**Co-producing an intervention for tobacco cessation and improvement of oral health among diabetic patients in Bangladesh.**

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**Abstract**

Background: Tobacco consumption is considered as a major risk factor for many diseases including diabetes and has deleterious effects on oral health. Diabetic parents are vulnerable for certain oral conditions. So far, no studies attempted to co-develop a tobacco cessation intervention to be delivered at dental clinics for people with diabetes.

Aim: To co-produce a tobacco cessation intervention for use in dental clinics for diabetic patients in Bangladesh.

Objectives: To assess: 1) patients’ perception of tobacco cessation support delivered by dentists 2) current tobacco cessation support provision by the dentists 3) barriers and facilitators of delivering a tobacco cessation intervention at a dental clinic, and to 4) co-produce a tobacco cessation intervention with diabetic patients, dentists and public health research experts, to be delivered at dental clinics for people with diabetes.

Methods: The study was conducted in the dental department of Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorders (BIRDEM), the largest diabetic hospital in Bangladesh, in two stages: Stage 1 (July 2019) consisted of a cross sectional survey among 35 tobacco user diabetic patients to address the first objective, and a workshop with dentists and consultations with patients to address the second and third objective. Stage 2 (January 2020) consisted of consultations with patients, and a workshop with dentists to co-produce the intervention.

Result: All 35 participating patients were interested in receiving tobacco cessation support from their dentist. We identified important barriers and facilitators to deliver tobacco cessation intervention within dental services. Dentists are willing to provide support but currently there is no structured support system or training available. It would be feasible to deliver tobacco cessation intervention if properly designed to fit with the activity of the dental department of BIRDEM. The intervention was built on behaviour change techniques delivered within brief advice using a flipbook, a short video on the harmful effects of tobacco and a pharmacotherapy.

Conclusion: Incorporation of tobacco cessation into dental care for diabetic people was considered feasible and would provide a unique opportunity to support this vulnerable group in quitting tobacco.

**Introduction**

Tobacco use (smoking and smokeless) is a known risk factor for many chronic diseases, which are the major health challenges and economic burden [1]. Evidence shows that smoking has an adverse impact on oral health, which includes increase risk of gum disease and tooth loss [2]. Smoking has been recognized as one of the most biggest risk factors for periodontitis (disease of tooth supporting bone and soft tissue) [3]. It accelerates periodontitis and can worsen its response to dental treatment and recovery [4] as smoking could impair the periodontal tissue's ability to heal [5]. Some common conditions such as discoloration of teeth and dental restorations, bad breath, taste and smell disorders can be also seen as a result of smoking [6]. Smokeless tobacco (ST) is equally, if not more harmful for oral health. ST consumed in South-East Asia (SEA) contains harmful chemicals [7], which are known risk factors for oral cancers and increase the risk of different oral lesions including potentially malignant disorders [8, 9].

Globally 463 million people have diabetes and a majority of them are from SEA Region [10]. Diabetes is a major health challenge in SEA [11] with high regional prevalence in adults of 8.8% [12]. Like other comorbid conditions, diabetic patients are more prone to certain oral diseases [13]. A review showed higher prevalence of oral mucosal disorders in diabetic patients (45–88%) in comparison to non-diabetic population (38.3–45%) [14]. Periodontitis is considered as the sixth common complication of diabetes [15]. Evidence suggests that there is bidirectional association between periodontal disease and diabetes mellitus (DM) [16–19]. Treating periodontal infections can be influential in contributing to glycaemic control and vice versa [17]. As tobacco use increases the risk of both diabetes and oral diseases, therefore, tobacco cessation is particularly important for diabetic patients to improve their general and oral health. A review of more than 200 studies concluded that there is a clear need to increase the frequency of smoking cessation advice and counselling for patients with diabetes [20]. ‘The National Diabetes Education Program’ has identified specific providers including dentists to work together through interdisciplinary collaboration and to implement evidence-based strategies to ask, advise, and assist patients in reducing risk and encouraging healthy behaviors, including smoking cessation [21]. It is therefore important to offer tobacco cessation support to diabetic patients who use tobacco, as part of routine dental care.

