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Evaluating the Impact of a Tobacco Cessation Training Program for Medical and Dental Students: A Pre-Post Intervention Study

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Abstract

Background: Tobacco dependence is a leading cause of preventable mortality. This study evaluated the impact of a Tobacco Cessation Training (TCT) program integrated into the medical/dental curriculum on students' knowledge, confidence, and subsequent patient outcomes.

Materials and Methods: A pre-post intervention study was conducted from January to March 2025. A total of 400 clinical-year medical and dental students received the TCT program. Pre- and post-training knowledge scores and counseling confidence (5-point Likert scale) were measured. Following training, students counseled 200 adult tobacco users (smoking ≥5 cigarettes/day or using other forms, motivated to quit). Secondary patient-related outcomes (quit attempts, 7-day point-prevalence abstinence, ≥50% reduction in use) were assessed via patient self-report at one-month follow-up.

Results: Post-training, students' knowledge scores increased significantly (mean difference +26.6 points, 95% CI: 24.1–29.1, *p*<0.001). Counseling confidence improved from 2.1±0.8 to 4.3±0.6 (*p*<0.001). Among patients counseled, 68% (136/200) initiated a quit attempt, 42% (84/200) achieved 7-day abstinence, and 58% (116/200) reduced tobacco consumption by ≥50%.

Conclusion: The integrated TCT program significantly improved students' cessation competencies and led to positive short-term behavioral changes in patients. This supports the formal inclusion of structured tobacco cessation training in health professions education.

Keywords: Tobacco cessation, Medical education, Dental education, Curriculum intervention, Patient counseling, Pre-post study

Introduction

Tobacco use remains one of the most significant and preventable causes of morbidity and mortality worldwide, accounting for millions of deaths annually and contributing substantially to cardiovascular disease, cancer, chronic respiratory illness, and premature disability. Recent global estimates indicate that tobacco-related diseases continue to impose a heavy health and economic burden, particularly in low- and middle-income countries where healthcare systems are already strained[1,2]. Prevalence remains high in South Asia despite international control efforts. Pakistan, in particular, faces a critical public health challenge, with more than 25 million tobacco users and tobacco-attributable deaths accounting for a considerable proportion of national mortality[3-6]. These figures underscore the urgent need for scalable, cost-effective and contextually appropriate cessation strategies.

Healthcare professionals play a pivotal role in tobacco control. Even brief, structured advice delivered during routine clinical encounters significantly increases quit attempts and long-term abstinence[7,8]. Frameworks such as the World Health Organization's "5 A's" model (Ask, Advise, Assess, Assist, Arrange) provide evidence-based guidance for delivering cessation counseling in primary care settings[9], though the model's effectiveness depends on proper implementation and provider training, and it has been critiqued for its variable application in real-world clinical settings.

Unfortunately, multiple studies have demonstrated that medical and dental students often feel underprepared to counsel patients about tobacco cessation due to insufficient curricular emphasis and lack of supervised clinical practice[10,11]. This educational gap directly contributes to missed opportunities for patient intervention, as unprepared clinicians are less likely to address tobacco use during routine consultations, ultimately affecting patient quit rates. Surveys from South Asia and other regions consistently report gaps in knowledge, limited exposure to behavioral counseling techniques, and low confidence in delivering cessation support[12]. Recent systematic reviews further suggest that integrating structured cessation education into undergraduate curricula can significantly improve students' knowledge, attitudes, and clinical engagement with tobacco users[13,14].

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Educational interventions that combine didactic instruction with experiential learning, such as role-play and real patient counseling, appear particularly effective in translating skills into measurable patient outcomes[15].

Given the high burden of tobacco use in Pakistan and the marginal integration of formal cessation training into undergraduate health professional curricula, strengthening students' competencies represents a practical and sustainable strategy to expand cessation services. Therefore, this study aimed to evaluate the effectiveness of an integrated Tobacco Cessation Training (TCT) program on medical and dental students' knowledge and counseling confidence. Additionally, the study assessed short-term secondary patient-related outcomes following student-delivered cessation counseling to determine whether educational gains translated into meaningful behavioral change.

