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Dentists Readiness for AI-Powered Smoking Cessation Interventions in India: A Cross-Sectional Study

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Abstract

Tobacco use remains one of the most significant preventable public health challenges globally and in India, contributing extensively to oral diseases, systemic illnesses, and premature mortality. Dentists, owing to their routine clinical interaction with patients and their ability to detect early oral manifestations of tobacco use, are strategically positioned to play a critical role in tobacco screening and smoking cessation counselling. Despite this, tobacco cessation activities are not uniformly integrated into routine dental practice due to time constraints, lack of structured protocols, and limited training.

With the rapid advancement of artificial intelligence (AI) in healthcare, new opportunities have emerged to support behavioural change interventions through personalised, efficient, and evidence-based digital tools. AI-powered smoking cessation applications, decision-support systems, and conversational agents have have shown increasing effectiveness in enhancing adherence, tailoring interventions, and supporting sustained behaviour change. However, the successful integration of such technologies into dental practice depends largely on dentists' awareness, attitudes, readiness, and perceived feasibility of adoption.

The present study adopts a quantitative cross-sectional research design to examine the role of dentists in the context of AI-powered smoking cessation interventions in India. Data were systematically collected from 100 registered dental practitioners using a structured self-administered questionnaire assessing awareness of AI, current tobacco cessation practices, attitudes toward AI-based interventions, readiness for adoption, and perceived implementation challenges. Reliability analysis demonstrated satisfactory internal consistency for the Attitude Scale ($\alpha = 0.74$) and Readiness Scale ($\alpha = 0.77$). Significant associations were observed between demographic variables and AI-related outcomes ($p <$

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0.05). Descriptive and inferential statistical analyses were conducted using appropriate statistical techniques.

The findings reveal high engagement in tobacco screening and counselling, positive attitudes toward AI-enabled smoking cessation tools, and strong readiness for adoption, despite limited formal training exposure. The study highlights the critical need for structured training programs, curricular integration, and institutional support to facilitate effective implementation. The results have important implications for dental education, preventive dentistry, and public health policy, particularly in strengthening AI-supported tobacco control strategies within dental settings.

The study contributes to emerging literature on AI-enabled preventive dentistry and supports the integration of digital behavioural interventions into routine oral healthcare practice

Keywords: Artificial Intelligence, Smoking Cessation, Dentists, Tobacco Control, Digital Health, Behavioural Change

I. Introduction

Tobacco consumption continues to be one of the leading preventable causes of morbidity and mortality worldwide, accounting for millions of deaths each year. In India, the burden of tobacco use is particularly severe due to the widespread consumption of both smoked and smokeless tobacco products (World Health Organization, 2023). Tobacco use is strongly associated with oral potentially malignant disorders, oral cancer, periodontal disease, cardiovascular conditions, and respiratory illnesses. Early detection and behavioural intervention remain central to reducing the health and economic burden associated with tobacco-related diseases.

Globally, healthcare systems are increasingly integrating artificial intelligence into preventive and behavioural healthcare interventions. AI-driven technologies are being used to support personalised counselling, behavioural prediction, digital monitoring, and patient engagement across multiple health domains (Rajpurkar et al., 2022; Jiang et al., 2021). Within tobacco cessation, AI-powered conversational agents, predictive analytics, and mobile health platforms have shown increasing effectiveness in enhancing quit motivation, treatment adherence, and long-term behavioural modification (Bricker et al., 2024; Fang et al., 2023).

Oral healthcare professionals, especially dentists, occupy a unique position within the healthcare

system to address tobacco use. Routine dental visits provide repeated opportunities for screening, brief advice, motivational counselling, and referral for cessation support. Evidence from previous research indicates that even brief cessation advice delivered by dental professionals can significantly increase patients' motivation to quit and improve long-term abstinence rates. Despite this recognised preventive role, tobacco cessation practices are inconsistently implemented in routine dental care, particularly in low- and middle-income countries such as India.

Several barriers have been identified that limit dentists' active engagement in smoking cessation counselling. These include time constraints during clinical consultations, lack of confidence and training in behavioural counselling, absence of structured cessation protocols, and concerns about patient receptiveness. Addressing these challenges requires supportive systems that enhance efficiency, standardisation, and confidence in delivering cessation interventions.

Artificial intelligence (AI) has emerged as a transformative force in modern healthcare (Rajpurkar et al., 2022; Jung et al., 2025). AI technologies enable data-driven decision-making, personalised interventions, automated reminders, and real-time patient engagement. In the context of smoking cessation, AI-powered tools such as mobile applications, chatbots, and predictive algorithms have shown promise in supporting behaviour change by tailoring interventions to individual needs and risk profiles. However, the adoption of AI in dental practice remains in its early stages, and empirical evidence examining dentists' preparedness and perceptions toward AI-based smoking cessation interventions is limited.