Patients diagnosed with oral lesions or advanced periodontitis experience worries about oral cancer or fear of losing teeth (respectively). This provides a ‘teachable moment’, which is conceptualized as events or sets of circumstances that can lead patients to alter their health behaviour positively [22]. Dental health professionals can use this opportunity to offer tobacco cessation advice [23] , although this opportunity is rarely taken. Evidence from a systematic review by Holliday et al. (2021) (findings from 20 studies, 15 included either smoking or both smoking and smokeless tobacco use and 5 included smokeless tobacco user only) showed that behavioural interventions using different behaviour change techniques (BCTs) on tobacco cessation conducted by oral health professionals in routine service increases tobacco abstinence rates by 1.9% at six months follow-up compared to usual care and by 2.8% when behavioural interventions were combined with the provision of nicotine replacement therapy (NRT) [24].

Based on the trans-theoretical model, there are several stages of behavior change (pre-contemplation, contemplation, preparation, action, and maintenance) [25, 26]. People changing their smoking behavior emphasize on different processes at particular stages of change. For example, they use the fewest processes of change during precontemplation; emphasize consciousness raising during the contemplation stage; emphasize self-reevaluation in both contemplation and action stages; emphasize self-liberation, a helping relationship, and reinforcement management during the action stage; and use counterconditioning and stimulus control the most in both action and maintenance stages [27]. Reflecting on different theories, the interventions at dental setting usually included multi component tobacco cessation intervention in conjunction with an oral examination as a consistent intervention component that was also provided in control groups [28]. Interventions usually included brief advice in combination with different intervention components like video based cessation with phone follow up [29–31], quitline referral [32]. Some studies included 5 A’s intervention (ask, advise, assess, assist, arrange counselling with quitline referral as an option at provider's discretion), 3 A's (ask, advise, arrange quitline referral) [33], counselling using the 5 A's plus NRT [34], brief 'tailored' tobacco advice, assistance using population-specific printed material & NRT [35].

Evidence also showed that behavioural interventions are effective in improving oral health related behaviours [36]. Quitting tobacco and maintaining oral hygiene through behavioural change intervention could improve oral and general health including better control of blood glucose among diabetic patients. Therefore, incorporation of tobacco cessation into dental care for this vulnerable group would provide a unique opportunity for supporting this patient group in quitting tobacco use. However, such a facility is very limited in the low and middle-income country (LMIC) setting in SEA.

Bangladesh is a country in SEA with higher prevalence of diabetes in adults(8.1%). The International Diabetes Federation estimated 7.1 million people with diabetes in Bangladesh and almost an equal number with undetected diabetes [37]. Recent Global Adult Tobacco Survey (GATS) showed that the prevalence of tobacco use is high in Bangladesh (18% smoker and 20.6% ST user) [38]. The level of addictiveness for ST is high among the users [39]. A study found that about 34% of diabetic patients estimated to be using tobacco [40]. Oral diseases are also common among diabetic population in this country [41]. Increasing prevalence of diabetes and oral diseases along with high levels of tobacco consumption is a major health challenge in Bangladesh. Furthermore, Bangladesh has no dedicated national tobacco cessation service or quitline [42]. Bangladesh Institute of Research and Rehabilitation for [Diabetes](https://en.wikipedia.org/wiki/Diabetes), [Endocrine](https://en.wikipedia.org/wiki/Endocrine) and [Metabolic](https://en.wikipedia.org/wiki/Metabolism) Disorders (BIRDEM) is the largest diabetic hospital in Bangladesh (tertiary hospital having more than 650 beds) [43]. Diabetic patients from all over the country receive their treatment here. There is a dental outdoor that serves almost 70 patients per day. A tobacco cessation intervention delivered by dental health professionals in the dental outdoor of BIRDEM integrated with messages to improve oral hygiene could help diabetic patients quit tobacco and improve their oral health.

