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Assessing Knowledge Gains Following a Short Educational Intervention in Adult TB Suspects and Their Relatives: A Prospective Pre-Test/Post-Test Study

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ABSTRACT

Background. Tuberculosis remains a major global health problem. In 2023, WHO estimated 10.8 million new cases and 1.25 million deaths worldwide. India contributes about 26 % of these cases. **Objective.** To measure immediate changes in TB-related knowledge among adult clinically suspected TB patients and their accompanying relatives following a structured educational session in a TB outpatient department. **Methods.** In this prospective pre-test/post-test study, 500 adults (58 suspected patients, 442 relatives) aged $\geq$ 18 years completed a 15-item questionnaire covering disease/symptoms, laboratory diagnosis, transmission and treatment/prevention. Immediately after the pre-test, participants attended an interactive session in groups of $\leq$ 25, using visual aids, video and printed leaflets. The identical questionnaire was re-administered post-session. Composite scores (0–15) were compared by paired t-test and the proportion with "adequate knowledge" ($\geq$ 75 % correct) in each domain was compared by McNemar test. Significance was set at $p < 0.05$. **Results.** Mean age was 42.7 $\pm$ 14.8 years; 51 % were male. Pre-test composite score averaged 8.12 $\pm$ 3.18 and rose to 12.45 $\pm$ 2.05 post-test (mean change 4.33; 95 % CI 4.12–4.54; $p < 0.001$; Cohen's d 1.48). Adequate knowledge increased from 28.8 % to 92.4 % for disease/symptoms, 50.4 % to 85.6 % for diagnosis, 48.2 % to 80.8 % for transmission and 62.8 % to 82.2 % for treatment/prevention (all $p < 0.001$). **Conclusion.** A brief, well-structured teaching session led to substantial immediate improvements in TB knowledge across all domains. Integrating such sessions into routine NTEP clinics is feasible and may reduce diagnostic delays and improve treatment adherence.

KEYWORDS: Pre-assessment, Post-assessment, Questionnaire, Tuberculosis

INTRODUCTION

Tuberculosis (TB) remains a leading infectious disease despite being both preventable and curable. In 2023 the World Health Organization (WHO) estimated 10.8 million new TB cases and 1.25 million deaths worldwide.[1] India has the heaviest national burden, accounting for roughly 26 % of global incident cases and more than one-fourth of TB deaths.[2] Beyond active disease, a recent meta-analysis reported a mean tuberculosis infection (TBI) prevalence of 36 % in the general population, rising to $\geq$ 50 % among smokers, diabetics, and the malnourished, and exceeding regional averages in both the north and south of the country.[3]

The combination of a high burden of drug-sensitive as well as drug-resistant disease and a substantial pool of latent infection heightens the risk of onward transmission and future progression to active TB.[4–6]

To accelerate progress, India's National Tuberculosis Elimination Programme (NTEP) has embraced the National Strate-

gic Plan 2017–2025, which aims to "Detect, Treat, Prevent and Build" toward eliminating TB by 2025, five years ahead of the Sustainable Development Goal timeline [7], yet delays in care seeking, stigma, variable knowledge in general population and spread of multidrug-resistant (MDR) strains continue to impede progress. [4–7]

Although NTEP has intensified information-education-communication (IEC) activities, evidence indicates that inadequate knowledge of TB symptoms, transmission routes, and free services contributes to diagnostic delay and non-adherence. [8, 9] Previous cross-sectional surveys among patients, community members and even health-care workers have shown wide variations in awareness, with correct responses for key items ranging from 30% to 80%. [8–11]

Most existing studies describe baseline knowledge but do not assess whether brief, clinic-based educational sessions translate into immediate learning gains. Patients and the adult relatives who accompany them to the TB outpatient department (OPD) are an accessible audience for such interventions; enhancing their understanding could foster timely health-seeking behaviour, improve treatment adherence and reduce community transmission.

The present study therefore measures the change in TB-related knowledge among adult clinically suspected TB patients and their accompanying relatives after a structured 20-minute educational session delivered in an NTEP-affiliated TB-OPD in Maharashtra. By quantifying the immediate impact of this pragmatic intervention, we aim to generate operational evidence that can inform routine IEC strategies within high-volume public clinics.

SUGGESTED MATERIALS AND METHODS

Study design and setting: A prospective pre-test/post-test quasi-experimental study in the Tuberculosis Out-Patient Department (TB-OPD) of B.J. Government Medical College and Hospital, Pune, Maharashtra, India, was conducted between 1 July and 31 August 2023. The OPD runs daily under the National Tuberculosis Elimination Programme (NTEP) and serves both urban and peri-urban communities.

Study population: All clinically suspected pulmonary or extra-pulmonary TB patients aged 18 years or older and the relatives who accompanied them to the TB-OPD between 1 July and 31 August 2023 were approached for enrolment. Hospital staff, individuals with prior formal TB training, and those unwilling to provide written informed consent were excluded.