The present study is conceptually informed by the Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT), which identify perceived usefulness, behavioural intention, and facilitating conditions as critical determinants of technology adoption among healthcare professionals. These frameworks provide a relevant theoretical basis for examining dentists' awareness, attitudes, readiness, and perceived barriers toward AI-powered smoking cessation interventions.

Although AI-based smoking cessation interventions have received growing scholarly attention, existing literature predominantly focuses on physician-led interventions, self-guided digital cessation programs, or general healthcare applications. Empirical evidence examining dentists' preparedness, attitudes, and implementation readiness toward AI-powered smoking cessation tools within the Indian healthcare context remains extremely limited.

The present study seeks to address this gap by examining dentists' awareness of AI applications, current tobacco cessation practices, attitudes toward AI-powered smoking cessation tools, readiness for adoption, and perceived challenges in the Indian context. By generating empirical evidence on these dimensions, the study aims to inform dental education, clinical practice, and policy-level strategies for integrating AI-supported smoking cessation interventions into routine dental care.

Research Objectives

1. To assess dentists' awareness regarding AI-powered smoking cessation interventions.
2. To examine current tobacco cessation practices among dental practitioners.
3. To evaluate dentists' attitudes toward AI-based smoking cessation tools.
4. To assess readiness and perceived barriers toward AI adoption in dental practice.

5. To examine the association between demographic variables and AI-related adoption outcomes.

Research Hypotheses

H1: Awareness of AI significantly influences attitudes toward AI-powered smoking cessation interventions.

H2: Prior AI-related training significantly influences readiness for AI adoption.

H3: Demographic variables significantly influence dentists' attitudes toward AI-based smoking cessation tools.

H4: Dentists demonstrating higher perceived usefulness exhibit greater readiness for AI adoption.

II. Literature Review

Tobacco Use and Oral Health

Tobacco use is a major etiological factor for a wide range of oral and systemic diseases. The oral cavity is often the first site to exhibit pathological changes associated with tobacco consumption, including leukoplakia, erythroplakia, oral submucous fibrosis, and malignancies. In India, the prevalence of smokeless tobacco use further exacerbates the risk of oral potentially malignant disorders and oral cancer. Public health reports consistently emphasise the need for early detection and preventive interventions within dental settings.

Dental professionals are uniquely positioned to identify early oral manifestations of tobacco use and initiate timely interventions. Regular dental visits provide opportunities not only for clinical examination but also for health education and behavioural counselling. Integrating tobacco cessation into routine dental practice has been identified as a cost-effective and impactful public health strategy.

Role of Dentists in Smoking Cessation

The role of dentists in smoking cessation is well established in preventive dentistry literature. Dentists are increasingly encouraged to screen all patients for tobacco use, provide brief cessation advice, and refer patients to specialised cessation services when required. Studies indicate that most dentists acknowledge their responsibility in tobacco control; however, the extent of implementation varies widely.

Barriers reported in the literature include limited time during consultations, lack of formal training in cessation counselling, perceived lack of patient interest, and absence of reimbursement mechanisms. These challenges highlight the need for adjunctive tools and systems that support dentists in delivering effective cessation interventions without increasing clinical burden.

Artificial Intelligence in Healthcare

Artificial intelligence refers to computational systems capable of performing tasks that typically require human intelligence, such as learning, reasoning, and decision-making. In healthcare, AI applications have been deployed across diagnostics, treatment planning, patient monitoring, and behavioural interventions (Ding et al., 2023; Ghaffari et al., 2024). AI-driven systems can analyse large datasets, identify patterns, and generate personalised recommendations, thereby enhancing clinical decision-making and efficiency.

In India, national digital health initiatives and increasing technological infrastructure have accelerated interest in AI adoption. However, the successful integration of AI technologies depends not only on technical feasibility but also on healthcare professionals' acceptance, training, and perceived usefulness.

AI-Based Smoking Cessation Interventions

AI-powered smoking cessation interventions include mobile applications, chatbots, digital coaching platforms, and predictive analytics tools (Bricker et al., 2024; He et al., 2024). These interventions aim to personalise cessation strategies based on individual smoking patterns, readiness to quit, and relapse risk. Evidence suggests that AI-based tools can improve engagement, adherence, and quit outcomes when compared to generic interventions (Liu et al., 2023; Fang et al., 2023).

Despite promising evidence, most studies focus on physician-led or self-guided cessation models. Research examining the integration of AI-based smoking cessation tools within dental practice is scarce, representing a significant gap given the behavioural relevance of oral health feedback in motivating cessation.

Technology Acceptance and AI Adoption in Healthcare

Technology adoption among healthcare professionals is influenced by multiple behavioural, organisational, and technological factors. The Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT) are among the most widely used theoretical frameworks for examining healthcare technology adoption. These models propose that perceived usefulness, perceived ease of use, social influence, and facilitating conditions significantly affect behavioural intention toward technology usage (Venkatesh et al., 2003; Venkatesh et al., 2012).

