



Effect of a Comprehensive Training Programme for Tuberculosis Health Care Providers and Tuberculosis Patients on Diabetes – A Report from South India

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Authors' contributions

This work was carried out in collaboration between all authors. Author VV designed the study and performed review of the manuscript. Author AV designed the protocol, performed analyses, managed the literature searches and wrote the first draft of the manuscript; author K. Satyavani interpreted the results of the study and reviewed the manuscript. Author K. Selvan performed the statistical analysis. Author RR designed the study and author AK managed the discussion section and reviewed the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Aims: High prevalence of diabetes mellitus (DM) in TB patients demands that TB health care providers are sensitized and updated on risk factors, screening, diagnosis and management of DM. This study was designed to assess the impact of one day training programme on screening, detection and management of DM.

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Study Design: One group – pre and post test design.

Place and Duration of Study: The one day training session with an inbuilt awareness programme was conducted for TB health care providers and TB patients with diabetes, over a period of 3 years, from since November 2010 involving 22 tuberculosis units of 3 districts in Tamil Nadu, India.

Methodology: The impact was assessed using a pretested questionnaire pre and post training, based on the improvement in knowledge among physicians and other health care providers and awareness among patients. Similarly, using a separate questionnaire before and six months after the training programme, improvement in practice was assessed based on an increase in the proportion of staff involved in screening, educating and referring TB patients with diabetes. Appropriate statistical analysis was done using SPSS version 16.

Results: There was a significant increase in the knowledge of physicians and other health care providers and in patient's awareness on all components covered under the training and awareness session respectively. No significant improvement was noted in the knowledge of other TB health care providers, in diet category on the questionnaire. There was a significant improvement in practice based on the substantial increase in the proportion of tuberculosis unit staff conducting DM screening for TB patients using appropriate methods and in referrals for proper management of DM.

Conclusion: The training session on DM with an inbuilt awareness campaign for TB patients had a significant impact on the knowledge and practice of TB health care providers.

Keywords: TB patients; diabetes mellitus; South India; training session; health care providers.

1. INTRODUCTION

India records the highest number of new tuberculosis (TB) patients in the world and is listed as one of the high TB burden countries [1]. Diabetes mellitus (DM) is a major global health problem [2] and India has the second highest number of DM patients. Increasing prevalence of DM in high TB burden countries influences the burden and control of TB too [3]. There is strong evidence for the association between TB and DM and also that this association results in poor outcomes. Undiagnosed, inadequately treated and poorly controlled diabetes mellitus is a much bigger threat to TB prevention and control in high TB burden countries than previously realized [4]. DM accounted for 14.8% of pulmonary TB and 20.2% of smear positive (i.e. infectious form) TB disease in India in 2000 as reported by Stevenson et al. [5]. Several recent studies conducted in various parts of India show a much higher prevalence of DM among TB subjects [6-8].

The biological plausibility behind this relationship could be explained as the impairment in the immune system due to diabetes as that of which observed in HIV [9]. DM increases the risk for TB and also found to be responsible for poor treatment outcome of TB [10,11]. It becomes necessary to reveal the undiagnosed diabetes and also to control diabetes among TB patients, especially in a country like India, which has a

high prevalence of both diseases [12]. World Health Organization and the International Union Against Tuberculosis and Lung Diseases (IUATLD) have developed and adapted a Collaborative Framework for Care and Control of Tuberculosis and Diabetes [13]. It is hoped that this should prompt the health ministers to ensure that all levels of the health workforce, including ancillary health workers, are trained to screen for the two diseases and that basic diagnostic and therapeutic facility are available to manage both diseases [14].

Earlier reports from South India provide evidence that the training programmes for prevention and management of DM are useful in improving knowledge and practice of primary care physicians [15,16]. A recent study to detect DM in TB patients in 56 Directly Observed Therapy (DOT) centers in Lagos Nigeria concluded that TB health workers in those TB facilities had inadequate knowledge about diagnosis and non-pharmacological management of DM [17].

In light of the above, there is a need to sensitize the TB health care providers on this dual burden [14]. A project was initiated by Prof M. Viswanathan Diabetes Research Centre, a World Health Organization collaborating centre for research, education and training in Diabetes in India, in the state of Tamil Nadu in 2010 to sensitize the TB health care providers on this dual burden. The objectives of this project were

to build the capacity of 1000 doctors treating TB patients for the diagnosis, prevention and management of DM; to increase the knowledge and skill of 300 paramedical staffs and 350 health workers about screening and detection of DM; and to create awareness and need for DM screening and optimal care among 2510 TB patients in the primary health care setting in three districts of Tamil Nadu, India.

