ORIGINAL ARTICLE

The Effectiveness of the UMAR Module in Improving Dentists' Knowledge and Attitude in Delivering Smoking Cessation Interventions to Adult Patients: A Pre-post Evaluation

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ABSTRACT

Introduction: Dentists are well-suited to provide smoking cessation interventions, as they can educate patients about the adverse effects of smoking on oral health. Acknowledging the significance of this, the study aims to evaluate the effectiveness of the newly developed UMAR (*Usaha Memerangi Asap Rokok*) module in improving dentists' knowledge and attitudes towards delivering smoking cessation interventions to patients. **Materials and methods:** Between November 2022 and May 2023, a pre-post study was conducted among 80 government dentists working at primary dental clinics in Kelantan. The UMAR module was developed based on the Theory of Planned Behaviour (TPB) and was then disclosed to the participants through workshops that included lectures and practicals. A validated questionnaire was administered before and after the workshop through Google Forms to assess the improvement of knowledge and attitudes. **Results:** Participants' overall knowledge increased significantly from 7.29 (2.194) to 10.39 (1.026), t=10.990, p<0.001. Participants' overall attitudes also increased significantly from 18.64 (1.669) to 19.49 (1.060), t=5.074, p<0.001. There was no significant association between demographic factors, working characteristics, smoking cessation training, and the availability of a quit smoking clinic with the post-intervention knowledge and attitude. **Conclusion:** The UMAR module was effective in improving dentists' knowledge and attitudes towards delivering smoking cessation interventions to patients.
Malaysian Journal of Medicine and Health Sciences (2025) 21(4): 245-255. doi:10.47836/mjmhs.21.4.31

Keywords: Dentists, Smoking cessation intervention, Knowledge, Attitude, Module

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INTRODUCTION

The prevalence of adult smoking is a widely debated topic. Globally, there are over one billion people who smoke, with 847 million being men and 153 million being women aged 15 years and older. Tragically, smoking claimed the lives of over seven million people annually, including more than one million non-smokers (1).

In Malaysia, despite numerous efforts to reduce smoking prevalence, the number of smokers remains high. In 2023, the prevalence of current smokers aged 15 years and above in Malaysia was 19.0% (2), a slight decrease from 21.3% in 2019 (3), 22.8% in 2015 (4) and 23.1% in 2011(5). Smoking also was more prevalent among males (35.7% vs 1.5% among females), in rural areas (21.7% vs. 18.3% in urban areas), and peaked in the 25-44 age group (24.9% vs. 12.7% among those aged 15-24 and 9.3% among those aged 65 and older). Besides, there was an increase in secondhand smoke exposure in restaurants (76.4% vs 68.3% in 2011) and healthcare facilities (18.4% vs 8.6% in 2011) (2).

Unfortunately, smoking has adverse effects on oral health, such as increasing the risk of periodontitis, peri-implantitis, caries, alveolar osteitis, halitosis, and oral cancer (6). Fortunately, dentists can play a key role in showing early signs of smoking during oral examinations. They can visually demonstrate the effects of smoking and smoking cessation directly in the mouths of patients, making them key contributors to smoking cessation intervention programs (7).

Acknowledging the role of dental professionals in addressing smoking cessation, the World Health Organization (WHO) advocates for the integration of

smoking cessation programs within primary oral health care (8). Furthermore, as a signatory country to the WHO Framework Convention on Tobacco Control agreement, Malaysia has included inter-agency collaboration as one of the strategies to reduce tobacco use and smoking prevalence. Presently, government dentists in Malaysia are actively engaged in delivering screening and smoking cessation intervention for school children through the *Kesihatan Oral Tanpa Amalan Merokok* (KOTAK) program, which has been operational since 2016 (9). In 2019, 97.4% of 1.95 million secondary school students and 99.4% of 2.70 million primary school students underwent screening through the KOTAK program. Of those screened, 32.5% of current smokers in secondary school and 64.6% in primary school successfully quit smoking (10), indicating the effectiveness of dentists in delivering smoking cessation interventions. This effectiveness was also supported by a systematic review study (11) and a study conducted in Canada, which reported that patients were more likely to quit smoking if supported by dentists (12). Additionally, patients generally respond positively to smoking cessation advice delivered by dentists (13).