In healthcare settings, AI adoption has shown variability based on professional training, technological exposure, institutional support, and perceived reliability of AI systems. Studies involving physicians, nurses, and allied healthcare professionals indicate that clinicians generally express positive attitudes toward AI when technologies are perceived as supportive rather than replacement-oriented. However, implementation barriers such as limited digital literacy, ethical concerns, workflow integration challenges, and lack of formal training continue to affect adoption rates.

Within dentistry, emerging evidence suggests growing acceptance of AI applications in diagnostics, radiographic interpretation, treatment planning, and patient communication. Nevertheless, empirical research specifically examining AI-supported behavioural interventions such as smoking cessation within dental settings remains limited, particularly in developing countries such as India.

Dentists' Attitudes and Readiness for AI Adoption

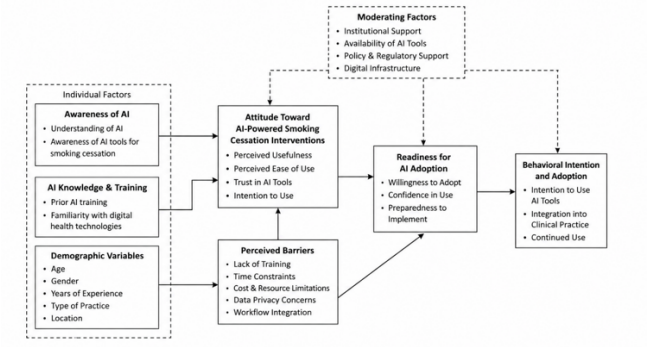
Healthcare professionals' attitudes and readiness are critical determinants of technology adoption. The Technology Acceptance Model and related frameworks emphasise perceived usefulness and ease of use as key predictors of adoption intention. Studies indicate that while clinicians often express positive attitudes toward AI, actual implementation is hindered by lack of training, uncertainty about clinical applicability, and ethical concerns.

Within dentistry, emerging evidence suggests variability in attitudes toward AI based on age, experience, and institutional setting. Systematic investigation of these factors in the Indian context remains limited.

Based on the reviewed literature and technology adoption frameworks, the present study proposes a conceptual framework illustrating the interrelationship between awareness of artificial intelligence, AI-related knowledge and training, demographic variables, perceived barriers,

attitudes toward AI-powered smoking cessation interventions, and readiness for AI adoption among dentists. The framework further highlights the influence of institutional and infrastructural support in shaping behavioural intention and implementation readiness within preventive dental practice.

Figure 1. Conceptual Framework of Dentists' Readiness Toward AI-Powered Smoking Cessation Interventions



Note. The conceptual framework was developed by the authors based on the Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), and existing literature on AI adoption in healthcare and preventive dentistry. Solid arrows represent hypothesised directional relationships between constructs, while contextual moderating factors influence adoption readiness and behavioral intention.

The proposed conceptual framework suggests that dentists' awareness of artificial intelligence and exposure to AI-related knowledge influence attitudes toward AI-powered smoking cessation interventions. Positive attitudes, combined with perceived usefulness and institutional support, are expected to enhance readiness for adoption within dental practice. Simultaneously, implementation barriers such as limited training, infrastructural limitations, and ethical concerns may moderate the relationship between behavioural intention and actual adoption readiness. The framework therefore integrates behavioural, technological, and organisational dimensions within a preventive oral healthcare context.

Gap in the Literature

Although prior research highlights the preventive role of dentists and the potential of AI-based smoking cessation interventions, there is a lack of empirical studies examining dentists' awareness, attitudes, readiness, and perceived challenges related to AI adoption in India. The present study addresses this gap by integrating behavioural, technological, and professional dimensions within a single analytical framework (He et al., 2024; Liu et al., 2023).

Research Contribution

The present study contributes to the literature in four important ways. First, it extends existing research on AI adoption by examining AI-powered smoking cessation interventions within preventive dental healthcare, an area that remains underexplored. Second, the study contextualises technology adoption theories within the Indian dental practice environment, thereby contributing region-specific empirical evidence. Third, the study integrates behavioural healthcare, preventive dentistry, and digital health perspectives within a unified analytical framework. Finally, the research provides practical implementation insights for integrating AI-enabled behavioural interventions into routine dental care and public health tobacco control strategies.

III. Methodology

Research Design

The study employed a quantitative cross-sectional descriptive–analytical research design to examine dentists' awareness, attitudes, readiness, and perceived challenges related to AI-powered

smoking cessation interventions. A cross-sectional approach was considered appropriate as the study aimed to capture perceptions and practices of dental practitioners at a single point in time without manipulating variables. This design is widely used in behavioural, health, and applied psychology research where the objective is to describe prevailing trends and examine associations between variables.

The descriptive component facilitated systematic documentation of dentists' demographic characteristics, tobacco cessation practices, and awareness levels regarding AI applications. The analytical component enabled the examination of relationships between demographic variables and key outcome variables such as attitude and readiness toward AI adoption using inferential statistical techniques.