While there is currently no evidence of the use of these strategies with tobacco user diabetic patients in a dental setting in Bangladesh, evidence from other routine health-care settings such as tuberculosis (TB) programmes delivered in primary and secondary care have shown that behavioural advice delivered by health workers with only minimal training (one day training) in cessation, using flipbooks, leaflets and posters were effective in achieving quit rates of 41% at 6 months among patients attending TB clinics. This was only 45% more effective when combined with pharmacological treatments for cessation [44]. A further study among TB patients found that 25% quit at 12 months following brief behavioural advice, in Bangladesh and Pakistan [45]. Another study showed that a behavioural change intervention using flipbook was acceptable and feasible to deliver in SEA setting for ST cessation [46]. The flipbook consisted of messages based on behaviour change techniques proven effective for helping people quit smoking. In general populations, behavioural support combined with pharmacotherapy is the most effective strategy in helping people to quit smoking [47, 48]. So far, no pharmacological therapies, including NRT, are routinely available in Bangladesh nor any behavioural change intervention developed that is tailored to tobacco user diabetic patients, therefore, developing such intervention would be highly beneficial for this population.

When developing a public health intervention, it is vital to engage with the patients and key stakeholders [49, 50]. Co-production gives the opportunity for the end user to directly shape the intervention and empower the public to contribute to and draw on research to improve their lives. Co-production increases the involvement of the ultimate beneficiaries and end users of research from the very beginning of the research process. This has the potential to produce stronger research and research outcomes that better fit the needs, values and interests of end-users [51, 52]. Therefore, co-production of a tobacco cessation intervention including adaptation of some existing intervention materials for a dental setting would be beneficial for this vulnerable group. So far, no studies have attempted to co-produce a tobacco cessation intervention to be delivered at dental clinics for people with diabetes in Bangladesh. For developing an effective public health intervention, it is essential to follow some crucial steps [53] that include, understanding the problem, identifying modifiable contextual factors, and deciding on the mechanisms of change; followed by planning of delivering the intervention, testing and adapting the intervention, and effectiveness evaluation.

Aim:

The aim of this study was to co-produce a tobacco cessation intervention for use in dental clinics for diabetic patients in Bangladesh.

Following the initial three stages of developing an intervention [53], we have the following four objectives.

Objective:

1. To assess tobacco use patterns and perceptions of diabetic patients who smoke/use ST about receiving tobacco cessation support from the dentists, at the dental department of BIRDEM.
2. To assess the status of any current tobacco cessation support provision by the dentists at BIRDEM.
3. To assess barriers and facilitators of implementing a tobacco cessation intervention in the proposed site.
4. To co-produce the tobacco cessation intervention with patients, and dentists to be used in the proposed context.

**Methods**

The study was conducted in the department of dentistry of BIRDEM in Dhaka. Ethics approval was obtained from the Ethical Review Committee (ERC) of the Diabetic Association of Bangladesh (BADAS). We used the MRC framework phase 1 on developing the intervention and this paper reports on the findings of this phase. Phases 2-4 will be conducted in future studies. According to the MRC framework phase 1 for developing and evaluating complex interventions [54], we co-produced the tobacco cessation intervention materials for tobacco user diabetic dental patients, with the long-term aim of testing the developed intervention for feasibility, effectiveness and cost-effectiveness. The study was conducted in two stages adapted from the standard steps of co-production recommended by Hawkins et al. [55]. Stage 1 (related to objective 1, 2 and 3) included surveys, and consultation with patients and workshop with dentists; stage 2 (related to objective 4) included co-production of the intervention materials.

PPI activity was embedded at each stage to work collaboratively with the patients and dentists. The research question was developed and informed by the needs and priorities of the patients and dentists.

To assess tobacco use patterns and perceptions of tobacco user diabetic patients on receiving tobacco cessation support from the dentists, a cross-sectional questionnaire survey was conducted between July-August 2019. The anonymous survey was conducted among randomly selected tobacco user diabetic dental patients who came for dental treatment. We did not conduct any sample size calculation for this study. Informed consent was obtained from the patients. The tobacco use questions were adapted from GATS in Bangladesh [38] and other study specific questions were developed for this study.

To assess barriers and facilitators of implementing a tobacco cessation intervention, one to one consultation was conducted with fifteen tobacco user diabetic dental patients and a separate workshop was conducted with twenty-five dentists of BIRDEM to discuss their views about the barriers and facilitators to deliver the tobacco cessation intervention at the proposed setting. Verbal consent was obtained from them before taking part in the workshop. Notes were taken during the consultation and workshop and were summarized as a report. As a part of the workshop to assess the current tobacco cessation support provision by dentists in this setting, the dentists filled an anonymous questionnaire that was adapted from the National Centre for Smoking Cessation and Training [56] questionnaire for Health Professionals and was translated in Bengali.

