Original Article

Screening of Non-Communicable Diseases and their Risk Factors among Tuberculosis Patients in Delhi: A Mix Method Study

Gurmeet Kaur, Kritika*, Vivek K. Thakur

Department of Community Medicine, Army College of Medical Sciences, New Delhi, Delhi, India.

Abstract

Background: India has the highest burden of tuberculosis in the world. It is experiencing an increasing burden of non-communicable diseases, thereby facing a dual disease burden. Recent evidence shows an association between TB and non-communicable diseases like diabetes, CVD and chronic respiratory infections.

Aims and Objectives: To assess the feasibility of screening for NCDs and risk factors for NCDs among patients with TB in DOTS centers of a medical college in Delhi and ascertain challenges for the same among providers and patients.

Methodology: It was a mixed-methods study with a quantitative component (cross-sectional study using questionnaires, anthropometric measurements and records review) and a qualitative component (descriptive study using interview data).

Results: Among the 139 patients screened, ten new cases of hypertension and six new patients were diagnosed with DM. Out-of-pocket expenditure for tests was a concern of the patients. Health care providers found the screening tool easy to use but were apprehensive about increased workload

Conclusion: The study provides useful visions for incorporating NCDs into routine TB care through DOTS centers under RNTCP/NTEP.

Keywords: Diabetes, DOTS Centre, Hypertension, National Tuberculosis Elimination Program (NTEP), Pulmonary TB.

Introduction

The burden of Non-Communicable diseases (NCDs) is mounting inexplicably in lower-and middle-income countries.[1] Every year around 5.8 million Indians expire from NCDs.[2] Moreover, India carries the highest burden of Tuberculosis (TB) globally. It reports 23% of the world's incident cases of TB and 21% of the world's deaths from TB. [3]

Though it has been known that tuberculosis is a disease of poor, non–communicable diseases mainly affect the rich and are prevalent mostly in urban areas. However, with the changing Indian society, including people's lifestyle and dietary habits, there has been an epidemiological shift and transition in the burden of NCDs. The dual burden of diseases exhibits through the vulnerability of those with NCDs to TB and from the negative effect of NCDs on treatment outcomes for TB.[4] Recent evidence suggests an association between TB and NCDs like diabetes mellitus (DM), cardiovascular disease (CVD), lung cancer and chronic respiratory infections.[5,6] Moreover, TB and most NCDs stake many risk factors such as smoking, unhealthy diet and abuse of alcohol. These risk factors need to be focused for effective prevention.[4]

The Global action plan for prevention and control of NCDs 2013- 2020, has documented strong interaction between NCDs and infectious diseases, including TB and the resulting need to explore common manifestos and methods to maximize the detection and treatment of comorbidities.[4,7] This collaboration and the need for unified, patient-centered

Address for correspondence: Kritika,
Department of Community Medicine, Army College of Medical Sciences, New Delhi, Delhi, India.
E-mail: kritika.nik@gmail.com

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care, support and prevention are the key components of the World Health Organization (WHO) End TB Strategy, that have been recognized by all the WHO Member States in 2014.[8]

Twin screening for TB and DM has been already executed in india under the revised national tuberculosis elimination programme (NTEP) and the national program for prevention and control of cancer, diabetes, cardiovascular diseases and stroke (NPCDCS).[10] NPCDCS also recommends opportunistic screening for other NCDs and their risk factors at every health facility in the country.[9] There is substantiation which suggests that screening of TB patients for diabetes mellitus is possible at the peripheral level.[11] However, till date, inadequate programmatic data is available on the execution and feasibility of screening of other NCDs and their risk factors at the level of DOTS center. Further, more research is required to explore the acceptability and relevance of such screening programs both by the providers and patient's perspective.

Aim and Objective

To assess the screening of NCDs and risk factors for NCDs in a two-stage procedure among TB patients aged ≥20 years and treated in DOTS (directly observed treatment, short course).

Methodology

This study was a mixed methodology, triangulation study. It is comprised of a quantitative component and a qualitative component. The quantitative component of this study followed a cross-sectional study design. This component was conducted using questionnaires, anthropometric measurements and a review of records. The qualitative component of this study was conducted following a descriptive study design using interview data (Figure 1). This study was conducted in the DOTS centre attached to a medical college.