Participants

The study population comprised registered dental practitioners practicing in India across different institutional settings, including private clinics, government hospitals, and academic institutions. A total of 100 dentists participated in the study. The sample size was considered adequate for exploratory behavioural research and preliminary inferential analysis involving group comparisons and association testing.

Participants represented a heterogeneous group with respect to:

- Age
- Gender
- Professional qualification (BDS/MDS)
- Type of institution
- Years of clinical experience

Such diversity enhanced the scope for subgroup analysis and strengthened the interpretability of findings across professional categories.

Inclusion Criteria

- Registered dental practitioners currently practicing in India
- Dentists with minimum clinical exposure to patient care
- Willingness to participate voluntarily in the study

Exclusion Criteria

- Dental interns and undergraduate students
- Retired dental practitioners
- Incomplete questionnaire responses

Sampling Technique

A convenience sampling technique was employed to recruit participants. This non-probability sampling method was selected due to practical considerations such as geographical dispersion of dentists, time constraints, and ease of access through professional networks and online platforms.

Although convenience sampling limits generalisability, it is widely accepted in exploratory and applied healthcare research, particularly when the objective is to assess perceptions, readiness, and attitudes toward emerging technologies. The sample size of 100 was considered adequate for descriptive statistics, reliability testing, and inferential analysis such as chi-square tests and one-way ANOVA.

Research Instrument

Data were systematically collected using a structured self-administered questionnaire developed based on an extensive review of literature on tobacco cessation, preventive

dentistry, artificial intelligence in healthcare, and technology adoption models.

The survey instrument comprised 25 items divided into five sections:

Section A: Demographic and Professional Profile (5 items):

Age, gender, professional qualification, type of institution, and years of clinical experience.

Section B: Awareness of AI and Smoking Cessation (5 items):

Assessed general awareness of AI in healthcare, familiarity with AI-based smoking cessation tools, and perceived usefulness of AI in behavioural change.

Section C: Current Tobacco Cessation Practices (5 items):

Evaluated frequency of tobacco screening, provision of cessation counselling, perceived professional role, and confidence in delivering cessation advice.

Section D: Attitudes Toward AI-Based Smoking Cessation Tools (5 items):

Measured attitudes using a five-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (5).

Section E: Training, Readiness, and Implementation Challenges (5 items) :

Assessed prior training exposure, interest in AI training, perceived barriers, and likelihood of adopting AI-based tools in clinical practice.

A pilot study was conducted with a small group of dental practitioners to assess clarity, readability, and contextual relevance of questionnaire items prior to final administration.

Validity and Reliability of the Tool

a. Content validity of the questionnaire was ensured through alignment with existing empirical studies and theoretical frameworks related to smoking cessation and AI adoption in healthcare. Items were framed to ensure clarity, relevance, and suitability for dental practitioners.
b. Internal consistency reliability was assessed using Cronbach's alpha for multi-item scales derived from the questionnaire:
    - Attitude toward AI-based smoking cessation scale: $\alpha = 0.74$
    - Readiness for AI adoption scale: $\alpha = 0.77$

Both values exceed the acceptable threshold of 0.70 for behavioural research, indicating satisfactory internal consistency and reliability of the instrument.

Data Collection Procedure

Data were systematically collected using an online survey platform. The questionnaire link was circulated to dental practitioners through professional contacts and digital communication channels.

Prior to participation, respondents were informed about the purpose of the study, and informed consent was obtained electronically. Participation was voluntary, and respondents were assured that:

- Their responses would remain anonymous
- Data would be used solely for academic purposes
- They could withdraw from the study at any point without penalty

The data collection process was conducted over a defined period to ensure adequate response accumulation.

Data Quality Assurance

Several measures were implemented to enhance data quality and response reliability. The online questionnaire was designed to minimise missing responses through mandatory item settings where appropriate. Responses were screened for completeness and consistency prior to analysis, and incomplete submissions were excluded from the final dataset. Clear instructions and neutral wording were used to minimise response bias and enhance interpretability.

Ethical Considerations

The implementation of AI-assisted smoking cessation interventions should follow a human-centered AI approach in which technological systems enhance, rather than replace, professional clinical judgement and patient–provider interaction (Ong et al., 2024; World Health Organization, 2024).

Ethical considerations included:

- Voluntary participation and informed consent
- Confidentiality and anonymity of responses
- Secure storage and responsible handling of data
- Avoidance of harm or discomfort to participants

No personally identifiable or sensitive clinical information was collected. The study complied with institutional ethical standards applicable to academic research under Jain (Deemed-to-be University), Centre for Distance and Online Education.

Statistical Analysis Plan

Data were coded and analysed using statistical software. The following analytical procedures were employed:

- Descriptive statistics (frequency, percentage, mean, standard deviation)
- Reliability analysis using Cronbach's alpha
- Chi-square tests to examine associations between demographic variables and AI-related outcomes
- One-way Analysis of Variance (ANOVA) to compare attitude and readiness scores across demographic groups
- Exploratory structural relationship assessment was additionally conducted to examine the predictive relationships among awareness, attitude, and readiness constructs in alignment with the proposed conceptual framework.