After survey data were analysed using descriptive statistics for the first two objectives, a second round of iterative consultations were undertaken with patients and a workshop was conducted with the dentists to address the fourth objective of the study in January 2020. The aim of these activities was to co-produce a tobacco cessation intervention integrated with oral hygiene messages and tailored to the tobacco user diabetic patients.

The consultations included one to one discussion on the intervention components and delivery with ten tobacco user diabetic patients. Patients were asked what support they would like to get from the dental health professionals that would help them to quit tobacco use. We planned to develop a brief advice based tobacco cessation intervention by dentists or dental nurses as suggested by most of the patients and dentists and supported by literature. To facilitate the counseling, a draft template of a flipbook with different intervention components was shown to them to provoke their ideas and get their feedback. We adapted the template from theory-based behaviour change interventions on smoking [45] and smokeless tobacco used among South Asians [46].

A workshop with the dentists was conducted to prioritise messages for tobacco cessation behaviour support intervention integrated with oral hygiene messages (based on the feedback of the patients) and outline the culturally and contextually suitable intervention components, and plan to deliver the intervention into routine practice. In that workshop the participants responded to the following points for each key message: acceptability to the patients, acceptability to the dentists and dental nurses to discuss with patients, perceived effectiveness in helping patients to quit, and feasibility to deliver. They also decided whether each key message should be kept in the behaviour support counseling to the patients and training to the dentists and dental nurses, or just covered in training but not in the advice session, or excluded completely. The participants responded yes/ no for each point. The planning of fitting the intervention within the regular workload and the potentiality for incorporation of NRT along with behavioural support was also discussed.

Further refining of the intervention material was conducted with the patients. One to one consultation with another five patients of BIRDEM was conducted to show them the intervention materials and obtain their feedback. For the feedback on the delivery plan, a hypothesized study scenario was described and open questions were asked to elicit their response to the delivery plan and for their suggestion. A short video on the harmful effect of tobacco was also created as most of the patients suggested incorporating a short video to demonstrate the harmful effect of tobacco along with the flipbook. We took feedback on the short video via consultation with another five patients. The consultation with the patients was analysed based on what they think will work and what will not and how to improve the design further. Based on the feedback we created a tobacco cessation intervention, which combines a behavior change intervention and pharmacotherapy (NRT). The behavior change intervention included brief advice using a flipbook, and a short video on the harmful effect of tobacco. We also mapped the major BCTs with potential mechanism of action of the key intervention components in the intervention package (based on different stages of behavior change based on ‘transtheoretical model’), where BCTs were numbered based on the theory and technique tool [57].

**Result**

A total of 35 tobacco user dental diabetic patients (20 male and 15 female) took part in the survey. Among those 8 were cigarette smokers, 20 were ST users and 7 were dual users. The demographic characteristics of the participants and tobacco use are presented in Table 1.

Table 1: Socio-demographic characteristics of the patients and their tobacco use and attitude towards tobacco quitting (N, max=35)

|  |  |  |
| --- | --- | --- |
|  | Categories | n (%) |
| Socio-demographic characteristics |  |  |
| Sex | Male | 20 (57.1) |
| Female | 15 (42.9) |
| Age | 29-50 | 13 (39.4) |
| 51-70 | 20 (60.6) |
| Education | No | 14 (40)  |
| Primary | 8 (22.9) |
| Secondary | 7 (20) |
| Higher  | 6 (17.1) |
| Occupation | Service | 6 (17.1) |
| Household work | 14 (40) |
| Retired and Unemployed | 15 (42.8) |