2. METHODOLOGY

The training project was started in 2010 and it was conducted for the health care providers of the TB units in three districts viz., Thiruvallur, Kanchipuram and Chennai – in the state of Tamil Nadu [5]. An expert advisory committee consisting of representatives from the South Asia office of IUATLD-New Delhi; Revised National Tuberculosis Control Programme (RNTCP); National Institute of Tuberculosis Research (NIRT); Tamil Nadu State Government, i.e., Department of Public Health, Director of Medical Service, State Tuberculosis officer (STO), concerned district tuberculosis officers (DTO); and the Health Department, Chennai Corporation was set up to accomplish this training task. Recognized local Non-Governmental Organizations in selected districts gave voluntary support for identifying and mobilizing TB patients.

2.1 Strategies Followed in Conducting Training Programme

The project leader communicated with the Department of Public Health and Chennai Corporation to obtain approval for conducting the training programme. A multi-specialty training facility was set up to design the conceptual framework for the training. It consisted of experts

in different fields such as epidemiology of the dual burden of TB and DM; screening and diagnosis of DM; dietary management; self-monitoring and management of DM and its complications in patients with coexistent TB. Training manuals and materials on the above aspects were developed based on different categories of trainees (physicians, other health care providers and patients) and content validated by experts and approved by the institutional training committee. The faculties involved in the preparation of training material conducted the appropriate sessions of the training programme. The duration of the entire training programme was one day with various sessions as shown in Table 1. The session topics are designed in an attempt to create awareness of the burden of diabetes among TB patients and the importance of early detection, monitoring of Diabetes and its management among the TB patients and also to impart the importance of diet and lifestyle modification.

The programme was conducted once in a week and the maximum number of participants was restricted to 30 in each programme. Contents of education materials for patients, which included, educational posters, manuals, flip charts, pamphlets in English and Tamil (regional language) was done by experts. A social scientist packaged them with an interesting narrative to reach the TB patients from different socioeconomic strata. To facilitate outreach activities a mobile van was procured and equipped with Television and Digital Versatile Disc player for showcasing a short video film about the impact of the dual burden of TB and DM at the individual level.

Table 1. Capacity building for tuberculosis health care providers on diagnosis, prevention and management of diabetes – the various topics covered in one day training programme

S. no.	Topic	Duration
1	Introduction to the Training programme	15 minutes
2	Burden of Diabetes among TB patients and Strategies for early detection and monitoring of Diabetes among the TB patients	45 minutes
3	Diagnosis of Diabetes in TB Patients	45 minutes
4	Overview of DM and management of DM in TB patients	60 minutes
	LUNCH BREAK	30 minutes
5	Diet and Lifestyle modification	30 minutes
6	Demonstration of Self Monitoring of Blood Glucose and administration of various Insulin injections	30 minutes

2.2 Strategies Followed for Identifying the Potential Trainee in the Health Sector

To identify potential trainees, details such as the name of the center, location of TB unit/ DOTS center in the selected districts were collected from the state tuberculosis officer (STO) and the concerned district tuberculosis officer (DTO) was approached to find out the total number of Senior Treatment Supervisors (STS), (STLS) or Tuberculosis Home Visitor (TB-HV) and medical officers in each unit of the selected districts. The DTOs directly issued the circular directing all TB health care providers to attend the training programme without affecting their routine activities. The TB health care provider in each TB unit who took care of the routine activities were given priority for the next training programme and close to 99.6 % participation was achieved. One day training programme was arranged in the research centre for the physicians and the other staff respectively, over a period of three years to achieve the required target.

2.3 Strategies for Awareness Creation and Conducting Screening for Diabetes among TB Patients

The average number of new patients (TB patients, those who enrolled in TB units for DOTS) registered in a month and the average number of review patients visiting the center per day was collected. A handout, having all the instructions and details of the screening tests to be performed was prepared in the vernacular language. STS, STLS, or TB-HV gave these handouts to new and review TB patients visiting the selected centers and they were explained in-person. Patients who were not previously diagnosed with diabetes were instructed to visit the DOT centers in the fasting state (overnight fast of 8-10 hrs) and an oral glucose tolerance test (OGTT) was performed. For subjects with a previous diagnosis of diabetes fasting and postprandial blood glucose estimations were done. All beneficiaries were shown audio visual education material about DM and TB and provided an opportunity to interact with well trained and experienced multidisciplinary team during their wait while undergoing blood glucose tests. The multidisciplinary field team consisted of dietitians and social workers; and helped create awareness among TB patients, about the common signs and symptoms of diabetes and its complications and the importance of proper diabetes management in TB control and vice

versa. The screening programme covered 2510 TB patients and identified 256 (10.2%) subjects with undiagnosed diabetes.