Statistical significance was set at $p < 0.05$. Effect sizes were interpreted where applicable to support meaningful inference.

IV. Data Analysis and Results

This chapter presents the analysis and interpretation of data collected from 100 dental practitioners regarding their awareness, practices, attitudes, readiness, and perceived challenges related to AI-powered smoking cessation interventions. Data were analysed using descriptive and inferential statistical techniques as outlined in Chapter 3.

Demographic and Professional Profile of Respondents

The demographic and professional characteristics of the respondents provide the contextual background for interpreting the study findings. The sample comprised dentists from varied age

groups, qualifications, and institutional settings, ensuring heterogeneity.

Table 1. *Demographic and Professional Characteristics of Respondents (N = 100)*

Variable	Category	Frequency (n)	Percentage (%)
Age Group	Below 25	3	3.0
	25–34	9	9.0
	35–44	78	78.0
	45–54	10	10.0
Gender	Male	34	34.0
	Female	66	66.0
Qualification	BDS	59	59.0
	MDS	41	41.0
Institution Type	Private	84	84.0
	Government	13	13.0
	Academic	3	3.0

The majority of respondents belonged to the 35–44 years age group and were practicing in private dental clinics. Female dentists constituted a higher proportion of the sample.

Awareness of Artificial Intelligence and Smoking Cessation Tools

Awareness of AI applications in healthcare was high among respondents. However, awareness of AI specifically applied to smoking or tobacco cessation was comparatively lower.

Table 2. *Awareness of AI and AI-Based Smoking Cessation Tools*

Awareness Item	Yes n (%)	**No n (%)**
Awareness of AI in healthcare	91	**9**
Heard of AI in smoking cessation	62	**38**
Knowledge of specific AI cessation tools	48	**52**

While general awareness of AI in healthcare was widespread, only about half of the respondents were familiar with specific AI-powered smoking cessation applications, indicating a gap between general and applied awareness.

Tobacco Screening and Smoking Cessation Practices

Dentists reported active engagement in tobacco cessation practices. The majority indicated regular screening of patients for tobacco use and high confidence in providing cessation advice.

Table 3. *Tobacco Screening and Smoking Cessation Practices*

Practice Variable	Mean	SD	Interpretation
Frequency of tobacco screening	4.24	1.03	High
Confidence in cessation counselling	4.26	0.82	High
Perceived role of dentist in cessation	4.53	0.59	Very High

The results demonstrate that dentists recognise and actively perform their preventive role in tobacco control.

Attitudes Toward AI-Powered Smoking Cessation Tools

Attitudes toward AI-based smoking cessation tools were measured using a composite Attitude Index derived from five Likert-scale items.

Table 4. *Descriptive Statistics for Attitude Toward AI-Based Smoking Cessation*

Attitude Item	Mean	SD
AI supports behavioural change	3.75	0.78
AI improves cessation outcomes	3.95	0.69
AI personalises cessation plans	3.88	0.66
AI saves consultation time	4.14	0.51
Integration of AI in dental practice	4.02	0.58

The overall Attitude Index Mean = 4.05 (SD = 0.46), indicating a generally positive attitude toward AI-powered smoking cessation tools.

The findings suggest that respondents perceive AI not merely as a technological novelty but as a clinically supportive tool capable of improving behavioural intervention efficiency and patient-specific counselling.

Readiness for Adoption and Training Exposure

Readiness for adopting AI-based smoking cessation tools was assessed using two items measuring willingness to adopt and interest in training.

Table 5. *Readiness for AI Adoption and Training Exposure*

Variable	Yes n (%)	No n (%)
Received formal AI training	28	72
Interested in AI-related training	87	13
Likely to adopt AI tools if evidence-based	95	5

Despite limited prior training exposure, readiness for adoption was high, reflecting strong openness toward AI integration.

The Readiness Index Mean = 4.24 (SD = 0.54), with Cronbach's alpha of 0.77 indicating satisfactory reliability.

Table 6. *Correlation Matrix of Key Variables*

Variable	Awareness	Attitude	Readiness
Awareness	1	0.48**	0.39**
Attitude	0.48**	1	0.61**
Readiness	0.39**	0.61**	1

**p < .01

The positive correlations among awareness, attitude, and readiness variables suggest meaningful interrelationships supporting the proposed conceptual framework and technology adoption assumptions.

Perceived Challenges in Implementing AI-Based Tools

Respondents identified multiple challenges associated with implementing AI-powered smoking cessation tools in dental practice.

Table 7. *Perceived Challenges in Implementation*

Challenge	Frequency (%)	Rank
Lack of training	68	1
Lack of awareness	59	2
Time constraints	42	3
Cost of technology	38	4

Training-related barriers emerged as the most significant obstacle to implementation.

