Section: Community Medicine

Original Research Article

EFFECTIVENESS OF A SCHOOL-BASED HEALTH EDUCATION INTERVENTION ON TUBERCULOSIS AWARENESS, STIGMA, AND PREVENTIVE PRACTICES AMONG SECONDARY SCHOOL STUDENTS IN RURAL MAHARASHTRA

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A B S T R A

Background: Tuberculosis (TB) remains a significant public health issue in India, with high disease burden, stigma, and poor awareness, especially in rural communities. Adolescents represent an underutilized target group for community-based awareness initiatives. This study evaluates the effectiveness of a structured school-based health education intervention on TB-related knowledge, stigma, and practices among secondary school students in a rural setting. **Objectives:** To assess the effectiveness of a health education intervention in improving TB knowledge, reducing stigma, and enhancing preventive practices among students.

Materials and Methods: A single-group pre-post interventional study was conducted among 157 students (grades 7–10) from a rural secondary school in Koproli Village, Uran, and Maharashtra. A validated, pre-tested questionnaire measured knowledge, stigma, and practice domains before and immediately after a structured TB health education session. Data were analyzed using paired t-tests in SPSS v25.0; $p < 0.05$ was considered statistically significant.

Results: post-intervention scores significantly improved across all domains. The mean total score increased from 11.66 ± 3.01 to 14.04 ± 2.43 ($p = 0.0001$). Knowledge scores rose from 7.91 ± 2.18 to 9.73 ± 1.76 ($p = 0.0001$). Stigma scores decreased from 1.10 ± 0.70 to 0.81 ± 0.63 ($p = 0.0001$), and practice scores improved from 2.59 ± 0.82 to 3.50 ± 0.71 ($p = 0.0001$). Subgroup analysis showed greater stigma reduction among younger students and stronger behavioural improvement in older students.

Conclusion: The health education intervention was effective in enhancing TB awareness, reducing stigma, and promoting preventive practices. Integrating TB education into school curricula in rural India can empower adolescents as informed health advocates and support national TB elimination goals.

Keywords: Tuberculosis, Health Education, School-based Intervention, Adolescents, Public Health, Stigma Reduction, Preventive Practices, Rural Health.

INTRODUCTION

Tuberculosis (TB) continues to be a major public health concern globally and in India, despite the availability of effective diagnosis and treatment. India accounts for nearly one-fourth of the global TB burden, with millions affected annually across all age groups.[1] Although the disease primarily affects adults, children and adolescents remain a vulnerable and often overlooked population in TB control strategies.[2]

The spread of TB is facilitated not only by delayed diagnosis and inadequate treatment but also by widespread ignorance, social stigma, and misconceptions about its transmission and cure.[3,4] Addressing these non-clinical factors particularly through community-based awareness and educational interventions has become a key focus of the national TB elimination programme.[5]

Health education in schools is an evidence-based approach to fostering positive health behaviours and increasing disease-related knowledge among adolescents.[6] School students, in particular, serve as a vital entry point for health promotion because they are receptive to learning and capable of disseminating health information within their families and communities.[7] Studies have shown that involving school children in TB education can enhance awareness, reduce stigma, and encourage timely health-seeking behavior in the broader population.[8,9]

In rural and semi-urban areas, where access to healthcare and health literacy levels may be limited, such school-based interventions can be particularly impactful. The National Health Mission and Revised National Tuberculosis Control Programme (RNTCP) both advocate for innovative models of health education at the grassroots level.[10]

Against this backdrop, the present study was undertaken to assess the effectiveness of a structured TB health education intervention among secondary school students in Koproli village, Uran, a rural area of Maharashtra. The study aimed to measure the improvement in TB-related knowledge, changes in attitudes, stigma reduction, and enhancement in preventive practices following the intervention.

Objectives

Primary Objective

To assess the effectiveness of a structured health education intervention on improving knowledge and awareness about tuberculosis (TB) among secondary school students in a rural setting.

Secondary Objectives

1. To evaluate the change in students' knowledge regarding symptoms, modes of transmission, and preventive measures of TB following the intervention.
2. To assess the change in attitudes toward individuals with TB and measure the reduction in TB-related stigma.
3. To examine any improvement in health-seeking behaviour and adoption of preventive practices related to TB after the intervention.