Sample-size: Assuming baseline adequate-knowledge prevalence of 50 % and a 15-percentage-point post-intervention improvement (α = 0.05, power = 80 %), the minimum sample required was 458. Accounting for 10 % non-response, the target was 510.

Ethical Clearance: Approval was obtained from the Institutional Ethics Committee, B.J. Government Medical College and Hospital, Pune, Maharashtra, Medical College (IEC No. ND 0623112-112, dated 01 June 2023). Participation was voluntary; anonymity was ensured using unique study codes. Written informed consent was obtained from participants. Questionnaires and records were stored in locked cabinets and password-protected computers accessible only to the research team.

Instrument development and validation: A 15-item structured questionnaire was developed after literature review and consultation with NTEP experts. Content validity index = 0.86. In a pilot with 20 respondents (excluded from analysis) the internal consistency was acceptable (Cronbach's α = 0.78). Items covered four knowledge domains—disease and symptoms, laboratory diagnosis, transmission, and treatment or prevention—and were available in English, Hindi and Marathi following standard forward-back translation procedures.

Educational intervention: Immediately after the baseline (pre-test) questionnaire, participants attended a 20-minute interactive session conducted in small groups ($\leq$ 25) by postgraduate residents under faculty supervision. Content covered TB epidemiology, signs/symptoms, free diagnostic services (CBNAAT, smear, radiology), treatment regimens, infection-control measures, BCG vaccination, and stigma reduction. Visual aids, a short video (NTEP IEC material), and a Q&A segment were utilised. Printed leaflets reinforced key messages.

Data-collection procedure

1. **Pre-test (Time 0):** Participants completed the questionnaire with assistance where needed ($\approx$ 15 min).
2. **Intervention:** Educational session (20 min).
3. **Post-test (Time 1):** The identical questionnaire was re-administered immediately after the session ($\approx$ 15 min).

Each participant thus spent ~50 minutes in total, minimising OPD flow disruption.

Outcome measures were **c**hange in composite knowledge score (0–15) between pre- and post-test and domain-specific knowledge gains and proportion achieving "adequate knowledge" ($\geq$ 75 % correct responses).

Statistical analysis: Data were entered in Microsoft Excel and analysed using SPSS v20.0.Descriptive statistics: mean $\pm$ SD (continuous) and n (%) (categorical). Normality checked with Shapiro–Wilk test. Paired comparisons were performed by McNemar test for each item (pre- vs post-proportion correct) and Paired-t test (or Wilcoxon signed-rank if non-normal) for composite scores. Effect size: Cohen's d for score change. $p < 0.05$ (two-tailed) was Significance threshold. Missing data were < 2 % and handled by listwise deletion.

RESULTS

A total of 500 adult participants (58 clinically suspected TB patients (11.6 %) and 442 accompanying relatives (88.4 %))

completed both questionnaires. The mean age was 42.7 ± 14.8 years (range 18–85); just over half were male (255; 51.0 %).

Characteristic	Category	No. (%)
Age (years)	18–30	112 (22.4)
	31–50	284 (56.8)
	> 50	104 (20.8)
Sex	Male	255 (51.0)
	Female	245 (49.0)
Respondent type	Suspected patient	58 (11.6)
	Relative/caregiver	442 (88.4)

Table 1: Socio-demographic profile of participants (n = 500)

Most participants were middle-aged adults; the sex distribution was nearly equal, and the vast majority were relatives rather than index patients (Table 1).

Time point	Mean ± SD	Mean change (95 % CI)	t (df= 499)	p-value	Cohen's d
Pre-test	8.12 ± 3.18	—	—	—	—
Post-test	12.45 ± 2.05	4.33 (4.12 – 4.54)	33.7	< 0.001	1.48

Table 2: Composite knowledge score before and after the educational session (maximum items = 15)

Table 2 shows the mean composite score rose by 4.3 points (effect size d = 1.48), indicating a large and statistically significant improvement in overall TB knowledge immediately after the intervention.

Significant gains were observed across all four knowledge domains, with the highest rise in recognition of TB disease and symptoms (63.6 percentage-points). Improvements for laboratory diagnosis and transmission were also good at 35% and 32.6% respectively and little lesser for treatment and intervention (Table 3).

Item level findings: Correct responses increased on every one of the 15 items (range of absolute gains, 13 %–72 %; all p < 0.01, McNemar). Knowledge gains did not differ significantly by sex or respondent type although age group > 50 years showed marginally smaller mean score change (3.9 ± 2.4 vs 4.5 ± 2.0, p = 0.04) but remained statistically significant.

