thankful to the Head of the Department of Community & Family Medicine, Dean and Director of AIIMS, Rishikesh for supporting and funding the project. We are also thankful to the field investigator, Mr. Tarun Barthwal for collecting the data and the patients for actively participating in the same.

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