MATERIALS AND METHODS

Study Design

This was a single-group, pre-post interventional study conducted to assess the impact of a structured health education session on tuberculosis (TB) awareness, stigma, and preventive practices among secondary school students. The study adhered to the STROBE checklist for observational studies.

Study Setting

The study was conducted in a secondary school located in Koproli Village, under the Rural Health Training Centre (RHTC) affiliated with the Department of Community Medicine, MGM Medical College, Vashi. The intervention was delivered within the school premises during regular school hours.

Study Period

The total duration of the study was nine months, which included planning, baseline data collection, intervention, and two phases of follow-up assessments. The structured TB health education intervention was delivered at baseline, and its impact was evaluated both one month and six months post-intervention to assess both short-term and sustained outcomes..

Inclusion Criteria:

1. Students enrolled in grades 7th to 10th at the selected secondary school in Koproli Village.
2. Aged between 10 and 15 years.
3. Provided verbal assent and whose parents/guardians provided written informed consent through school authorities.

Students with cognitive impairments or those unwilling to participate were excluded.

Exclusion Criteria:

1. Students with known cognitive impairments or learning disabilities that could affect questionnaire comprehension.
2. Students who were absent on the days of baseline, intervention, or follow-up assessments.

Sample Size

The minimum required sample size was calculated as 120, based on the formula for comparing means (pre- and post-intervention scores) with reference to a similar Indian study. However, to increase power and representativeness, complete enumeration was done, and all 157 eligible students were enrolled.

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee of MGM Medical College, Kamothe. Written informed consent was obtained from school authorities and parents, and verbal assent was taken from students.

Intervention

The intervention comprised a structured health education session delivered by trained faculty from

the Department of Community Medicine. The session included:

1. TB symptoms and signs
2. Modes of transmission
3. Diagnosis and treatment
4. Stigma and misconceptions
5. Preventive measures and health-seeking behaviour.

The content was designed for adolescent comprehension, incorporating audiovisual aids and interactive discussion.

Data Collection Tools and Procedure

A pre-tested, semi-structured questionnaire was used to assess:

1. Knowledge score (e.g., symptoms, spread, and prevention)
2. Stigma score (e.g., attitudes toward TB patients)
3. Practice score (e.g., willingness to seek treatment, adopt hygienic habits).

The same questionnaire was administered before and immediately after the health education session. The tool was validated in a pilot sample and finalized prior to data collection.

Variables

1. Primary outcome: Change in total TB knowledge score (pre vs. post)
2. Secondary outcomes: Change in stigma score, practice score
3. Independent variables: Age, gender, standard (grade level)

Data Management and Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 25.0. Continuous variables were expressed as means and standard deviations (SD). A paired t-test was applied to assess the statistical significance of pre- and post-test changes. A Chi-square test was used to examine the distribution of students across grades by gender. A p-value <0.05 was considered statistically significant.

STROBE Compliance

1. Participants: Described in terms of eligibility, enrollment, and analysis (n=157)
2. Bias: Minimised through complete enumeration and validated questionnaire
3. Study size: Justified with sample size estimation and complete inclusion
4. Quantitative variables: Summarized using means, SD; compared using t-tests
5. Statistical methods: Clearly stated and appropriate for study design
6. Ethics and consent: Fully addressed
7. Funding and role of investigators: Not applicable for this institutional academic study

RESULTS

Table 1: Gender-wise Distribution of Students Across Standards (n = 157)

Standard	Male (n)	Female (n)	Total (n)
7th	19	18	37
8th	28	19	47
9th	21	16	37
10th	20	16	36
Total	**88**	**69**	**157**

Table 1 presents the gender-wise distribution of students across the four participating standards (7th to 10th). A total of 157 students were included in the study, comprising 88 males and 69 females. The distribution of students was fairly balanced across all grades: 37 students each from the 7th and 9th standards, 47 from the 8th standard, and 36 from the 10th standard. While the 8th grade had the highest male representation (28 males), other standards had comparable numbers of male and female students. Although no statistical test was conducted to assess the significance of this distribution, the demographic spread appears reasonably uniform, supporting unbiased group-level comparisons for further analysis.