However, findings of a prior study in Malaysia showed that only 41.8% of government dentists felt confident in their ability to assist patients in quitting smoking. Moreover, the study indicated that just 8.2% of dentists had knowledge about pharmacotherapy, 27.4% were satisfied with their ability to help patients quit tobacco, and only 21.5% felt confident in delivering ongoing support and monitoring during the smoking cessation process (14). Another study in Malaysia reported that while 97.9% of government dentists felt responsible for delivering smoking cessation interventions, only 34.7% advised their patients to quit, 16.3% offered suggestions regarding pharmacotherapy, and 14.0% referred their patients to a quit-smoking clinic (15). Barriers to implementing smoking cessation interventions included lack of knowledge and skills (15), time constraints (14,15), patient reluctance to seek counselling, and smoking cessation being of lower priority (14). These findings underscore the necessity of enhancing dentists' ability to deliver smoking cessation interventions, and recent findings are crucial for designing more effective training programs for dentists in primary care (16).

Furthermore, the currently available guideline is not specifically designed for dentists (17). Another guideline also did not include the pharmacotherapy components, as it is were intended to help dentists assist school students in quitting smoking (10). Dentists would benefit from acquiring an understanding of pharmacotherapy to assist patients in their smoking cessation endeavours effectively. A previous study indicated that patients exhibited a higher likelihood of achieving smoking cessation when dentists integrated counselling with nicotine replacement therapy (NRT) (11). Furthermore, one of the side effects of NRT is oral irritation, highlighting the necessity of dentists conducting oral examinations before and during NRT use (18). These studies emphasised the importance of developing an educational module specifically for dentists, enabling them to acquire a comprehensive understanding of how to deliver smoking cessation interventions to patients in primary care.

In addition to enhancing dentists' knowledge, the module should also cultivate a positive attitude towards delivering smoking cessation interventions to patients. Therefore, a new module called UMAR (*Usaha Memerangi Asap Rokok*) was developed based on the Theory of Planned Behaviour (TPB). This theory was chosen for its clear framework, which suggests that modifying an individual's behavioural, normative, and control beliefs can change their attitudes, subjective norms, and perceptions of behavioural control, ultimately influencing the individual's intention to engage in a specific behaviour (19). Therefore, the study's objective was to assess the effectiveness of the UMAR module in improving dentists' knowledge and attitudes towards delivering smoking cessation interventions to patients.

MATERIALS AND METHODS

Study Design

A pre-post-study design was conducted from November 2022 to May 2023. A validated, self-administered questionnaire in the Malay language was utilised to assess the effectiveness of a newly developed UMAR module. A sample restriction was implemented to mitigate bias in a single-arm therapy study. Participants who underwent any form of training or education between the pre-and post-data collection periods were excluded from the sample (20).

Study Population and Sample Size Calculation

The study population was dentists working in government primary dental clinics in Kelantan. Kelantan and government dentists were selected considering budget, practicality, and the availability of human resources within the study team. Furthermore, the government dentists were chosen because they are also delivering smoking cessation interventions to schoolchildren (9). Their successful track record (10) makes them well-suited to expand the coverage of smoking cessation interventions to patients visiting primary dental clinics, aligning with WHO recommendations (8).

The inclusion criteria for study participants were Malaysian citizens, while dental specialists, dentists working in specialist clinics or units, or dentists minimally involved in clinical work were excluded. The sample size was determined using the PS Sample Size Calculator, resulting in a range of 57 to 80 samples, with an expected dropout rate of 40.0% at a significant level of 0.05. The selection of the sample size also took into account the practicality and a previous study (21).

Sampling Method and Participants Recruitment

After obtaining ethical approval, participants were recruited for the study. The researcher contacted the Deputy Director of the State Oral Health Division to discuss the study, followed by an online meeting with all District Dental Officers or their representatives to explain its implementation. Then, the researcher emailed the Deputy Director to invite dentists who met the inclusion and exclusion criteria. This email included a poster and a link to the Google Forms for participant recruitment. The email was forwarded to each District Dental Officer and distributed to the dentists. A total of 245 dentists were deemed eligible to participate in this study. Of these, 164 completed the recruitment form, with 110 consenting to take part. After the screening process, ninety-one dentists fulfilled the criteria, from which 80 were conveniently selected to participate in the study.