Materials and Methods

A single-arm, pre-post intervention study (without a control group due to practical constraints and ethical considerations regarding withholding training from a subset of students during the academic term) was conducted at Frontier Medical and Dental College, Abbottabad, Pakistan, over a three-month period from January to March 2025. The study was approved by the Institutional Ethical Review Committee (Ref: FMDC-85-R-A-25). A total of 400 clinical-year medical (MBBS, 4th/5th year) and dental (BDS, 3rd/4th year) students were enrolled. The sample size was calculated to detect a moderate effect size (Cohen's d = 0.5) in knowledge scores with 80% power and α=0.05, requiring 64 participants per group. However, given that the training program was delivered to all clinical-year students as part of their routine curriculum, we enrolled all 400 eligible students to maximize statistical power, enable subgroup analyses, and ensure robustness against potential attrition. Inclusion criteria for students were being active clinical-year students committed to full attendance. Students with self-reported prior formal tobacco cessation training were excluded, although baseline data revealed 10% had some prior exposure; these students were retained in the analysis to reflect real-world implementation. Following training, students counseled a convenience sample of 200 consecutive adult patients who used tobacco. Patient inclusion criteria were: age 18 years or older, daily use of any form of tobacco (with a threshold of ≥5 cigarettes/day for smokers to ensure a defined population of regular users), expression of willingness to discuss tobacco use, and provision of informed consent. To assess motivation, patients rated their readiness to quit on a 10-point scale; only those with a score ≥6 were included in the outcome evaluation. Exclusion criteria were pregnancy, significant cognitive impairment, concurrent participation in another cessation program, or inability to complete the one-month follow-up.

The Tobacco Cessation Training (TCT) program was developed using Kern's six-step model for curriculum development[16], and adapted from a validated plan for integrating such training into undergraduate curricula[17]. The program was delivered in two phases over one academic term: a didactic phase consisting of four one-hour lectures covering tobacco epidemiology, nicotine pharmacology, behavioral counseling techniques (the 5 A's model), and pharmacotherapy basics; and a practical phase involving small-group discussions on motivational interviewing followed by supervised patient counseling in clinical settings (totaling approximately 6-8 hours of supervised clinical exposure per student), including setting a quit date.

Student knowledge was assessed via a 20-item multiple-choice questionnaire developed based on lecture content, with content validity established by a panel of three experts. The questionnaire demonstrated acceptable internal consistency in our sample (Cronbach's α = 0.82). Pre- and post-test scores (range 0-100) were compared. Student confidence was measured using a 5-item, 5-point Likert scale (1=Not at all confident, 5=Very confident) assessing confidence in performing each of the 5 A's; the scale demonstrated good internal consistency in our sample (Cronbach's α = 0.87). Patient outcomes were assessed at one-month post-counseling via a telephone interview by a research assistant blinded to the student-counselor identity. Outcomes included: a quit attempt (patient-reported attempt to quit for at least 24 hours), 7-day point-prevalence abstinence (self-reported abstinence from all tobacco in the past 7 days at one month), and a ≥50% reduction in tobacco consumption compared to baseline.

Data were analyzed using SPSS version 26. Descriptive statistics summarized participant characteristics. The paired t-test was used to compare pre-post knowledge scores after normality was confirmed by the Shapiro-Wilk test. The Wilcoxon signed-rank test was used to analyze the non-parametric confidence scores which are therefore reported as medians with interquartile ranges in the results section. To account for potential confounding, we performed additional analyses stratifying by prior TCT exposure and academic program (MBBS vs. BDS). Patient outcomes are reported as proportions with 95% confidence intervals (CI). All analyses were two-tailed with significance set at $p<0.05$.

Ethical Considerations

Written informed consent was obtained from all students and patients. Confidentiality was ensured by using coded identifiers. Counseling was supervised by faculty to ensure patient safety. Nicotine replacement therapy was not provided as part of this study protocol.

Ethical Approval

IRB approval was granted before start of research EC # FMDC-85-R.A-25

Results

All 400 students completed the training and assessment. The mean age was 22.4±1.2 years, and 55% were male. As noted, 10% (n=40) reported some prior TCT exposure (Table 1). Students counseled 200 patients, all of whom completed the one-month follow-up.

Table 1. Baseline Characteristics of Student Participants (n=400)

Characteristic	Total (n=400)	MBBS (n=250)	BDS (n=150)
Age (years), Mean +SD	22.4 ± 1.2	22.6 ± 1.1	22.0 ± 1.3
Male , n (%)	220 (55%)	160 (64%)	60 (40%)
Prior TCT exposure, n (%)	40 (10%)	25 (10%)	15 (10%)

Significant improvements were observed in both knowledge and confidence. The mean knowledge score increased by 26.6 points (95% CI: 24.1–29.1, *p*<0.001). Counseling confidence scores improved significantly (median increase of 2.2 points, *p*<0.001) (Table 2).

Table 2. Pre- and Post-Training Student Outcomes

Group	Pre-Training	Post-Training	Change (95% CI)	*p*-value
Knowledge Score (0-100) Mean + SD				
All Students	52.3 ± 12.1	78.9 ± 9.8	+26.6 (24.1 – 29.1)	<0.001*
MBBS	54.1 ± 11.7	80.2 ± 8.5	+26.1 (23.3 – 28.9)	<0.001*
BDS	49.2 ± 12.5	76.5 ± 10.2	+27.3 (24.0 – 30.6)	<0.001*
Counseling Confidence (Likert Scale 1-5) [Median IQR]	2.0 (1.5-2.5)	4.0 (4.0-5.0)	+2.0	<0.001**

*Paired t-test; **Wilcoxon signed-rank test. Counseling confidence score improved significantly from median 2.0 (IQR: 1.5-2.5) to 4.0 (IQR: 4.0-5.0), p<0.001.