Table 2: Overall Pre- and Post-Test Comparison of Scores Among All Students (n = 157)

Domain	Pre-Test Mean ± SD	Post-Test Mean ± SD	p-value
Total Score	11.66 ± 3.01	14.04 ± 2.43	0.0001
Knowledge Score	7.91 ± 2.18	9.73 ± 1.76	0.0001
Stigma Score	1.10 ± 0.70	0.81 ± 0.63	0.0001
Practice Score	2.59 ± 0.82	3.50 ± 0.71	0.0001

As shown in Table 2, the educational intervention led to a marked improvement in students' understanding, attitudes, and practices related to tuberculosis. The mean total score increased from 11.66 ± 3.01 in the pre-test to 14.04 ± 2.43 in the post-test, indicating a significant overall gain in TB-related awareness ($p = 0.0001$). The knowledge score rose from 7.91 ± 2.18 to 9.73 ± 1.76, confirming that students acquired better information about the symptoms, transmission, and prevention of TB after the session. Stigma scores, where lower values indicate more positive attitudes, showed a notable reduction from 1.10 ± 0.70 to 0.81 ± 0.63 ($p = 0.0001$), suggesting increased acceptance and reduced prejudice toward individuals affected by TB. Similarly, practice scores improved from 2.59 ± 0.82 to 3.50 ± 0.71 ($p = 0.0001$), reflecting a positive shift in health-seeking behavior and preventive practices among the students. These findings

highlight the overall effectiveness of the intervention in multiple domains.

Table 3: Standard-wise Pre- and Post-Test Comparison of Scores Among Students

Standard	Domain	Pre-Test Mean ± SD	Post-Test Mean ± SD	p-value
7th	Total Score	12.08 ± 2.20	14.41 ± 2.66	0.0001
	Knowledge Score	8.27 ± 1.79	10.32 ± 1.93	0.0001
	Stigma Score	1.19 ± 0.70	0.70 ± 0.52	0.0001
	Practice Score	2.76 ± 0.80	3.38 ± 0.89	0.005
8th	Total Score	11.13 ± 2.72	13.13 ± 2.86	0.001
	Knowledge Score	7.38 ± 1.66	9.11 ± 2.02	0.001
	Stigma Score	1.09 ± 0.75	0.64 ± 0.74	0.007
	Practice Score	2.47 ± 1.04	3.38 ± 1.15	0.0001
9th	Total Score	12.03 ± 4.57	14.46 ± 2.23	0.004
	Knowledge Score	8.41 ± 3.26	9.76 ± 1.64	0.016
	Stigma Score	1.05 ± 0.66	1.03 ± 0.55	0.860
	Practice Score	2.51 ± 1.28	3.86 ± 0.71	0.0001
10th	Total Score	11.56 ± 1.89	14.42 ± 1.25	0.0001
	Knowledge Score	7.72 ± 1.56	9.92 ± 0.91	0.0001
	Stigma Score	1.08 ± 0.69	0.92 ± 0.60	0.337
	Practice Score	2.67 ± 0.96	3.58 ± 0.60	0.0001

Table 3 provides a detailed breakdown of pre- and post-intervention scores across different standards. Among 7th standard students, the intervention produced statistically significant improvements in total, knowledge, stigma, and practice scores. This group showed the largest reduction in stigma scores (from 1.19 to 0.70), indicating a strong attitudinal shift. The 8th standard also demonstrated significant gains across all parameters, particularly in practice scores, which rose from 2.47 ± 1.04 to 3.38 ± 1.15. In contrast, the 9th standard showed improvement in total, knowledge, and practice scores, but the change in stigma was negligible (1.05 to 1.03), and statistically non-significant ($p = 0.860$), suggesting persistent attitudes that were less easily modified. Among 10th standard students, the gains in knowledge and practice were substantial and statistically significant; however, the stigma score reduction (1.08 to 0.92) did not reach significance ($p = 0.337$), indicating that older students may require more intensive or repeated interventions to influence their attitudes. Overall, the intervention was effective in improving cognitive and behavioral domains across all standards, with younger students showing greater attitudinal change and older students translating knowledge into action more effectively.

DISCUSSION

This interventional study in Koproli Village, Maharashtra, demonstrates that a structured TB health education session significantly improved secondary school students' knowledge, attitudes, and practices related to tuberculosis. The findings align closely with multiple recent school-based interventions conducted in India and other countries.