Questionnaire Development

Questionnaire Domains and Items Selection

The questionnaire used in this study was adapted from the Malay version of the 'Provider's Smoking Cessation Training Evaluation (ProSCiTE)®' developed by Hasan et al. in 2019 (22). Permission to adapt the questionnaire was obtained from the original authors. In the demographic domain, four original items were omitted, and the remaining items were reorganised. In the knowledge domain, the original items were adjusted to evaluate knowledge of the '5A' method based on input from an expert panel and a review of relevant literature. The response options for this section were Yes (score 1), No (score 0), and Do not Know (score 0).

In the attitude domain, five items were retained and reorganised to assess dentists' attitudes towards delivering smoking cessation interventions for patients. Response choices for this section included Strongly Agree (score 4), Agree (score 3), Disagree (score 2), and Strongly Disagree (score 1).

Content Validation and Face Validation

The content validation process engaged six experts, comprising four dental public health specialists, a public health specialist, and a psychiatrist. It was conducted online, with the draft questionnaire and evaluation form sent to the experts through email. Following the experts' evaluation and recommendations, the questionnaire was refined. The Content Validation Index values for each domain fell between 0.83 and 1.00, signifying the questionnaire's relevance and representativeness (23).

The validation process proceeded with face validation, involving panels of 30 dentists from the Kedah State Oral Health Division. This process was conducted online, with instructions provided during a virtual session. The questionnaire was fine-tuned based on the panel's ratings and suggestions. The questionnaire's clarity and comprehensibility, including language and instructions, were confirmed with a Face Validation Index value ranging from 0.97 to 1.00 for each domain (24). The panels also verified that the questionnaire was user-friendly and took an average of 15 minutes to complete when administered through Google Forms.

UMAR Module Development

Module Components and Content Development

The UMAR module aims to train and prepare dentists to provide smoking cessation interventions to patients in primary care settings. It should be noted that this module does not cover e-cigarette smoking cessation. It was developed by a team composed of a dental public health doctorate student and two dental public health specialists. The development process involved conducting an online search for information and then structuring the module's content around three beliefs in the TPB framework: behavioural belief, normative belief, and control belief. This process resulted in the formation of four components of the module (25).

The first component was invented to provide dentists with information about the importance of smoking cessation for adult patients. The content includes covering the epidemiology of adult smoking in Malaysia, the impact of smoking on adult health, its effects on other age groups, and the relationship between smoking, economic burden, and poverty.

The second component was designed to raise awareness among dentists about the importance of delivering smoking cessation interventions to adult patients. This component emphasises the role of dentists, smoking cessation programs, the unique position that dentists hold in this area, patient acceptance, and perception of dentists in this role and their effectiveness and contribution to reducing smoking prevalence among healthcare providers.

The third component was developed to equip dentists with the knowledge to implement smoking cessation interventions for adult patients. It includes methods for asking questions, delivering advice, assessing the patient's readiness to quit smoking using various models and tests, motivating the patient to quit, assisting patients in quitting, as well as arranging and conducting follow-up appointments.

The fourth and final component was designed to improve dentists' skills and ability to offer smoking cessation interventions to adult patients. It consisted of a set of exercises illustrating various scenarios of smoking cessation intervention activities between dentists and adult patients. It also included a scripted dialogue specifically for dentists to give them ideas when conducting smoking cessation counselling or other intervention activities.

Module Delivery Methods

The first and second components were developed and delivered as PowerPoint presentations, along with accompanying scripts, to ensure consistent and effective delivery of the content. The third and fourth components were created as PDF soft copies of a book, with a focus on presenting information through engaging infographics and mind maps. The entire module was written in Malay to be tailored specifically for dentists in Malaysia, where Malay is the primary language.

Module Validation

The module underwent validation using the 'Patient Education Materials Assessment Tool (PEMAT)' (26,27). A panel of six experts, including four dental public health specialists, a public health specialist, and a psychiatrist, participated in this process (28). The draft of the UMAR module and evaluation form was emailed to the experts, and subsequent improvements were made based on their recommendations. The module scored between 94.8% and 100.0% for actionability and between 93.6% and 100.0% for understandability (27,29). After that, the module underwent a thorough review for spelling errors, formatting, font type and size, numbering, and spacing before it could be utilised.