|  |  |  |
| --- | --- | --- |
| tobacco use and attitude towards tobacco quitting |  |  |
| Tobacco use | Cigarette  | 8 (22.9) |
| Smokeless tobacco | 20 (57.1) |
| Dual use | 7 (20) |
| Tobacco use pattern | Daily use | 27 (79.4) |
| Sometimes | 7 (20.6) |
| Importance of tobacco cassation | No | 3 (10) |
| Moderately  | 11 (35.5) |
| Important | 7 (22.6) |
| Very important | 10 (32.3) |
| Want to quit tobacco | No  | 6 (17.1) |
| Yes, moderate, | 17 (48.6) |
| Yes, a lot | 12 (34.3) |
| Worried for expense of tobacco | No | 23 (65.7) |
| Yes, moderate, | 8 (22.9) |
| Yes, a lot | 4 (11.4) |
| Worried for health effect of tobacco | No  | 10 (35.7) |
| Yes, moderate, | 12 (42.9) |
| Yes, a lot | 6 (21.4) |
| Feel difficult to quit | No | 17 (48.6) |
| A little | 11 (31.4) |
| A lot | 7 (20) |
| Tried to quit in last 12 month | Yes | 26 (74.3) |
| No | 9 (25.7) |

Patients’ perception about receiving tobacco cessation support from the dentists showed that all the participants would like to be asked about their tobacco use and receive support on tobacco cessation from their dentist (Table 2).

Table 2: Patients perception on receiving tobacco cessation support from the dentists (N, max=35)

|  |  |  |
| --- | --- | --- |
|  | Categories | n(%) |
| If the doctor asked about tobacco use past 12 months | No | 20 (57.1) |
| Yes | 15 (42.9) |
| If the doctor gave advice for tobacco cessation past 12 months | No | 20 (57.1) |
| Yes | 15 (42.9) |
| Would you like, if the dentist asks about your tobacco use | No | 0 |
| Yes | 35 (100) |
| Would you like if dentist give you short advice on tobacco cessation | No | 0 |
| Yes | 35 (100) |
| Would you like if you are requested to set a quit date after giving advice | No  | 9 (25.7) |
| Yes | 26 (74.3) |
| Would you like if continuous help/support is provided to you for successful quitting | No | 3 (8.8) |
| Yes | 31 (91.2) |
| Would you like if telephone contact is made with you regarding tobacco cessation | No  | 11 (31.4) |
| Yes | 24 (68.6) |
| If you were requested to come again to dentist in 3 months or 6 months time regarding follow-up of tobacco cessation, would you like? | No  | 14 (40) |
| Yes | 21 (60) |
| Would you like if you were advised to take drug to make tobacco cessation successful? | No  | 12 (34.3) |
| Yes | 23 (65.7) |

A total of 25 dentists took part in the workshop and 18 (72%) of them considered that it is important to provide tobacco cessation advice and support along with oral hygiene instruction to improve oral health condition of the diabetic population and 7 (28%) disagreed with that. Currently almost all (24) of them asked their patients about tobacco use and advise them on quitting, however, do not provide any further support. More than 85% do not use any structured or evidence-based approach following a flipbook or leaflets or other materials to support patients to quit tobacco (Table 3).

 Table 3: The current tobacco cessation support provision by dentists in the site (N, max=25)

|  |  |  |
| --- | --- | --- |
|  | Categories | n (%) |
| **How much do the dentists agree with each of the following statements? (1-4)** |  |  |
| 1. I think it is important to provide tobacco cessation advice and support along with oral hygiene instruction to improve oral health condition of diabetic population | Disagree | 7 (28) |
| Moderately agree | 5 (20) |
| Completely agree | 13 (52) |
| 2. With my patients, I always discuss the effects of tobacco on health | Disagree | 4 (16) |
| Moderately agree | 9 (36) |
| Completely agree | 12 (48) |
| 3. With my patients, I always discuss the effects of tobacco on oral health  | Disagree | 7 (28) |
| Moderately agree | 5 (20) |
| Completely agree | 13 (52) |
| 4. I have enough time and capacity to provide face-to-face tobacco cessation intervention | Disagree | 7 (28) |
| Moderately agree | 14 (56) |
| Completely agree | 4 (16) |
| 5. I ask my patients about their tobacco use | Always | 11 (44) |
| Sometimes | 13 (52) |
| Never | 1 (4) |
| 6. I recommend patients to stop using tobacco products | Always | 12 (48) |
| Sometimes | 12 (48) |
| Never | 1 (4) |
| 7. In my centre, I offer help to patients want to quit tobacco use | Always | 10 (40) |
| Sometimes | 9 (36) |
| Never | 6 (24) |
| 8. Do you use any flipbooks or leaflets or other materials to support patients with oral hygiene instruction | Always | 1 (4) |
| Sometimes | 4 (16) |
| Never | 20 (80) |
| 9. Do you use any flipbooks or leaflets or other materials to support patients to quit tobacco? | Always | 0 |
| Sometimes | 3 (14.3) |
| Never | 18 (85.7) |