A total of 1000 doctors, and 666 health care providers (310 paramedical staffs and 356 Health workers) were sensitized on the double burden of TB and DM, and trained in recent aspects of prevention, screening, diagnosis, and management of diabetes and its complications.

2.4 Assessment of Knowledge and Practice

In order to assess the knowledge and practice, one group pretest and posttest study design was used. A set of three different pretested questionnaires to test knowledge and understanding of various aspects of diabetes and its interaction with TB covered in the training module was developed to assess improvements in knowledge before and after the training programme. Five people from each category were asked to respond to the knowledge questionnaire and they were informed to list any difficulties in understanding the questionnaire. After incorporating their comments and addressing the issues, the questionnaire was pre tested in 10 subjects in all the three categories. A reliability test was done and the estimated Cronbach alpha of the knowledge questionnaire for physicians was 0.73 and that of health care providers and patients were 0.87 and 0.81 respectively. These separate questionnaires were self administered to physicians and other health care providers whereas two trained medical, social workers administered the questionnaires to patients, who gave written consent for their participation in this evaluation. A total of 100 patients completed the pre and post training assessment successfully. On an average, 15 minutes were taken to complete the questionnaire. All are closed ended questions with multiple options and the right response to each question carried 10 marks. No score was given for negative response. The pre and post training scores were compared to assess change.

A questionnaire was developed to ascertain if the training impacted practice in terms of the number of trained personnel advising TB patients to undergo diabetes screening, improvement in the methods adapted for diabetes screening and the proportion of TB health care providers involved in the process of referring the patients for DM management. Each medical officer in the TB unit

was provided with these questions before sending their staff to the training and six months after the training programme. Based on the responses from the medical officers, the improvement in the above indicators was considered to be the impact of the training programme at the practice level.

2.5 Ethics Statement

Ethics Committee of Prof. M. Viswanathan Diabetes Research Centre approved the study and written consent was obtained from the participants of the training programme and from the TB patients who cooperated with this evaluation programme.

2.6 Statistical Analysis

Pre and post test comparisons were done using paired "t" test for continuous data and chi square test was done to compare the categorical data and a p-value of <0.05 was considered to be statistically significant. Statistical software SPSS version 16 was used for doing the statistical analysis.

3. RESULTS

Out of 1000 doctors, 666 health care providers and 2510 patients, a total of 576 doctors, 177 health care providers and 100 patients who completed both pre and post test were participated in the knowledge evaluation process. The level of practice was assessed in 22 tuberculosis units of the 3 districts.

3.1 Improvement in Knowledge

The mean scores after the training programme were significantly higher than the pre training scores of all the subjects in all the categories viz. physicians, other health care providers and patients. The total score allotted for each domain in the questionnaire and the proportion of subjects with different scores for each domain before and after the training programme among the physicians are shown in Table 2. The mean post training scores of physicians were significantly higher than that of the pre training scores (93.1±23.8 vs. 177.7±28.2; p<0.001).

There was a significant increase in the proportion of health care providers with maximum scores on diagnosis and management of DM after the training programme as depicted in Table 3. Although there was an increase in the number of

subjects with higher scores for questions related to dietary session of training programme, the difference was not statistically significant. The overall mean scores of the health care providers before and after the training programme were 43.8±16.6 and 53.1±14.6 respectively.

The mean score of patients before the training programme was 34±21.4 and increased significantly after training as 68.3±12.3. Table 4 shows the proportion of the patients with maximum and minimum scores in each domain. There was significant improvement in the awareness levels of patients after exposure to a short video film followed by an interactive session.

3.2 Improvement in Practice

The change of practice in TB units regarding screening and referral of TB patients for diabetes care, six months after exposure to training is shown in Table 5.

Nearly 97% of the trained staff started screening, TB patients for diabetes after the training programme, whereas it was only 36.6% prior to the training session. The proportion of TB units collecting venous blood samples for glucose estimation, increased from 53.7% to 77.5%. After the training programme, almost all the TB units started screening, TB patients for diabetes- 77.5% using venous blood and the remaining 22.5%, i.e. 15% and 7.5% using capillary blood samples or at least urine glucose estimation respectively.