Data Collection Process

Pre-Intervention Phase

The data collection process for this study was conducted in two phases: a pre-intervention phase and a post-intervention phase. During the pre-intervention phase, the response rate was 93.0% or 80 participants. The researcher reached out to participants through WhatsApp using the contact numbers obtained during recruitment. Each participant was provided with a link to the Google Forms containing the study title, participant information sheet, informed consent form, participant ID, pre-intervention questionnaire, and a submit button. Participants were required to provide informed consent before completing the questionnaire, and those who did not consent were directed to the 'Submit' button. Participants were given one week to complete the questionnaire, with two reminders sent to those who did not respond.

Intervention Phase

The intervention phase was conducted as a half-day session, a face-to-face workshop. The workshop commenced with lectures on the initial three components of the UMAR module, followed by participants being organised into small teams of three or four for practical sessions. They were then assigned various tasks based on the practical set in the fourth module component. The practical session involved role-playing, with participants acting as dentists counselling adult patients on smoking cessation. This study did not involve real patients. Instead, participants acted as both the dentist and the patient. Participants were given the option to use their dialogues or follow the script provided in the fourth component of the module. Following the practical session, there was a discussion and a question-and-answer session.

Post-Intervention Phase

The post-intervention data collection was conducted two weeks after the workshop ended. Participants were once again reached out to on WhatsApp and requested to complete the post-intervention questionnaire in Google Forms. They were given a week to submit their responses, and two reminders were sent to those who had not completed the questionnaire. The post-intervention data collection achieved an 87.5% response rate, with 70 participants completing the questionnaire. Dropouts from the study resulted from other work commitments.

Data Analysis

The data from Google Forms was exported to an Excel spreadsheet and then transferred into IBM SPSS 26.0 for analysis. Following data cleaning and normality distribution checks, a descriptive analysis was conducted to explore demographic characteristics, working characteristics, smoking cessation training and availability of quit-smoking clinics. The data analysis was followed by a paired t-test analysis to compare pre- and post-intervention data, using a statistical significance level of 0.05. Multiple linear regression analysis was performed to uncover any potential association between demographic factors, working characteristics, smoking cessation training, and the availability of quit-smoking clinics with the post-intervention knowledge and attitude. The overview of participant recruitment and data collection processes is shown in Figure 1.

Ethical Clearance

This study was registered with the National Medical Research Register and approved by the Oral Health Program of the Ministry of Health, the Human Research

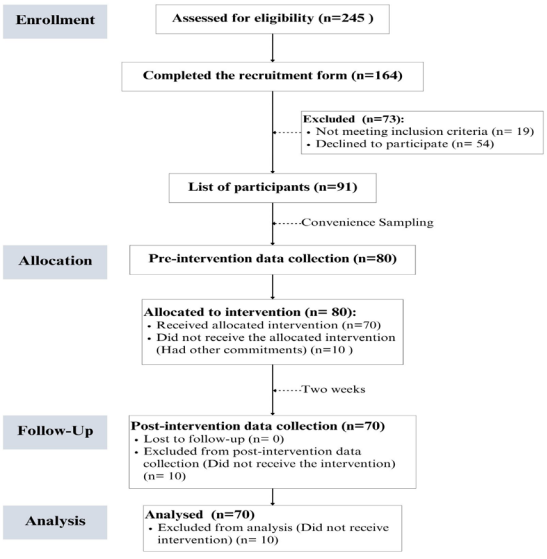

Figure 1: Study flow diagram

Ethics Committee of Universiti Sains Malaysia (JEPeM Code: USM/JEPeM/22010002), and the Medical Review and Ethics Committee (NMRR ID-22-01191-VUM (IIR)).