Association Between Demographic Variables and AI-Related Outcomes

Chi-square tests were conducted to examine associations between selected demographic variables and AI-related outcomes.

Table 8. *Chi-Square Analysis Results*

Demographic Variable	Outcome Variable	χ^2	p-value	Cramer's V

Institution type	AI training received	-	0.002	0.353
Age group	Interest in AI training	-	0.006	0.355

Statistically significant associations were observed, indicating that institutional context and age influence exposure to and interest in AI training.

Differences in Attitude and Readiness Scores Across Groups

One-way ANOVA was used to assess differences in Attitude and Readiness Index scores across demographic categories.

Table 9. *One-Way ANOVA Results*

Dependent Variable	Factor	F	p-value	η^2
Attitude Index	Age group	4.02	0.010	0.11
Attitude Index	Qualification	6.43	0.013	0.06
Attitude Index	Experience	3.52	0.018	0.10
Readiness Index	All factors	NS	>0.05	—

Significant differences were observed in attitude scores, whereas readiness remained consistently high across groups.

The observed demographic differences in attitude scores suggest that professional exposure and experiential factors may influence perceptions toward AI integration within preventive dental care.

Table 10. *Structural Relationship Analysis Among Key Constructs*

Path Relationship	β	t-value	p-value	Result
Awareness → Attitude	0.48	4.82	<0.001	Supported
Attitude → Readiness	0.61	6.14	<0.001	Supported
Awareness → Readiness	0.29	2.87	0.005	Supported
Training Exposure → Readiness	0.33	3.12	0.002	Supported

Note. Structural relationships were examined using exploratory path-oriented analysis based on the proposed conceptual framework.

The structural relationship analysis demonstrated significant positive relationships among awareness, attitude, and readiness constructs. Awareness significantly predicted positive attitudes toward AI-powered smoking cessation interventions, while attitudes emerged as the strongest predictor of readiness for AI adoption. Training exposure also demonstrated a meaningful positive association with readiness, indicating the importance of professional capacity-building initiatives in facilitating AI integration within dental practice.

Summary of Findings

The results indicate that dentists actively engage in tobacco cessation practices, hold positive attitudes toward AI-powered smoking cessation tools, and demonstrate high readiness for adoption (Readiness Index Mean = 4.24, SD = 0.54). However, gaps in formal training and awareness remain the primary barriers to effective implementation.

V. Discussion, Conclusion and Recommendations

This chapter discusses the findings of the study in relation to the objectives and existing literature. It further presents the conclusions drawn from the

results, outlines the implications of the study, identifies limitations, and suggests directions for future research.

The findings of the present study align with emerging global evidence suggesting increasing healthcare professional openness toward AI-assisted behavioural interventions. Similar studies conducted in digital healthcare and preventive medicine contexts have reported that clinicians generally perceive AI as a supportive clinical aid capable of improving efficiency, patient engagement, and personalised care delivery.

Discussion of Findings

The present study examined dentists' awareness, attitudes, readiness, and perceived challenges related to the adoption of AI-powered smoking cessation interventions in India. The findings provide important insights into the preventive role of dentists and the feasibility of integrating AI-based tools into routine dental practice.

a. Tobacco Cessation Practices and Preventive Role of Dentists

The results revealed that dentists actively engage in tobacco screening and cessation counselling, as indicated by high mean scores for screening frequency and confidence in providing cessation advice. This finding is consistent with earlier research that emphasises dentists' strategic position in tobacco control due to frequent patient contact and early identification of oral manifestations of tobacco use. The strong agreement regarding dentists' responsibility in smoking cessation reinforces the preventive orientation of contemporary dental practice.

However, existing literature suggests that despite recognising this role, dentists often face challenges in consistently implementing cessation counselling due to time constraints and lack of structured support. The present findings indicate that while motivation and confidence are high, additional support systems are necessary to strengthen routine implementation.

b. Awareness and Attitudes Toward AI-Based Smoking Cessation Tools

The study found high awareness of AI applications in healthcare among dentists, although awareness of AI specifically applied to smoking cessation was comparatively lower. This gap highlights the difference between general technological awareness and applied clinical knowledge. Similar observations have been reported in studies examining digital health adoption among healthcare professionals.

Attitudes toward AI-powered smoking cessation tools were largely positive, with respondents agreeing that AI can support behavioural change, personalise cessation plans, improve outcomes, and save consultation time. The overall Attitude Index score reflects favourable perceptions toward integrating AI into dental practice. These findings align with technology acceptance models, which identify perceived usefulness as a key determinant of adoption intention.

c. Readiness for Adoption and Training Needs

A key finding of the study is the high level of readiness among dentists to adopt AI-based smoking cessation tools, with the majority expressing willingness to use such tools if they are evidence-based and user-friendly. This indicates a strong openness to technological innovation within dental practice. The structural relationship findings further suggest that positive attitudes toward AI function as an important mediating pathway between awareness and readiness for adoption.