Subgroup analysis by academic program revealed that both MBBS and BDS students demonstrated significant improvements in knowledge scores (MBBS: +26.1 points, 95% CI: 23.3-28.9, p<0.001; BDS: +27.3 points, 95% CI: 24.0-30.6, p<0.001). The difference in post-training scores between programs was not statistically significant (p=0.12). Similarly, students with prior TCT exposure (n=40) showed comparable gains to those without prior exposure, though they started from a slightly higher baseline (mean baseline: 58.4 vs. 51.7).

At the one-month follow-up, 68% of patients initiated a quit attempt, 42% reported 7-day abstinence, and 58% had reduced their tobacco use by at least half (Table 3).

Table 3. Patient Outcomes at One-Month Follow-up (n=200)

Outcome	% (n/N)	95% CI
Initiated quit attempt	68% (136/200)	61.2%-74.2%
7-day point-prevalence abstinence	42% (84/200)	35.1% - 49.3%
> 50% reduction in tobacco use	58% (116/200)	51.0% - 64.8%

Discussion

This study demonstrates that a structured TCT program integrated into the clinical curriculum can significantly enhance the knowledge and confidence of medical and dental students in providing tobacco cessation counseling. Furthermore, this training was associated with positive self-reported secondary patient outcomes, with over two-thirds of patients initiating a quit attempt within one month.

Our findings align with previous research. The significant improvement in knowledge scores (+26.6 points) is consistent with studies that have implemented similar curricular interventions[18]. The increase in student confidence is particularly crucial, as lack of confidence is a known barrier to clinicians engaging in cessation counseling[10]. This lack of training is a widespread issue, as studies have shown high rates of tobacco use and insufficient cessation education among health professional students in South Asia[12].

The patient outcomes, while based on self-report and short-term, appear encouraging. However, the 42% 7-day abstinence rate at one month should be interpreted cautiously, as this represents short-term, self-reported cessation without biochemical validation. This rate exceeds those typically reported in longer-term studies (e.g., Shibly[19] reported a 12% biochemically verified quit rate at six months), highlighting that our findings likely reflect initial cessation attempts rather than sustained abstinence. Direct comparison with long-term studies may be misleading given differences in follow-up duration and outcome measurement.

The behavioral counseling delivered by students is supported by extensive evidence for adult smoking cessation[8], and future iterations of this program could be strengthened by incorporating pharmacological support strategies, which are considered a key component of comprehensive cessation programs[20].

The positive outcomes from this program are comparable to those seen in long-standing, required curricula, such as the decade-long outcomes reported from a dental hygiene program, which also demonstrated sustained benefits from integrating such training[21].

Despite these limitations, this study provides robust evidence for the effectiveness of integrating practical tobacco cessation training into health professions education. Future research should involve a multi-center, randomized controlled trial with a longer follow-up period (e.g., 6-12 months) and biochemical validation of abstinence. Incorporating more advanced communication skills training and pharmacotherapy education could further enhance the program's impact.

Limitations

This study has several limitations. Its single-arm, pre-post design lacks a control group, limiting the ability to attribute outcomes solely to the intervention. Additionally, we did not adjust for multiple potential confounders such as patients' baseline motivation levels beyond the inclusion criterion, prior quit attempts, or socioeconomic factors that may influence cessation outcomes. The inclusion of some students with prior TCT exposure (10%), while reflecting real-world implementation, may have influenced baseline knowledge scores. The follow-up period was short (one month), and outcomes were based on patient self-report without biochemical validation. The study was conducted at a single institution, which may affect generalizability.

Conclusion

In conclusion, equipping future doctors and dentists with effective cessation skills is a critical step towards reducing the immense burden of tobacco-related disease. This TCT program offers a viable and effective model for achieving this goal.

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Author Contributions

1. **Muhammad Rizwan:** Conception of the study, study design, supervision, and writing of the manuscript.
2. **Syed Abir Hussain:** Conception of the study, data analysis and interpretation, literature review, and critical review of the manuscript.
3. **Saif ur Rehman:** Conception of the study, supervision, materials provision, and data interpretation.
4. **Qaiser Masud Sheikh:** Data collection and processing, literature review, and critical review of the manuscript.
5. **Muhammad Umair:** Supervision, data collection and processing, materials provision, and writing of the manuscript.
6. **Shehzad Ahmed:** Study design, supervision, literature review, and data analysis.
7. **Maira Rizwan:** Materials provision, data collection and processing, and article writing.