RESULTS

Participant Characteristics

The mean (SD) age of the participants was 33.1 (4.13) years. Most of the participants were female (82.5%). All the participants were Malays, with 73.8% of them graduating from a local university. Almost all participants (96.3%) were non-smokers (Table I). The mean (SD) work experience of the participants was 8.2 (4.14) years. Participants estimated that they spent 20.5 (7.72) minutes per patient during treatment, and 38.8% of them estimated that 0% to 25% of their patients were smokers. A total of 15.0% of the participants had received smoking cessation training, and 65.0% were aware of a smoking cessation clinic available at their workplace (Table II).

Table I: Participants' demographic characteristics (n=80)

Variables	n (%)
1. Age (Years) [Mean (SD)]	33.1 (4.13)
2. Gender	
Male	14 (17.5)
Female	66 (82.5)
3. Ethnicity	
Malay	80 (100.0)
Others	0
4. Religion	
Islam	80 (100.0)
Others	0
5. Highest Qualification	
Bachelor	76 (95.0)
Master	4 (5.0)
Others	0
6. Undergraduate Training	
Local	59 (73.8)
International	21 (26.3)
7. Smoking Status	
Current Smokers	1 (1.3)
Ex-Smokers	2 (2.5)
Non-Smoker	77 (96.3)

%, percentage; n, frequency

Table II: Participants' working characteristics, smoking cessation training and availability of quit smoking clinic (n=80)

Variables	n (%)
1. Working Experience (Years) [Mean (SD)]	8.2 (4.14)
2. Estimated Time Spent with Each Patient (Minutes) [Mean (SD)]	20.5 (7.72)
3. Estimated Percentage of Adult Patients Smoking	
0%-25%	31 (38.8)
26%-50%	29 (36.3)
51%-75%	16 (20.0)
76%- 100%	1 (1.3)
Not Sure	3 (3.8)
4. Attended Smoking Cessation Program	
Yes	12 (15.0)
No	68 (85.0)
5. Last Time Attended Program	
1 Month Ago	2 (16.7)
3 Months Ago	1 (8.3)
6 Months Ago	1 (8.3)
More Than 6 Months Ago	8 (66.7)
6. Attended Smoking Cessation Program Organised By	
Organisation	8 (66.7)
Other	4 (33.3)
Both	0
7. Perceived Adequate Smoking Cessation Training	
Adequate	4 (33.3)
Inadequate	4 (33.3)
Unsure	4 (33.3)
8. Availability of Quit Smoking Clinic at Practise	
Yes	52 (65.0)
No	13 (16.3)
Not Sure	15 (18.8)

%, percentage; n, frequency

Comparison of Participants' Knowledge and Attitude Pre- and Post- Intervention

The paired t-test analysis revealed a significant increase in the mean (SD) total knowledge of the participants, rising from 7.29 (2.194) to 10.39 (1.026), with a t-value of 10.990 and $p<0.001$. Significant knowledge improvements were observed in areas related to assessing nicotine levels, the importance and process of setting a quit date, NRT, side effects of using nicotine gum, managing withdrawal symptoms, and the timing

of conducting a follow-up appointment (Table III). In addition, Table IV showed a statistically significant increase in the mean (SD) total attitude of the participants from 18.64 (1.669) to 19.49 (1.060), with t=5.074 and p<0.001.

Table III: Paired sample t-test comparing the results pre- and post-intervention for each item and the overall knowledge score (n=70)