Overall, there was improvement in the proportion of staff involved in educating TB patients, about symptoms, complications of DM, and on dietary and lifestyle modification required to control or prevent DM. Around 85% of the trained people advised the TBDM patients on technique of insulin administration and about the benefits of self-monitoring of blood glucose.

Nearly 98% of the staff in TB units referred the TBDM patients to physicians in the nearest diabetes clinics/hospitals of Govt. healthcare system for the further management of diabetes.

Table 2. Improvements in the knowledge of physicians after the training programme – pre and post assessment

Scores obtained for each category in the questionnaire	Pre test score N:576 (M:F 324:252)	Post test score N:576 (M:F 324:252)	P value
Diagnosis of DM and its complications (Total Score-80) *			<0.001 ^ψ
0	2(0.3)	2(0.3)	
10	8(1.4)	8(1.4)	
20	40(6.9)	14(2.4)	
30	92(16)	32(5.6)	
40	172(29.9)	94(16.3)	
50	115(20)	154(26.7)	
60	97(16.8)	174(30.2)	
70	46(8)	80(13.9)	
80	4(0.7)	18(3.1)	
Awareness on diet (Total score-10)*			<0.001 ^ψ
0	219(38.0)	109(18.9)	
10	357(62.0)	467(81.1)	
Double burden of TB and DM (Total score-30)*			<0.001 ^ψ
0	65(11.3)	4(0.7)	
10	294(51.0)	69(12)	
20	199(34.5)	305(53.0)	
30	18(3.1)	198(34.4)	
Management of DM (Total score-80)*			<0.001 ^ψ
0	29(5.0)	7(1.2)	
10	36(6.3)	27(4.7)	
20	65(11.3)	85(14.8)	
30	253(43.9)	159(27.6)	
40	191(33.2)	195(33.9)	
50	2(0.3)	88(2.6)	
60	29(5.0)	15(2.6)	
70	36(6.3)	7(1.2)	
80	65(11.3)	27(4.7)	
Average score (Mean±SD) (Max score 200)	93.1±23.8	177.7±28.2	<0.001 [#]

[#]P values are obtained using Paired t test. ^ψ P values are obtained using Chi Square test. *Values are n (%)

4. DISCUSSION

To the best of our knowledge, this is the first report from South India on evaluation of a training programme specifically directed at TB health care providers on diabetes screening, diagnosis and management. The training programme evaluated the knowledge and expertise of TB health care providers before and after the training programme. The post training evaluation revealed an initial gross inadequacy in

the knowledge and awareness of DM among TB health care providers and patients respectively. Our study shows that even a simple one day training programme on DM for doctors and other health care providers involved in TB care leads to significant increase in knowledge and practice towards screening and management of co-morbid DM. This also contributed to increased awareness of DM among TB patients, thereby facilitating compliance to screening and care for DM when found positive.

Training programmes for DM directed at the primary care physicians have been found to be useful and beneficial in developing countries like India [15,16]. A considerable proportion of TB health care providers, particularly physicians had adequate knowledge about the double burden of TB and DM before the training programme as also reported from Nigeria [17] and South Africa [18]. Despite this routine screening for DM among TB patients has been hitherto uncommon, may be due to lack of resources.

Table 3. The pre and post training scores of other health care providers in different domains of the training module

Scores obtained for each category in the questionnaire	Pre test score N=177 (M:F 34:143)	Post test score N=177 (M:F 34:143)	P value
Diagnosis of DM and awareness of double burden of DM & TB (Total score-60)*			
0	3(1.7)	-	<0.001 ^ψ
10	23(13)	6(3.4)	
20	41(23.2)	26(14.7)	
30	38(21.5)	53(29.9)	
40	47(26.6)	49(27.7)	
50	22(12.4)	36(20.3)	
60	3(1.7)	7(4.0)	
Awareness on Diet (Total score-20)*			
0	32(18.1)	24(13.6)	0.366 ^ψ
10	91(51.4)	89(50.3)	
20	54(30.5)	64(36.2)	
Awareness on management of DM (Total score-10)*			
0	134(75.7)	89(50.3)	<0.001 ^ψ
10	43(24.3)	88(49.7)	
Average score (Mean±SD) (Max score – 90)	43.8±16.6	53.1±14.6	<0.001[#]

[#]P values are obtained using Paired t test. ^ψ P values are obtained using Chi Square test. *Values are n (%)

Table 4. Assessment of improvement in the awareness level on diabetes in patients with diabetes and TB