All TB patients aged >20 years treated in DOTS centre of the medical college were included in the quantitative component. All health care providers involved in the screening were interviewed for the qualitative component. All patients in categories 1, 2 and 4 registered under DOTS and patients less than 20 years of age were excluded. The study was conducted after getting permission and being cleared by the institutional ethics committee. For the quantitative section, a two-stage procedure was followed. After explaining the purpose of study and taking informed consent, in the first stage, all the eligible patients were screened using a questionnaire-based screening tool for NCDs and their risk factors by the researcher and DOTS provider. The questionnaire-based screening tool is developed from the WHO STEPS instrument and findings from the earlier conducted Indian Council of Medical Research (ICMR, New Delhi) multi-center risk factor survey.[15, 16] The questionnaire was previously used in pilot study in the Ballabgarh block of Haryana by Amarchand et al.[17] In the

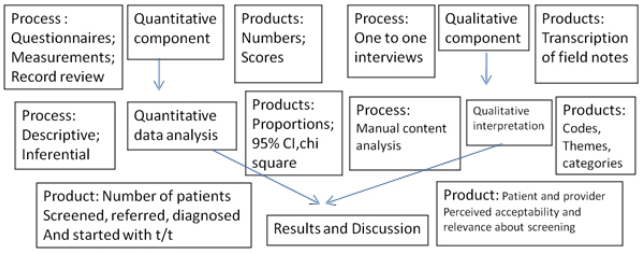

Figure 1: Visual description of study design

first stage, ten questions related to age, smoking, alcohol consumption, tobacco (smokeless form), fruit intake, vegetable intake, physical activity, waist circumference and family history of NCDs were evaluated. Those who scored more than eight in the first part out of 20 were asked questions in the second stage. In the second stage, measurements of blood pressure, height and weight (for Body Mass Index) were taken using validated techniques.

Those who scored more than 12 in both the parts were referred to NCD clinic for further management. Additionally, the blood sugar levels of each patient were obtained from the existing records. The records of the NCD clinic were reviewed to extract information regarding the confirmation of the diagnosis of hypertension and DM amongst the patients referred to NCD clinic. The patients' socio-demographic profile and TB treatment information from their treatment records was also ascertained. (Figure 2)

For the qualitative component, perceived relevance and acceptability of the screening programme among TB patients was explored through one-to-one interview with patients and DOTS provider. An interview guide with broad open-ended questions was used. Field notes from observations during data collection were made and interviews with the patients were conducted immediately after the screening procedure, while interviews with DOTS provider were collected after the quantitative data was obtained. A total of 15 one-to-one interviews were conducted (ten with patients and five with health providers). While the participants shared their experiences of undergoing an assimilated screening process, health providers discussed various affluence and challenges in the implementation of screening. The average duration of interview was 30 minutes.

Analysis

Data collected were entered in SPSS version 21 and were checked for entry errors. Descriptive statistics and central measures of statistics were used to define the data set. The chi-square test/ Fischer exact test was used to analyze the difference between the proportions of people who were diagnosed with NCDs, NCDs risk factors with socio-demographic and TB-related clinical factors. *p-value* less than 0.05 was used to determine the significance in the study. Patients' narratives in in-depth interviews were coded, labeled and analyzed.

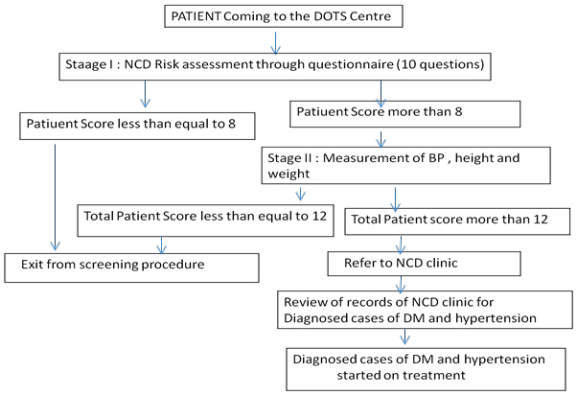

Figure 2: Summary of Study Procedure

Results

The patients' mean age and standard deviation (SD) was 34 ±13 years. There were 55% male participants. The majority of the participants were newly diagnosed patients (63%) with pulmonary TB (61%) (Table 1). There were four patients who were HIV positive also. Amongst the participants, 11 and 6 patients were already suffering from diabetes and hypertension, respectively.