Despite this readiness, formal training exposure related to AI was limited (Mesko & Topol, 2023).

Significant associations between institutional type and AI training exposure, as well as between age group and interest in AI training, suggest that access to training opportunities is uneven. These findings underscore the importance of structured and accessible training programs to translate readiness into effective adoption.

d. Perceived Challenges in Implementation

The most prominent challenges identified were lack of training, limited awareness, time constraints, and cost considerations. Importantly, these barriers are structural rather than attitudinal, indicating that resistance to AI adoption is minimal. This pattern mirrors findings from other studies in healthcare technology adoption, particularly in low- and middle-income country contexts.

Within the Indian healthcare context, the integration of AI-enabled behavioural interventions may face additional challenges related to uneven digital infrastructure, disparities in technological literacy, and variability in institutional readiness across urban and semi-urban clinical settings. Nevertheless, India's expanding digital health ecosystem and increasing governmental emphasis on AI-enabled healthcare innovation provide favourable conditions for future implementation within preventive dental practice (NITI Aayog, 2021; World Health Organization, 2024). Addressing these barriers through institutional support, simplified AI tools, and integration into existing workflows may enhance feasibility and sustainability of implementation.

Ethical Considerations in AI-Enabled Smoking Cessation

The integration of AI-powered smoking cessation interventions into dental practice raises important ethical considerations related to patient privacy, informed consent, data security, and algorithmic transparency (Harrer, 2023; Reddy et al., 2020). AI systems used in behavioural counselling should operate within established ethical and regulatory frameworks to ensure responsible healthcare delivery.

The implementation of AI-assisted smoking cessation interventions should follow a human-centred AI approach in which technological systems enhance, rather than replace, professional clinical judgement and patient–provider interaction.

Dentists must maintain professional oversight while using AI-assisted counselling tools to avoid excessive technological dependence and preserve patient-centred care. Additionally, ensuring equitable access to AI-based interventions remains critical, particularly within diverse socio-economic and digital literacy contexts in India. Responsible AI implementation should therefore prioritise transparency, explain ability, and human supervision in clinical decision-making (Ong et al., 2024; World Health Organization, 2024).

CONCLUSION

The present study concludes that dentists in India demonstrate strong engagement in tobacco cessation practices and hold positive attitudes toward AI-powered smoking cessation interventions. Readiness for adoption is high, reflecting openness to integrating digital tools into preventive dental care. However, gaps in formal training and practical exposure to AI technologies remain significant barriers.

The study establishes an important empirical foundation for integrating AI-powered smoking cessation interventions within preventive dental practice in India. Dentists demonstrated

favourable attitudes, strong professional commitment toward tobacco cessation, and high readiness for AI adoption despite limited formal technological training. These findings indicate substantial potential for leveraging AI-supported behavioural interventions to strengthen preventive oral healthcare and national tobacco control efforts. The observed structural relationships among awareness, attitude, training exposure, and readiness further reinforce the applicability of technology adoption frameworks within preventive dental healthcare settings.

These findings align with broader global healthcare trends emphasising ethically governed, human-centered, and digitally integrated preventive healthcare systems (Rajpurkar et al., 2022; World Health Organization, 2024). Strategic investments in training, ethical implementation frameworks, and institutional support systems will be essential to facilitate sustainable integration of AI-enabled cessation tools into routine dental practice.

IMPLICATIONS OF THE STUDY

a. Academic Implications

The study contributes to the growing body of literature at the intersection of dentistry, psychology, and digital health by providing empirical evidence on dentists' readiness for AI adoption in smoking cessation. It highlights the need to incorporate digital health and AI competencies into dental education curricula.

b. Theoretical Implications

The present study extends existing technology adoption literature by contextualising the Technology Acceptance Model (TAM) and Unified Theory of Acceptance and Use of Technology (UTAUT) within preventive dental healthcare and tobacco cessation practice. The findings suggest that perceived usefulness, awareness, and training exposure play a significant role in shaping dentists' attitudes and readiness toward AI adoption.

The study further contributes to emerging interdisciplinary literature connecting behavioural healthcare, preventive dentistry, and digital health innovation within developing healthcare systems. By integrating behavioural, professional, and technological dimensions into a unified analytical framework, the study provides a contextual foundation for future AI adoption research within oral healthcare settings.

c. Clinical Implications

From a clinical perspective, AI-powered smoking cessation tools can support dentists by enhancing efficiency, personalisation, and consistency of counselling. Such tools may help overcome time constraints and support sustained patient engagement beyond the dental chair.

d. Public Health and Policy Implications

Integrating AI-based smoking cessation interventions into dental practice can strengthen population-level tobacco control strategies. Policymakers and professional bodies may consider developing guidelines, accreditation incentives, and funding mechanisms to promote AI-enabled preventive care.