Scores obtained for each category in the questionnaire	Pre test score N=100 (M:F73:27)	Post test score N=100 (M:F73:27)	P value [#]
Knowledge on diagnosis of DM (Total score-50)*			
0	12(12)	-	<0.001 ^ψ
10	28(28)	-	
20	21(21)	2(2)	
30	17(17)	18(18)	
40	13(13)	28(28)	
50	49(49)	52(52)	
Awareness on Diet (Total score-10)*			
0	51(51)	17(17)	<0.001 ^ψ
10	49(49)	83(83)	
Awareness on double burden of TB and DM (Total score-10)*			
0	63(63)	8(8)	<0.001 ^ψ
10	37(37)	92(92)	
Awareness on management of DM (Total score-10)*			
0	64(64)	22(22)	<0.001 ^ψ
10	36(36)	78(78)	
Average score (Mean±SD) (Max score 80)	34±21.4	68.3±12.3	<0.001[#]

[#]P values are obtained using Paired t test. ^ψ P values are obtained using Chi Square test. *Values are n (%)

Table 5. Comparison of the changes in the practice in tuberculosis units (TUs) before and after the training programme

Characteristics	Before training number of TUs-22 N=147	After training number of TUs-22 N=147	P value
Proportion of staff advised diabetes screening in TB patients	54 (36.7)	142 (96.6)	<0.001
Screening for Diabetes using			
Venous-blood sample	79 (53.7)	114 (77.5)	<0.001
Capillary-blood	57 (38.8)	22(15)	<0.001
Urine-sample	9 (6.1)	11(7.5)	0.817
None	2 (1.4)	-	-
Educating the patients on			
Symptoms of DM	69 (46.9)	146(99.3)	<0.001
Complications of DM	54 (36.7)	146(99.3)	<0.001
Diet	76 (51.7)	146(99.3)	<0.001
Lifestyle modification	36 (24.5)	144(98)	<0.001
Insulin administration	33 (22.4)	125(85)	<0.001
Self monitoring blood glucose	27 (18.4)	118(80.3)	<0.001
Proportion of staff in TUs referring TBDM patients to Physicians for diabetes care	85 (57.8)	114(98)	<0.001

P values are obtained using Chi Square test. Values are n (%)

A study conducted in South India showed that counseling DM patients have a positive impact on glycemic control by improving compliance to drug, diet and physical activity [19]. While such programmes are feasible in tertiary care settings for management of diabetes, it may be difficult to implement them in the primary care setting. However, given the situation of the double burden of DM and TB, it is imperative that the TB health care providers are trained not only to manage co-morbid DM and TB but are also trained and equipped to counsel patients appropriately. The current study shows that a training programme for the health care providers of the concerned tuberculosis units proved to be successful and was also able to raise awareness on DM among TB patients.

Although, there was a significant increase in knowledge of all components of the training among the different groups viz., physicians, patients and other health care providers, improvement in knowledge in the dietary domain among other health care providers was not statistically significant. This could be attributed to the complexity of dietary advice for DM in TB patients. While most patients with DM (type 2) are likely to be overweight and require calorie restriction patients with TB are advised high protein high energy diets for encouraging weight gain. Non availability of guidelines for the dietary

management of patients with both DM and TB and the need for more individualized rather than broad inclusion and exclusion of food groups, in this condition is an important issue that needs to be addressed and suggests the need for further studies among patients with co-morbid DM and TB to develop evidence based practice.

The Revised National Tuberculosis Control Programme (RNTCP) data base on treatment outcome of patients, who participated in the awareness programme, was collected irrespective of their DM status. The analysis showed that there were no treatment defaulters among those with TB and DM [11]. This is an indicator of the positive impact of the awareness session. The change in the methods adopted for DM diagnosis before and after the training programme as well as the practice of patient education and referral indicates an improvement in practice even within the minimum resource settings.

In this study, a major limitation is a smaller sample size taken for the assessment process and we did not have control group to compare the performances of health care providers and physicians trained under this programme. However, the pre and post comparisons of the beneficiaries' knowledge and practice showed the positive impact of the programme.

5. CONCLUSION

In conclusion, a short training course tailored to the needs of different health care professionals in tuberculosis units with an inbuilt awareness session for patients of the concerned tuberculosis units not only empowered them with knowledge, but also improved their attitude and practice, thereby creating an environment for better TB DM outcomes. Evaluation of such training programmes has to be done in future, to compare the treatment outcomes of TB patients managed in TB units with staff trained under this programme with those TB units not trained under this programme. Similar training and awareness programmes need to be implemented and evaluated to create an evidence base to inform policy and develop guidelines for collaborative action to deal with the burgeoning double burden of TB and DM particularly in the developing world.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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