Items	Pre-Intervention	Post-Intervention	95% CI for meandifference	t	p
	Mean (SD)	Mean (SD)			
1. 'Ask' in method 5A means that all adult patients should be asked about their smoking status.	0.94 (0.234)	0.99 (0.120)	-0.020 to 0.106	1.349	0.182
2. 'Advice' in method 5A means smoking cessation advice given only to adult patients who are interested in quitting smoking.	0.61 (0.490)	0.66 (0.478)	-0.094 to 0.180	0.623	0.535
3. The 'Stages of Change Model' is used to assess the willingness of adult patients to quit smoking.	0.69 (0.468)	0.86 (0.352)	0.037 to 0.306	2.543	0.013
4. The level of nicotine addiction can be determined based on the Fagestrom test.	0.89 (0.320)	0.99 (0.120)	0.17 to 0.183	2.412	0.019
5. The body's nicotine level can be analysed using a carbon monoxide level screening test through exhalation.	0.34 (0.478)	0.90 (0.302)	0.431 to 0.683	8.820	<0.001
6. For adult patients who are ready to quit, the smoking cessation date should be set within two weeks after the smoking cessation readiness assessment session.	0.54 (0.502)	0.99 (0.120)	0.324 to 0.562	7.406	<0.001
7. For adult patients who are not ready to quit smoking, the dental officer does not need to discuss with the patient to set a smoking cessation date.	0.53 (0.503)	0.79 (0.413)	0.118 to 0.396	3.697	<0.001
8. The 5R method (Relevance, Risks, Rewards, Roadblocks, Repetition) is used to motivate adult patients who are not ready to quit smoking.	0.61 (0.490)	0.73 (0.448)	-0.018 to -246	1.730	0.088
9. NRT, such as gum and patches, requires a prescription from a medical/dental/pharmacy officer.	0.23 (0.423)	0.69 (0.468)	0.324 to 0.590	6.872	<0.001
10. Irritation in the mouth is a possible side effect of chewing gum NRT.	0.60 (0.493)	0.96 (0.204)	0.235 to 0.479	5.839	<0.001
11. The 'Delay' method is one of the strategies to control nicotine withdrawal symptoms.	0.76 (0.432)	0.99 (0.120)	0.120 to 0.337	4.194	<0.001
12. A follow-up appointment should be made within a week of the quit date.	0.54 (0.502)	0.87 (0.337)	0.178 to 0.479	4.359	<0.001
Total knowledge score	7.29 (2.194)	10.39 (1.026)	2.537 to 3.662	10.990	<0.001

The significance level was set at 0.05. The knowledge item was scored yes (1) or no (0), with a maximum score of 12.

Table IV: Paired sample t-test comparing the results pre- and post-intervention for each item and the overall attitude score (n=70)

Items	Pre-Intervention	Post-Intervention	95% CI for mean difference	t	p
	Mean (SD)	Mean (SD)			
1. Dentists must advise all adult patients who smoke to stop smoking.	3.73 (0.448)	3.90 (0.347)	0.064 to 0.279	3.191	0.002
2. Dentists must attend a SCI training course during their service period.	3.67 (0.473)	3.83 (0.380)	0.038 to 0.276	2.628	0.011
3. Dentists must be an example to adult patients by not smoking.	3.84 (0.367)	3.94 (0.234)	0.008 to 0.192	2.165	0.034
4. Dentists must ask pregnant women and their partners about their smoking status.	3.73 (0.448)	3.91 (0.282)	0.076 to 0.295	3.380	0.001
5. Dentists must assist adult patients who are ready to quit smoking.	3.67 (0.473)	3.90 (0.473	0.120 to 0.337	4.194	<0.001
Total attitude score	18.64 (1.669)	19.49 (1.060)	0.511 to 1.174	5.074	<0.001

The significance level was set at 0.05. Attitudes were measured by scoring strongly agree (4), agree (3), disagree (2) and strongly disagree (1) for each item with a maximum total score of 20.

Factors Association with the Improvement of Knowledge and Attitude

Multiple linear regression analysis showed no significant association between demographic factors, working characteristics, smoking cessation training, and the availability of a quit smoking clinic with the post-intervention knowledge and attitude (p>0.05), as shown in Tables V and VI.

Table V: Multiple regression association of demographic factors, working characteristics, smoking cessation training and availability of quit smoking clinic with post-intervention knowledge

Variable	Unstandardised coefficient		Standardised coefficient	t	p
	B	Std. error	Beta		
(Constant)	6.845	3.281		2.086	0.041
Age	0.145	0.119	0.601	1.221	0.227
Gender	0.456	0.365	0.174	1.248	0.217
Highest Qualification	-0.493	0.685	-0.098	-0.719	0.475
Undergraduate Training	-0.159	0.317	-0.067	-0.502	0.617
Smoking Status	-0.285	0.677	-0.057	-0.422	0.675
Working Experience	-0.173	0.118	-0.716	-1.468	0.147
Estimated Time Spent with Each Patient	-0.002	0.018	-0.014	-0.106	0.916
Estimated Percentage of Adult Patients Smoking	0.168	0.138	0.166	1.218	0.228
Attended Smoking Cessation Program	-0.012	0.368	-0.004	-0.033	0.973
Availability of Quit Smoking Clinic at Practise	0.192	0.173	0.152	1.110	0.272

The significance level was set at 0.05.