The initial consultation and workshop reflected that the proposed tobacco cessation intervention delivered within a dental setting in BIRDEM was considered to be important and acceptable by the patients. The opportunities and barriers identified are listed in Table 4. In short, willingness of the dentists to help their patients on tobacco cessation and willingness of the patients to receive related help from their dentists was identified as the main opportunity. On the other hand, not having enough time and resources on supporting patients for tobacco cessation was identified as the main barrier.

Table 4: Barriers and facilitators identified by dentists and patients for tobacco cessation intervention for diabetic patients at the dental department of BIRDEM

|  |  |  |
| --- | --- | --- |
|  | Barriers  | Facilitators |
| Dentists’ perspective  | 1. Not having enough time to spend with the patient to give full behavior change support on tobacco cessation due to work pressure. | 1. Willingness to help the patients on tobacco cessation.  |
| 2. Not having clear knowledge on how to support a patient for tobacco cessation successfully.  | 2. Willing to know how they can support their patients on tobacco cessation.  |
| 3. Not having a clear understanding of behavioral change theory and interventions. | 3. Willing to know about behavioral change theory and interventions  |
| 4. Not having clear knowledge on nicotine replacement therapy (NRT) and who can and how to prescribe NRT. | 4. Willing to know about NRT for tobacco cessation. |
| 5. No formal structure to take tobacco history from patients. | 5. Reputed hospital and doctors. |
| 6. No regular/ standard support structure to provide information on harmful effect of tobacco | 6. Teachable moment. |
| 7. No regular/ standard support structure for tobacco cessation is available. | 7. As the patients are registered diabetic patients, It would be possible to track the patients. Most of the patients come back for follow-up dental visit |
| Patients’ perspective | 1. lack of knowledge of harmful effect of tobacco2. Misperceptions: believe that ST is makes teeth strong 3. Long time addiction, they will find difficult to quit and relapse when they faced negative symptoms after trying to quit.4. Not interested to quit (specially ST)5. Have short time to receive advice6. Interested in finishing their dental treatment fast7. Difficult to come back just for getting the advise (if not match with their other treatment/ follow-up visits) | 1. Patients would like their dentist to give advice / help in tobacco cessation.2. Patients are happy to share their phone number.3. Most of the patients are willing to come back for follow-up visit if match with their scheduled visit |

The co-production activity reflected that brief advice using flip book, video in combination with pharmacotherapy would be the intervention that the dentists and patients think would work best in the setting. The key intervention components identified to include in the flipbook were: identifying tobacco product that the patient’s use, harmful ingredients, health effect of tobacco: specifically focusing on oral health effect of tobacco, effect of tobacco on general health (including diabetes), benefits of quitting, misconceptions/myths, importance to quit scale, triggers and coping strategies, planning and preparation, readiness to quit, withdrawal symptoms, incorporation of cessation medication along with the behavior change techniques and addressing patients expectation of cessation medication. In addition, it will include oral hygiene instruction. We received positive feedback from the patients on the short video (2 minutes long). They understood the key message of this video about harmful effects of tobacco on health and found it educational. They found the video motivating to quit tobacco and suggested to incorporate that along with the flipbook during the first face to face counselling session. The key intervention components with potential mechanism of action are shown in Table 5 where BCTs were numbered based on the theory and technique tool.