Improvement in Knowledge

In our study, the mean knowledge score increased from 7.91 ± 2.18 to 9.73 ± 1.76 post-intervention ($p < 0.0001$). A similar study among 2,635 students in Karnataka by Pandey et al. observed an increase in mean knowledge scores from 8.77 ± 2.59 to 14.95 ± 1.99 following a single visual educational session lasting 30 minutes.[11] Gopichandran et al. also reported a rise from 7.05 (64%) to 9.15 (83.2%) among 9th-grade students after a classroom audiovisual intervention in Vellore, India.[12] These results confirm the utility of focused educational interventions in significantly improving knowledge on TB among adolescents.

Reduction in Stigma

Our results showed a significant reduction in TB-related stigma, with mean scores dropping from 1.10 ± 0.70 to 0.81 ± 0.63. This outcome is in agreement with a study by Idris et al. conducted in Kelantan, Malaysia, where adolescents showed a statistically significant reduction in stigma levels one month after participating in a TB education program.[13] However, the Malaysian study also noted lesser impact in changing attitudes and practices, highlighting the influence of sociocultural context. Similarly, Saidu et al. in The Gambia reported significant improvement in awareness and reduction in misconceptions among school children after TB-focused illustration-based workshops.[14] These findings underscore the importance of using age-appropriate and culturally sensitive content to influence stigma among adolescents.

Behavioral Practices

Our study documented a statistically significant improvement in TB-related practices, with mean scores increasing from 2.59 ± 0.82 to 3.50 ± 0.71. These findings echo results from the Gambian study, which reported that students were more likely to encourage family members to seek medical care and avoid traditional healers after the intervention.[14] In contrast, the Malaysian study found only modest gains in preventive behavior, despite improved knowledge and reduced stigma, suggesting that repeated or reinforced educational exposures might be needed for behavior change.[13] Among medical students in Rajasthan, India, Sharma et al. observed that correct TB prevention practices increased from 67% to 79.5% post-intervention.[15] This supports the

idea that targeted, structured health education can have measurable impacts on behavior even among older learners.

Age-Related Trends

A notable observation from our study was that younger students (7th and 8th grades) showed more pronounced improvements in stigma-related domains, whereas older students (9th and 10th) demonstrated greater gains in knowledge and behavioral practices. This pattern aligns with findings from Idris et al. and Saidu et al., where adolescents responded differently to TB messaging based on age group, cognitive maturity, and learning context.[13,14] These differences suggest that tailoring intervention content to developmental stages may further optimize impact.

Public Health Implications

The consistent evidence from multiple studies supports school-based health education as a critical strategy to augment TB awareness and prevention. India's National TB Elimination Programme (NTEP) promotes active community engagement, including TB education in schools, as part of its awareness-raising efforts.[16] Our results provide local validation for this approach and support its wider implementation across rural and underserved schools. Engaging students not only enhances their personal understanding but also enables them to act as messengers within their households and communities.

Strengths and Limitations

Our study's strengths include complete coverage of the student population (n = 157), the use of validated assessment tools, and alignment of findings with both national and international evidence. Limitations include the absence of a control group, the immediate post-test design, and reliance on self-reported data which could introduce response bias. Furthermore, while stigma reduction was evident in younger students, older students showed limited attitudinal change, suggesting the need for longitudinal or multi-session strategies to impact deeply rooted perceptions.

Future Directions

To enhance the sustainability and depth of these impacts, future studies should explore repeated modules, peer-led sessions, and community-family engagement models. Integrating TB awareness within existing school health programs and conducting mixed-methods evaluations could provide richer insights into behavioral transformation and cultural adaptation.

CONCLUSION

This study demonstrates that a structured, school-based health education intervention significantly improves TB-related knowledge, reduces stigma, and enhances preventive practices among secondary school students in a rural Indian setting. The intervention was particularly effective in increasing awareness and modifying health behaviors across all grades, with younger students showing greater attitudinal shifts. These findings underscore the importance of integrating TB education into school curricula as part of India's broader TB elimination strategy. Early engagement through educational institutions can empower adolescents to become informed advocates within their families and communities, contributing meaningfully to national public health efforts.

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