Table VI: Multiple regression association of demographic factors, working characteristics, smoking cessation training and availability of quit smoking clinic with post-intervention attitude

Variable	Unstandardised coefficient		Standardised coefficient	t	p
	B	Std. error	Beta		
(Constant)	17.467	3.315		5.269	<.001
Age	0.079	0.120	0.317	0.659	0.513
Gender	-0.480	0.369	-0.177	-1.301	0.198
Highest Qualification	0.164	0.692	0.032	0.237	0.813
Undergraduate Training	0.510	0.320	0.208	1.593	0.117
Smoking Status	0.291	0.684	0.056	0.426	0.672
Working Experience	-0.086	0.119	-0.347	-0.727	0.470
Estimated Time Spent with Each Patient	0.004	0.018	0.033	0.250	0.803
Estimated Percentage of Adult Patients Smoking	0.156	0.140	0.149	1.118	0.268
Attended Smoking Cessation Program	-0.222	0.372	-0.077	-0.598	0.552
Availability of Quit Smoking Clinic at Practise	-0.164	0.175	-0.125	-0.937	0.353

The significance level was set at 0.05.

DISCUSSION

This study investigated the effectiveness of a newly developed smoking cessation education module tailored for dentists. The findings indicated a significant increase in dentists' knowledge and attitudes toward delivering smoking cessation interventions to patients. Although overall knowledge improved, certain specific aspects showed progress but were not significant, potentially due to existing knowledge in those areas. These findings might be attributed to dentists' current involvement in delivering smoking cessation interventions to school students, highlighting their comprehensive understanding and practical experience (10).

Meanwhile, a significant improvement was observed across various other aspects, including increased knowledge about the 'Stages of Change Model'. The findings aligned with a prior study conducted on other healthcare professionals in Malaysia, namely doctors, pharmacists, nurses, and medical assistants (30). Enhancing understanding of this model is valuable, as a study in Taiwan revealed its effectiveness in enabling healthcare providers to offer personalised smoking cessation, thereby reducing the likelihood of patients relapsing into smoking (31). Furthermore, dentists, through employing this model, can gain insights into the patient's motivations and obstacles faced in quitting smoking and subsequently can aid patients in formulating strategies to overcome these barriers (32).

Besides, a significant improvement in knowledge

was noticed concerning the understanding of carbon monoxide monitoring, similar to the findings of a study involving other healthcare providers in Malaysia (30). Throughout the workshop, dentists were introduced to the importance of conducting carbon monoxide monitoring and were given the opportunity to practice using the Smokerlyzer® device. Mastery of this method is important to help increase patient motivation by demonstrating a decrease in carbon monoxide levels in patients' breathing. It also enables the monitoring of patients' progress in quitting smoking (33).

The knowledge in assisting patients with setting a quit date and planning personalised smoking cessation strategies was also significantly increased. This improved knowledge will better prepare dentists to anticipate their patients' capability to quit smoking, prevent relapse, and comprehend the diverse motivations behind quitting (34). Consequently, in future, dentists can be expected to effectively guide patients in formulating customised plans to quit smoking in the future, thereby reducing the likelihood of failure to quit smoking, which will minimise patient frustration (35) and dentist burnout (36).

In a previous study conducted in Malaysia, doctors, pharmacists, nurses, and medical assistants showed increased confidence in offering NRT (30). Despite dentists being less involved in NRT, the finding of this study indicated a significant increase in dentists' knowledge about NRT types, dosages, administration methods, indications, contraindications, and side effects. Understanding NRT is important, as a previous study demonstrated that smoking cessation counselling delivered by dentists in combination with NRT could effectively enhance patients' intention to quit smoking (11). Additionally, a study revealed that the use of gum-type NRT may result in increased oral symptoms, highlighting the importance of dentists examining patients' mouths before and during the use of gum-type NRT (18).