Table 5: Major behaviour change techniques (BCT) used and their mechanism of action in the intervention package to support tobacco cessation (based on different stages of behavior change based on ‘transtheoretical model’)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Pre-contemplation | Contemplation | Preparation | Action  | Maintenance |
| 1. BCT used | 5.1 Information about health consequences | 5.1 Information about health consequences9.2 Pros and Cons5.2 Salience of consequences  | 1.1 Goal setting (behavior)1.3 Goal Setting (outcome)1.5 Review behavior goals1.7 Review outcome goals | 1.2 problem solving12.3 Avoidance/ reducing exposure to cues for the behaviour11.2 Reduce negative emotions | 1.2 problem solving12.3 Avoidance/ reducing exposure to cues for the behaviour11.2 Reduce negative emotions |
| Mechanism of Action | Knowledge | Knowledge, belief about consequences | Goals, beliefs about capability | Beliefs about capability. environmental context and resources, emotion | Beliefs about capability. environmental context and resources, emotion |
| Content used in flip chart | 1.Ingredients used in cigarette and ST2. Health effect of tobacco (general health, specific dental health) | 1.Ingredients used in cigarette and ST2. Health effect of tobacco (general health, specific dental health) | Use of scales: importance to quit,readiness to quit,Confidence to quit. Guidance for preparation | 1. Guidance for cessation2. Identify social cues and situation that lead to tobacco use.3.Tips to control the cues4. Tips to control the withdrawal symptoms | 1. Guidance for cessation2. Identify social cues and situation that lead to tobacco use.3.Tips to control the cues4. Tips to control the withdrawal symptoms |
| Content used in video | 1.Ingredients used in cigarette and ST2. Health effect of tobacco | 1.Ingredients used in cigarette and ST2. Health effect of tobacco |  |  |  |
| 2. BCT used | 3.1 Social support (unspecified)  | 3.1 Social support (unspecified) | 3.2 Social support (practical) | 3.1 Social support (unspecified)3.2 Social support (practical) | 3.1 Social support (unspecified)3.2 Social support (practical) |
| Mechanism of Action | Environmental context and resources | Environmental context and resources | Social influence | Social influence | Social influence |
| Content used in flip chart | Financial gain over time not buying tobacco products. Alternative use of saved money | Financial gain over time not buying tobacco products. Alternative use of saved money |  Tips to use friends, family and children as sources of encouragement in quitting tobacco. | 1. Tips to use friends, family and children as sources of encouragement in quitting tobacco.2 Improving public image and boosting confidence to attend social events because of quitting tobacco. | 1. Tips to use friends, family and children as sources of encouragement in quitting tobacco.2. Improving public image and boosting confidence to attend social events because of quitting tobacco |
| 3. BCT used | 3.2 Social support (practical) | 3.2 Social support (practical) |  |   |  |
| Mechanism of Action | Social influence | Social influence |  |  |  |
| Intervention setting | 1. Accessing professional support for tobacco cessation.2. Supportive environment at the dental clinic.3. Delivery of the intervention by dentists or dental nurses.  | 1. Accessing professional support for tobacco cessation.2. Supportive environment at the dental clinic.3. Delivery of the intervention by dentists or dental nurses.  |  |  |  |
| Pharmacological |  |  |  | NRT | NRT |

**Discussion**

For the first stage, the survey results of the patients showed that majority were smokeless tobacco users and all of them were willing to get support on tobacco cessation from their dentists.

The workshop with the dentists reflected that the majority of them did not have access to any resources such as flipbooks or leaflets or other materials nor did they have appropriate knowledge of techniques to help and support patients with quitting tobacco, but they were willing to provide support. The consultation with the patients and workshop with the dentists revealed some important facilitators and barriers that need to be considered for developing the intervention. Our study reflected that one of the main barriers of tobacco cessation intervention in the dental setting was lack of time (due to the provision of treatment to a large overflow of patients, dedicating sufficient time to engage in meaningful tobacco cessation consultation becomes infeasible). Lack of resources and training to the dentists was identified as another major challenge for providing tobacco cessation support at dental settings in this study. Our study also reflected that more than 85% of the dentists in this setting do not use any structured or evidence-based approach while giving tobacco cessation advice or provide further support. Overall, the intervention seemed to be feasible if it is short and designed to fit with the activity of the dental department of BIRDEM. In the second stage of our study, we created a tobacco cessation behaviour support intervention based on brief advice and pharmacotherapy. Following 3 A approach: dentists will first ask about the tobacco use and give very brief advice to the users and then assist the patient by signposting to a specially trained dentist or dental nurse who would be designated to provide support using the designed intervention.