Nearly One-third of the participants were either smokers (37%) or were using smokeless tobacco (30%) or were consuming alcohol (28%). Only 26% (n=36) were consuming the recommended amounts of fruit servings. The majority of patients with TB (81%) were physically inactive. There were 25 patients (18%) who were obese (Table 2).

As depicted in (Figure 3), of the 139 participants, 78% (n=108) had a score >8 and were enrolled in the stage-II of the screening. Among them, 33% (n=36) were referred to NCD clinic. Out of the total who were referred, 89% (n=32) reached the NCD clinic. Ten new cases of hypertension and six new cases of diabetes were diagnosed by NCD clinic. 90% of the new cases of hypertension and 83% of newly diagnosed diabetics were started on treatment. The prevalence of hypertension among TB patients was found to be 12% and that for diabetes was 11%.

Age, male gender and pulmonary TB were found to be associated with the presence of NCDs ($p<0.05$). The increasing age was found to be significantly associated with NCDs. (Tables 3 and 4).

Qualitative

From the transcripts of in-depth interviews of patients with TB and directly observed treatment short course (DOTS) providers, 16 codes were identified. These codes were then grouped into four main themes: 1) Positive experiences 2) Negative experiences 3) Enabling Factors and 4) challenges in execution as perceived by health providers.

Positive experiences of TB patients

The screening process was considered suave by almost all the participants. 4 to 6 minutes was the waiting time. Patients commented that they could understand the questions very well. One patient commented, "many diseases are being checked at one place, it's very good and useful too". Another one said, "there is no harm if we are getting this service free of cost, it is actually satisfying". The effective communication skills and the positive outlook of staff involved were conveyed as important elements of the screening process. Interviewees found the screening contented and their privacy secure, except for one participant.

Table 1: Socio-demographic and clinical characteristics of TB patients aged[3] ≥ 20 years, Delhi, India

Variable	*Number (n)*	*(%)**
Age		
20-34 years	83	(60)
35-49 years	32	(23)
≥50yrs	24	(17)
Gender		
Male	76	(55)
Female	63	(45)
TB treatment category		
New cases	88	(63)
Retreatment cases	41	(30)
Multi-Drug Resistant cases	10	(7)
Type of TB		
Pulmonary	85	(61)
Extra-pulmonary	54	(39)

Negative experiences of TB patients

There were several disheartening factors that led to some negative experiences by patients. Waiting time and out-of-pocket expenditure for blood glucose testing arose as major issues. The cost of test from a private laboratory varies from Rs 20 to Rs 80." *It is not possible to go..... there are long queues..... I don't have time ...",* one participant stated. Some participants who were referred to NCD clinic cited

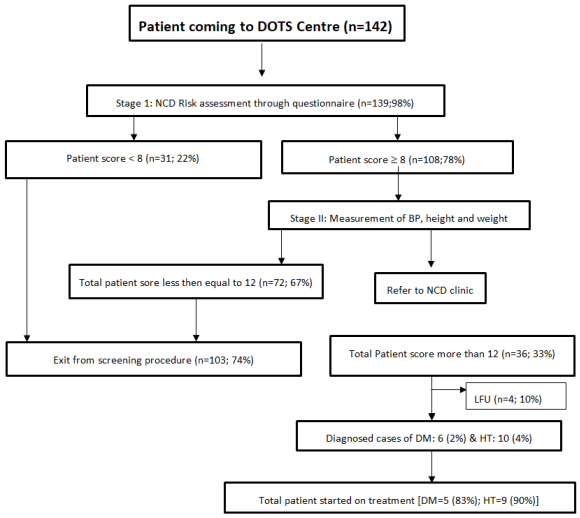

Figure 3: Flow of participants through the screening process

Table 2: NCD risk factors and NCDs detected among TB patients aged[3] ≥ 20 years, Delhi, India

NCD risk factors	*N*	*%**
Smoking Status		
Non-smokers	88	(63)
Ever-smoker/ smoke occasionally	23	(17)
Daily smoker	28	(20)
Consumption of smokeless tobacco		
Non-user	97	(70)
Ever user/ use occasionally	28	(20)
Daily user	14	(10)
Consumption of alcohol		
Non-user	100	(72)
Ever user/ use occasionally	32	(23)
Daily user	7	(5)
Fruit consumption		
5 days in a week	36	(26)
<5 days a week	103	(74)
Vegetable consumption		
>3 servings in a day	24	(17)
<3 servings in a day	115	(83)
Physical activity		
Moderate-vigorous PA for 10 mins/day	26	(19)
Moderate- vigorous PA for < 10 mins/day	113	(81)
Waist circumference		
Less than 72/78 cm	31	(22)
72-79/78/89 cm	83	(60)
>80/90 cm	25	(18)
New cases		
Diabetes Mellitus	6	(4)
Hypertension	10	(7)

long waiting time at the hospital as a constraining factor. Additionally, they had to have an out-patient (OPD) slip which meant waiting in another queue.