Besides that, the dentists' understanding of the importance of scheduling follow-up appointments and knowing what to do during these appointments significantly increased. This knowledge is crucial because patients often struggle with the strong urge to smoke, especially in the initial phase of quitting (8). Furthermore, a study revealed that patients found it challenging to adhere to patch-type NRT, especially in the first month of quitting, due to forgetfulness or experiencing side effects. Therefore, it is essential to follow up with patients who have recently quit smoking to understand their challenges and review the prescribed therapy (37).

Furthermore, this study indicated that dentists possess a favourable attitude towards implementing smoking cessation interventions for their patients, possibly attributed to their exposure to knowledge about the hazards of smoking during their education (38). Another study conducted in Malaysia revealed that the attitudes of other healthcare providers improved after they received training to offer smoking cessation interventions (30). Moreover, the dentists' attitude towards setting a positive example by refraining from smoking also showed significant improvement. This finding is particularly promising, considering a prior study in Perak, Malaysia, which found that a majority of primary healthcare providers have relatives and friends who smoke (38).

Meanwhile, this study found no significant associations between demographic factors, working characteristics, smoking cessation training, and the availability of quit-smoking clinics with improved knowledge and attitude post-intervention. A previous study also revealed no significant association between demographic variables and the TPB element or intention. This finding indicates that the UMAR module might have effectively influenced the improvement of knowledge and attitude (39).

The effectiveness of this module may have been influenced by numerous factors, one of which is the use of the TPB model as a framework for its development. The content of the module was structured to alter dentists' behavioural, normative, and control beliefs, which might lead to improving their knowledge and attitudes towards delivering smoking cessation interventions for patients, in line with a finding from a previous study in Iran (21). Similarly, a study from Canada revealed a significant increase in the attitudes of nurses and nursing students after they participated in a theory-based e-learning program focusing on smoking cessation, unhealthy eating habits, and medication abstinence (40).

The module's effectiveness can also be attributed to its fourth component, which emphasises practical training. During the workshop, dentists engaged in role-play to simulate smoking cessation counselling and intervention activities, potentially enhancing their understanding of the material (41). This finding aligns with a study in Korea, which demonstrated the efficacy of role-playing in improving knowledge and skill acquisition, comparable to real patient practice (42). Additionally, a study in Germany found it to be more cost-effective. (43).

Last but not least, the effectiveness of this module may be attributed to its comprehensibility and usability, which were assessed using PEMAT, as reported by another study in Malaysia (27). In this study, PEMAT was used to ensure that dentists could understand the module's content, that the sentences used were easy to comprehend, that the information was well-organised and presented, and that each piece of information had a summary. Besides that, the content of this module was also ensured to be presented with an appropriate layout and the important content was highlighted. The content

was meticulously developed with detailed explanations and clear steps for users to follow, ensuring successful implementation (26).

Strengths and Limitations of The Study

This study's strength lies in the development of a questionnaire based on the '5A' method to assess knowledge about delivering smoking cessation interventions to patients. Therefore, it might provide insight into which aspects of the 5A method dentists may struggle with, making it more manageable to plan relevant training for them. However, this study also has limitations. For instance, the data collected relies on self-reporting, which may lead to subjective judgments, especially in the attitude section. Additionally, the lack of long-term follow-up makes it difficult to assess the real impact of the module's effectiveness and the extent to which knowledge and attitudes can be retained. Furthermore, since the study only involves one state in Malaysia, future research should consider a larger sample size and proportionate sampling to ensure the generalizability and validity of the findings.

CONCLUSION

The UMAR module has been found to effectively improve the knowledge and attitudes of dentists regarding providing smoking cessation interventions to patients. Dentists should continue to receive education and training in order to stay updated on the latest smoking cessation techniques and to maintain a positive attitude towards incorporating such interventions for patients. In the future, patients will have a wider range of healthcare providers to assist them in quitting smoking, including dentists at government primary dental clinics. This initiative will help in reducing smoking prevalence among adults and minimising the adverse oral effects associated with smoking.

ACKNOWLEDGEMENT

The authors would like to thank the Director General of Health Malaysia for the permission to publish this paper. Sincere thanks to the Principal Director of Oral Health, Ministry of Health, Deputy Directors of Kelantan and Kedah State Oral Health Division, District Dental Officers of Kelantan State Oral Health Division, panel experts, and all those who are directly and indirectly involved in this study.

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