Similar to our study lack of training and resources to the dentists was identified as a major challenge for providing tobacco cessation support at dental settings in other studies. Prakash et al. [58] in their study showed that only 39% dentists assisted with quitting, and 42% dentists had formal training in tobacco cessation. A study showed that health care providers missed opportunities for smoking cessation counseling in 70% of the time [59]. This situation could be improved by providing proper training to the dentists and creating some organizational support structure.

Following the evidence of effectiveness of behavioural support combined with pharmacotherapy in helping people to quit smoking [47] and successful integration of a patient-facing flipbook for brief advice in SEA settings for smoking [45] and ST cessation [46], we considered adapting the same approach. The multi component tobacco cessation intervention that we created contains a flip book to guide tobacco cessation based on appropriate behavior change techniques, a short video based on the harmful effect of tobacco to increase awareness, and pharmacotherapy (NRT). Some tobacco cessation interventions delivered in dental settings have also used patient-facing flip books, leaflets and videos as intervention components and some studies used NRT [28]. System-based approaches: advice, assistance, and follow-up support, which are effective for the general population, is expected to be true for people with diabetes [20]. Some health effects were specifically tailored to diabetes and particular oral diseases to make the maximum likeness to the individual patient’s condition and take the opportunity of the teachable moment [22]. Exploratory surveys and consultations with study participants revealed that they agreed with this approach and considered it acceptable. Therefore, we are expecting to provide the optimum package to help people quit tobacco in this setting. We could not try the intervention component of referral to a quit line or support center as no such services are available in Bangladesh.

The study had some limitations. The sample size calculation was not conducted for the survey rather it was based on how many tobacco user patients agreed to participate within the two-month time of data collection period. Most of the behaviour change techniques were adapted from existing studies. However, the behavior change techniques adapted here were validated in South Asian population.

To our knowledge, this is the first study of developing tobacco cessation intervention for and with the tobacco user diabetic patient in Bangladesh in a dental setting using a co-production model. Assessing patients’ perceptions for a tobacco cessation intervention, dentists’ current service provision and identification of barriers and facilitators in this context, would help to find a feasible approach to design the future trial to test the effectiveness of the co-produced intervention materials. Co-production increases the relevance of research by ensuring that it reflects the needs, values and interests of the patients and improves the quality of research through broadening the range of expert input. The next stage of work should focus on designing a feasibility trial and training materials. This will create organizational changes to build a supportive environment for tobacco cessation at dental setting and capacity building among dental health professionals.

**Conclusions**

As diabetic patients are more prone to oral diseases and tobacco use has deleterious effects on both conditions, therefore, it is the responsibility of the dental professional to aware the patient of the risk of tobacco use and help for cessation. Incorporation of tobacco cessation into dental care will give a unique opportunity to support the people with diabetes in quitting tobacco, and hence improving their oral as well as general health. Thus, the designed tobacco cessation intervention for the tobacco user diabetic dental patient is expected to be helpful to address a major health challenge.

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**Declarations**

Ethics approval and consent to participate:

Ethics approval was obtained from the Ethical Review Committee (ERC) of the Diabetic Association of Bangladesh (BADAS) (Memo no. BADAS-ERC/EC/17/0142, Date 27.09.2018)

Informed consent was obtained from the study participants.

Verbal consent was obtained from the dentists who participated in the workshop before starting the activity of the workshop. The ethics committee [Ethical Review Committee (ERC) of the Diabetic Association of Bangladesh (BADAS)] approved this consent process from the dentists.

All methods were **carried out in accordance with relevant guidelines**and regulations.

Consent for publication: Not applicable.

Availability of data and materials: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests: The authors declare no competing interest.

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Author’s contribution:

MPM designed and conducted the study, adapted and translated the study tools and drafted the manuscript. OD contributed designing the study. Provided critical feedback on the study design and manuscript. HE provided critical feedback on the study design and manuscript. ARC collaborated in conducting the study in BIRDEM and gave critical feedback to the study tools and manuscript. SD helped with data collection, drafting the manuscript and reviewed the manuscript and gave critical feedback to the manuscript. SK helped coordinating the data collection and workshops and gave critical feedback to the manuscript. TT helped coordinating the data collection and workshops and gave critical feedback to the manuscript. HMS helped in data collection and gave critical feedback to the manuscript. RK helped in data collection and gave critical feedback to the manuscript.

All authors read and approved the final manuscript.

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