The overall reaction of the patients to disclosure of their high-risk status was that of concern and rejection. One of the patients voiced the extent of distress: "I don't know what to do now. First I got TB and diabetes at a young age and now I have high BP…it feels so horrible to me….I will have to take one more pill now. "Another one stated "*I don't agree with the lab report, my sugar level can't be so high as it has always been normal previously*". Notwithstanding the non-stigmatizing nature of NCDs, the need for counseling and patient support arose as an essential component of such a screening procedure.

Enabling Factors, according to health providers

Similarly to patients, health providers found the screening tool to be easy. Small waiting and screening time were described from both contributing health facilities. Health providers considered unified screening of NCDs pertinent in the present context. One of them pointed out "*,we were educated in our training that TB patients have higher risk of diabetes…By measuring BP, we may find TB patients at risk of high BP …Even if not, such screening will help in the earlier revelation of disease."* The strong support, direction and obligation they received from their departments were highly valued as enabling factors by the interviewees.

Table 3: Association between selected socio-demographic, clinical and NCD risk factors amongst TB patients aged[3] ≥ 20 years, Delhi, India

Socio-demographic, clinical variables	**NCD Risk Factors N (%)*	*NCD Risk Factors Present*	*NCD Risk Factors Absent*	*‡OR (§C.I.)*
Age				
20-34 years	57 (69)	57	26	3.1 (1.4-7.1)
35-49 years	28 (88)	28	04	
≥50yrs	23 (94)	23	1	
Gender				
Male	63 (83)	63	13	1.93 (0.8-4.3)
Female	45 (72)	45	18	
†TB treatment category				
New cases	69 (79)	69	19	0.5 (0.1-2.6)
Retreatment cases	34 (83)	34	07	
‖Multi-Drug Resistant cases	06 (64)	06	04	
Type of TB				
Pulmonary	64 (75)	64	21	0.6095(0.2-1.45)
Extra- pulmonary	45 (83)	45	09	
¶HIV Status				
Positive	04 (100)	04	0	
Negative	108 (80)	108	27	

*NCDs: Non-Communicable Diseases; †TB: Tuberculosis; ‡OR: Odds Ratio;
§C.I.: Confidence Interval; ‖MDR TB: Multi-drug Resistant Tuberculosis; ¶HIV: Human Immunodeficiency Virus

Challenges in execution, according to health providers

Participants had mixed feelings regarding the perceived workload after implementing the unified screening "... *with daily regime my work has increased.. ...An additional person should be nominated for this*" one of them remarked. Health providers also express their concern regarding the inadequacy of their knowledge and skills.

One of the health providers took a particular gender issue related to anthropometric measurements; "Since *I am male, I cannot take [waist circumference] measurements of females."* The unavailability of glucometers at the DOTS center was informed, because of which the patients got their blood sugar done from somewhere else. One health provider stated "*I do*

Table 4: Association between selected socio-demographic, clinical factors for NCDs amongst TB patients aged ≥ 20 years, Delhi, India

Socio- demographic, clinical variables	**NCD Present N*	*NCD Absent N*	*Total*	*NCD N (%)*	*‡OR (§C.I.)*
Age					
20-34 years	15	68	83	15 (18)	4.6 (2.3- 9.1)
35-49 years	8	24	32	8 (25)	
≥50yrs	10	14	24	10 (42)	
Gender					
Male	23	53	76	23 (30)	2.3 (0.9986-5.2977)
Female	10	53	63	10 (16)	
†TB treatment category					
New cases	22	66	88	22 (25)	1.1(0.6-1.8)
Retreatment cases	9	32	41	9 (22)	
‖Multi-Drug Resistant cases	2	8	10	2 (20)	
Type of TB					
Pulmonary	25	60	85	25 (29)	2.39 (0.98-5.79)
Extra- pulmonary	8	46	54	8 (15)	
¶HIV Status					
Positive	0	4	4	0(0)	1.9(0.2-14.6)
Negative	33	102	135	33(100)	