Administrative and Institutional Implications

Dental institutions, clinic administrators, and healthcare organisations may play a critical role in facilitating AI integration by investing in digital infrastructure, professional development programs, and evidence-based clinical support systems. Institutional leadership and administrative readiness are likely to influence the pace and effectiveness of AI adoption within preventive dental practice. Establishing interdisciplinary collaboration between dental professionals, behavioural specialists, and

technology developers may further support sustainable implementation.

Practical Implementation Framework for AI-Powered Smoking Cessation Interventions in Dental Practice

Based on the study findings, a phased implementation framework is recommended for integrating AI-powered smoking cessation interventions into dental practice settings in India:

1. Awareness and Sensitisation : Conduct continuing dental education (CDE) programs focused on AI applications in preventive dentistry and behavioural counselling.
2. Professional Training and Skill Development : Introduce structured training modules on AI-assisted patient communication, digital health tools, and ethical AI practices within dental education and professional development programs.
3. Clinical Integration : Integrate evidence-based AI-powered smoking cessation tools into routine patient counselling workflows to improve efficiency and consistency of behavioural interventions.
4. Institutional and Policy Support : Encourage professional dental bodies, academic institutions, and public health agencies to develop guidelines, accreditation support, and digital infrastructure for responsible AI implementation.
5. Monitoring and Evaluation : Establish mechanisms for evaluating usability, patient engagement, counselling effectiveness, and ethical compliance following AI implementation.

Table 11. *Practical Implications for Stakeholders in AI-Powered Smoking Cessation Interventions*

Stakeholder	Practical Implication
Dentists	Adoption of AI-assisted smoking cessation counselling tools to improve efficiency and patient engagement
Dental Colleges	Integration of AI, digital health, and behavioural counselling modules into dental curricula
Policymakers	Development of regulatory guidelines and ethical frameworks for AI-enabled preventive healthcare
Public Health Agencies	Expansion of AI-supported tobacco cessation programs within community oral healthcare systems
Professional Bodies	Organisation of continuing dental education (CDE) programs on AI applications in dentistry
Technology Developers	Development of user-friendly, evidence-based, and ethically compliant AI cessation platforms

Strengths of the Study

The study possesses several notable strengths. It addresses an emerging interdisciplinary area at the intersection of preventive dentistry, behavioural healthcare, and artificial intelligence. The study further integrates established technology adoption frameworks with practical behavioural healthcare applications within the Indian dental context. Inclusion of inferential statistical analysis, conceptual modelling, and ethical AI considerations enhances the

comprehensiveness and contemporary relevance of the research.

Limitations of the Study

Despite its contributions, the study has certain limitations. The cross-sectional design limits causal inference. The use of convenience sampling restricts generalisability of the findings. Data were based on self-reported responses, which may be influenced by social desirability bias. Additionally, the study assessed readiness and perceptions rather than actual usage behaviour or patient outcomes.

Despite these limitations, the study provides valuable exploratory evidence regarding dentists' readiness for AI-powered smoking cessation interventions within an emerging and under-researched area of preventive dental healthcare. The exploratory structural relationship analysis should be interpreted cautiously due to the moderate sample size and cross-sectional nature of the study.

Recommendations for Future Research

Future studies should adopt longitudinal and experimental designs to evaluate the effectiveness of AI-based smoking cessation tools in dental settings. Research involving larger and more diverse samples across different regions of India would enhance generalisability. Exploring patient perspectives on AI-supported cessation counselling and examining ethical considerations related to data privacy and algorithmic decision-making would further enrich understanding.

Broader Significance of the Study

The convergence of behavioural healthcare, preventive dentistry, and artificial intelligence represents an emerging frontier in contemporary healthcare delivery. By examining dentists' readiness for AI-powered smoking cessation interventions within the Indian context, the present study contributes to broader discussions regarding digital transformation, preventive public health innovation, and technology-enabled behavioural care. The findings indicate that AI-supported preventive interventions may strengthen continuity of care, improve accessibility of behavioural counselling, and enhance long-term public health outcomes when implemented within ethically responsible and professionally supervised clinical frameworks.

Future Outlook

The future of preventive dentistry is likely to be increasingly shaped by intelligent digital ecosystems integrating behavioural analytics, conversational AI, predictive risk assessment, and personalised patient engagement platforms (Jung et al., 2025; Ghaffari et al., 2024). AI-assisted smoking cessation interventions may evolve into integrated chairside and remote-care support systems capable of enhancing continuity of care and long-term behavioural outcomes. As healthcare systems continue to embrace digital transformation, dentists may increasingly function within technologically augmented preventive healthcare environments requiring both clinical and digital competencies.

Final Summary

In summary, the study establishes a strong empirical foundation for integrating AI-powered smoking cessation interventions into dental practice in India. Dentists exhibit readiness and positive attitudes toward AI adoption, suggesting favourable conditions for implementation. Addressing training gaps and structural barriers will be critical to realising the full potential of AI in strengthening preventive dentistry and advancing public health goals.

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