Knowledge domain (item count)	Pre-test n (%)	Post-test n (%)	Absolute gain	McNemar χ^2	p-value
Disease & symptoms (3)	144 (28.8)	462 (92.4)	+63.6 %	294.1	< 0.001
Laboratory diagnosis (5)	252 (50.4)	428 (85.6)	+35.2 %	146.3	< 0.001
Transmission (3)	241 (48.2)	404 (80.8)	+32.6 %	138.7	< 0.001
Treatment & prevention (4)	314 (62.8)	411 (82.2)	+19.4 %	64.6	< 0.001

Table 3: Proportion of participants with "adequate knowledge" (≥ 75 % correct) by domain (n = 500)

Overall, the brief clinic-based educational session produced a large, immediate and statistically significant improvement in TB-related knowledge among both patients and their accompanying relatives.

DISCUSSION

The present quasi-experimental study demonstrates that a brief, structured educational session delivered in a routine TB-OPD can produce a large, immediate and statistically significant improvement in tuberculosis knowledge among both clinically-suspected patients and their accompanying relatives. The mean composite score rose by 4.3 points (Cohen's d = 1.48), and the proportion achieving "adequate knowledge" (≥ 75 % correct) increased across all four domains, most strikingly for disease recognition (+63.6 percentage-points). These findings affirm that even a twenty-minute intervention, when aligned with NTEP information-education-communication (IEC) material and delivered by trained staff, can bridge the knowledge gaps.

Our baseline figures are in line with earlier Indian surveys, which found modest awareness of TB symptoms, transmission and services [8–12]. For example, Sonawane et al. recorded 54.8 % awareness of TB disease, 58.7 % of transmission and 75.3 % of prevention and treatment among patients in Maharashtra. [8] Sharma et al. found similar disease awareness (55.2 %) but much poorer understanding of treatment (10.1 %) in Uttarakhand. [9] In another Uttarakhand study, Nautiyal et al. noted 65 % awareness that TB is communicable and 82.9 % awareness of the six- to nine-

month treatment duration [11]. By contrast, Nyamagoud et al. reported only 37 % recognition of airborne spread, 2 % awareness of multidrug-resistant TB and 5 % familiarity with DOTS therapy in Karnataka.[12] Similarly, Singh et al. observed substantial gaps in symptom and transmission awareness even among nurses in Himachal Pradesh. [10]

The improvement seen here is greater than that reported in those studies. Possible reasons include the use of a trilingual, pilot-tested questionnaire, small-group teaching that allowed questions, and the inclusion of relatives, who often guide treatment decisions.

Community-based studies had this similar variation. Pramanik and Ghosh found modest knowledge levels in rural West Bengal [13], while Divhare et al. reported limited counselling skills on TB nutrition among doctors in Maharashtra [14]. Das et al. showed that only one-third of general patients in tertiary hospitals in Bengal could identify key TB symptoms [15], and Paramasivam et al. documented delayed care-seeking linked to poor awareness in Kerala [16]. None of these studies assessed diagnostic modalities in depth; our questionnaire therefore adds new information on this neglected area and shows that correct responses about diagnosis rose by thirty-five percentage-points after the intervention.

The smallest gain was in the treatment-and-prevention domain (+ 19.4 percentage-points). One reason may be that many participants already knew about the six-month drug course promoted in mass media. Another is that topics such as drug resistance and vaccination may need more time than a single session affords. Follow-up studies should test knowledge retention and explore digital or repeat teaching formats.

Limitations include the single-centre setting, the absence of a control group and the lack of long-term follow-up. Social-desirability bias is possible, though self-administered, anonymous forms were used to reduce it.

Even with these constraints, the findings are clear. Embedding a concise lesson in everyday NTEP services can fill major knowledge gaps quickly and at low cost. Wider adoption of this model could shorten diagnostic delays, improve adherence and speed progress towards the 2025 TB-elimination goal. [7]

CONCLUSION

A brief, well-structured teaching session delivered during routine outpatient visits produced a large and immediate rise in tuberculosis knowledge among adult patients and their accompanying relatives. The greatest gains were seen in recognising symptoms and understanding free diagnostic services, both of which are important for early care-seeking. Although knowledge of treatment and prevention improved more modestly, overall scores after the session reached a level considered adequate in every domain. Because the intervention used existing staff, required only twenty minutes, and fitted smoothly into clinic workflow, it can be scaled across National Tuberculosis Elimination Programme settings without major extra cost. Wider adoption of this simple strategy could shorten diagnostic delays, enhance treatment adherence, and thereby support India's goal of eliminating TB by 2025.

DISCLOSURES

Author's Contribution: JSB- Literature survey, prepared first draft of manuscript, implementation of study protocol, data collection, data analysis, manuscript preparation and submission of article; SSP- Definition of intellectual content**,** manuscript editing, and revision; PGS- Definition of intellectual content**,** manuscript editing, and revision, Statistical analysis; RPK- manuscript editing, and revision; PNP, AAT, GRC, VDV, KBJ, VS- helped in data collection.

Conflict of interest: Nil.

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