*NCDs: Non-Communicable Diseases; †TB: Tuberculosis; ‡OR: Odds Ratio;
§C.I.: Confidence Interval; ‖MDR TB: Multi-drug Resistant Tuberculosis; ¶ HIV: Human Immunodeficiency Virus

not think my center has fully functional equipment like BP apparatus, glucometer and measuring tape. For TB-DM screening, I ask patients to get their blood sugar test done from elsewhere. Almost all of them had to pay for these tests." This point appeared as the most negative experience from the patient's point of view. Health providers also pinned that unlike reporting of TB in the program, there is a lack of standardized reporting formats for DM services.

Discussion

The study provides supportive quantitative and qualitative evidence on the feasibility of incorporating screening for NCDs and its risk factors at the level of DOTS centre. This is encouraging in present, due to large dual burden of TB and NCDs in India.

The overall prevalence of diabetes in this TB group in Delhi was 12%, of whom 4% were newly diagnosed cases. This is much lower than reported by several studies from Southern India[18,19] However, findings by India Tuberculosis-Diabetes Study Group (ITDSG) in North India and a study in Bangalore displayed comparable prevalence [20,21] The lower prevalence of DM among TB patients testified could be due to lower mean age of population than other studies and due to heterogeneity of diabetes across geographic areas and ethnic groups.

While the prevalence of DM among TB patients is well recognized, there is very limited evidence available for the prevalence of hypertension among TB patients in India. [22] The prevalence of hypertension our study was 11%. According to the existing literature on the occurrence of hypertension amongst TB patients worldwide, the prevalence varies from 0 to 50%.[23] Therefore, more confirmations are required for valid conclusions. In any case, the profit of screening for hypertension in our patients was high. It provides reasonable evidence for incorporation of NCDs and TB program as evidenced in other parts of the country.[22]

This study also revealed the high prevalence of NCD risk factors like smoking, and consumption of smokeless tobacco and alcohol. The finding substantiates with studies done elsewhere in similar populations.[22,24,25] Low consumption of fruits and vegetables in our study population is troublesome, particularly when equated to general population. [26] The insufficient intake of fruits and vegetables poses risk factors for NCDs and is an important cause of clinical outcomes of TB.[27,28] Therefore, the finding needs to be addressed for optimal management of TB. Lastly, most of the study population was physically inactive. This suggests TB disturbs physical functioning along with many other proportions of life due to physical de-conditioning, muscle atrophy, and impaired lung function.[29,30] More than a fourth of TB patients in our study has central obesity which poses increased risk for diabetes.[31]

As anticipated, age and male sex were found significantly associated with NCDs and their risk factors in this study, which is consistent with evidence.[31]

Several propositions were given by health providers. Firstly, the screening for NCDs should be done at the level of the Tuberculosis unit. This will make the screening more standardized for early diagnosis. There is enough evidence for screening TB patients with DM.[21] Further, it will tackle

the shortage of staff, distributing workload and task shifting at this level. Secondly, training and re-training of staff would enhance the quality of services delivered. Lastly, they advocated for NCDs and NCD risk factors in existent TB reporting formats. This would enable better scrutinizing of such services.

Conclusion

This mixed methodology study provides useful visions into incorporating NCDs into routine TB care through DOTS centers under National Tuberculosis Elimination Program (NTEP).

Recommendation

A large-scale and multicentric studies (both quantitative and qualitative) are recommended to test the feasibility of NCD screening at DOTS centers among TB patients.

Limitation of the study

It is a small-scale study with a limited sample size.

Relevance of the study

The article highlights the importance of screening for NCDs among tuberculosis patients. NCDs are an important emerging health problem and their co-occurrence with communicable diseases is a challenge to reckon with in low- and middle-income countries. This study used a mixed-methods approach to determine the feasibility of screening for NCDs among Tuberculosis patients.

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Ethical Approval

Ethical approval of this study was obtained IEC of Army College of Medical Sciences, New Delhi. Ref No. IEC/ BHDC/37 of 2019 dated 07-05-2019.

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Conflicts of Interest

Nil

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