RESEARCH ARTICLE

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Developing a Sustainable Model for Tobacco Cessation by Integrating Dental Professionals: An Evaluation of a Capacity Building Intervention in Pondicherry, India

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Abstract

Background & Objectives: Tobacco use is the primary reason for preventable deaths. Reducing tobacco use among the general population is pivotal in decreasing the burden of non-communicable diseases, and dentists are in a unique position to provide tobacco cessation services. **Methods:** This Randomized Controlled Trial (RCT) enrolled 78 dentists engaged in private practice at Puducherry for more than one year. Participants were randomly assigned to either Intervention group who received a capacity building intervention and control group that received posters on the 5As of tobacco cessation. Baseline and post intervention assessments measured knowledge, attitude, self-efficacy, practice behaviours and barriers related to tobacco cessation counselling using ProSCiTE tool. **Results:** The analysis was done by intention to treat and per protocol methods. Difference in Differences (DID) analysis was performed to compare the change between the study groups using independent t-test. No significant differences in knowledge and attitude were observed, but improvement was seen in scores of self-efficacy [Mean difference 2.72 (-1.55 to 6.98)] and practice behavior [Mean difference 3.49 (-1.35 to 8.32)] after the intervention. **Conclusion:** Tailored training programs and evidence-based guidelines could address identified barriers and empower dentists to play a more impactful role in tobacco cessation efforts, contributing to just and sustainable healthcare systems.

Keywords: Tobacco Use cessation- dentists- counseling- capacity building- 5A technique

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Introduction

Tobacco use, the leading cause of preventable deaths, is projected to cause about 8.71 million deaths by 2030 [1]. The Global Adult Tobacco Survey (GATS) 2016-2017 highlights India's high tobacco usage rate at 28.6%, with a higher prevalence among males (42.4%) than females (14.2%), and a specific rate of 11.2% in Puducherry [2, 3]. Tobacco consumption is associated with a wide range of health issues, including cancer, cardiovascular diseases and chronic obstructive pulmonary disease. There's a critical need to reduce tobacco use and support cessation efforts.

The significance of tobacco cessation services cannot be overstated. Maciosek and colleagues evaluated the potential impact of 28 evidence-based clinical preventive services based on their cost-effectiveness and clinically preventable burden, measured by quality-adjusted life-years (QALYs) saved. This evaluation, which covered various risk factors, revealed that two of the top three highest- ranking services were related to tobacco. These included (a) screening for tobacco use and brief counseling interventions to promote cessation among adults, and (b) counseling aimed at preventing tobacco use initiation among youth [4, 5].

Studies have shown that brief interventions by healthcare providers can significantly increase the likelihood of quitting [6].The role of dentists in healthcare extends beyond oral health; they can act as primary advocates for tobacco cessation, integrating these services into their practice.

The primary objectives of this study are to assess the improvement in knowledge, attitudes, practice behaviors, and self-efficacy of dental practitioners in delivering tobacco cessation counseling following an intervention and identify perceived barriers faced by dental practitioners in implementing tobacco cessation counseling in clinical practice.

The study aims to evaluate the impact of a targeted intervention on enhancing the knowledge, attitudes, self-efficacy, and practice behaviors of dental professionals regarding tobacco cessation counseling. By also identifying the perceived challenges they face, the findings can inform the development of structured training modules

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and support systems. Ultimately, this research seeks to support the integration of tobacco cessation services within routine dental care, contributing to broader tobacco control efforts and improved public health outcomes.

Materials and Methods

This parallel arm randomised controlled trial was conducted between August 2021 to January 2022. We included Dentists engaged in private dental practice in the district of Puducherry for at least one year.

Study tool

In this study, the Providers' Smoking Cessation Training Evaluation (ProSCite) questionnaire was utilized after obtaining the permission of the authors. The questionnaire was based on the 5A Technique in smoking cessation and contained 67 items on smoking cessation intervention, organized into five primary constructs: knowledge (12 items), attitude (8 items), self-efficacy (13 items), behavior (19 items), and barriers (15 items) [7]

Validation of the Evaluation Tool

Face and Content validation of the questionnaire was done by a group of eight experts from the fields of Public Health dentistry, Oral Medicine and Radiology, Public Health by using a response sheet. It was done prior to commencement of the study. It was conducted in two rounds and based upon their inputs from round 1, we reduced the items and modified the tool. In round 2, we resend the modified tool to the experts, for a revaluation. Thereafter we pretested the modified tool in a subset of community other than the selected study population and the tool was finalized.

Study setting and duration

The study was conducted in Pondicherry district of the Union Territory of Puducherry. Based on the 2011 census, the population of Pondicherry was 1.25 million. According to the GATS survey 2016-17, the proportion of people with any Tobacco use in Puducherry was 11.2% [3]. About 52.1% of smokers and 47.9% of smokeless tobacco users were advised by a healthcare provider to quit tobacco use. The district of Pondicherry has one government dental college and two private dental institutions, and approximately three hundred private dental clinics spread across the district. The study was conducted from April 2021 to December 2021.

Sample size

The intervention's effectiveness was assessed by comparing mean differences between the intervention and control groups, with paired observations within each group. Hasan et al. reported a standard deviation of 7.45 for self-efficacy scores post-intervention [8]. We hypothesized a 5-point increase in self-efficacy, indicating significant improvement in delivering tobacco cessation counseling. Using Open Epi version 3.01, with a 5% alpha error and 80% power, the required sample size was 35 participants per group. To account for a 10% attrition rate, we adjusted this to 39 participants per group. Of the 78 participants recruited, 39 were randomly assigned to each group: intervention and control using random allocation software.

Randomisation

The list of practicing dentists was obtained from the Indian Dental Association; Pondicherry chapter and Google Maps served as a sampling frame. A sample of participants equal to the required sample size was randomly selected using simple random technique using rand between command in Microsoft Excel. To the participants who did not respond a reminder mail was sent after three days followed by two telephonic reminders with an interval of three days. The participants who did not respond even after three reminders were considered as non-responders.

Random Sequence Generation and Allocation Concealment

Unique identification numbers were assigned to the selected sample of dentists. Random Allocation software was used to generate a random sequence for allocation into either of the two groups. This helped us to maintain a 1:1 ratio between the arms.

Blinding

Blinding was not possible in this study; the same investigator conducted baseline data collection, delivered the intervention, and performed end-line assessments, and the intervention's nature precluded participant blinding.

Capacity Building Intervention

The intervention package included motivational interview delivered personally by the investigator, including detailed discussions on tobacco control, providing the desk calendar, and weekly reminders for tobacco cessation activities. Based on a comprehensive literature review and WHO (World Health Organisation) toolkit for brief tobacco interventions, we designed a 23-page desk calendar to educate both dental practitioners and their patients [9]. This interactive, bilingual (Tamil and English) calendar had the same information in the adjacent pages to facilitate the dentist to use it as an IEC (Information, Education and Communication) material. The dentist will be able to read out the information while the patient also will be seeing it in the adjacent page. The intervention lasted about 30 minutes. Additionally, we developed a wall poster outlining the 5As (Ask, Advise, Assess, Assist and Arrange) of Tobacco Cessation, distributed to both groups to reinforce the cessation message within dental practices.

We assessed the dentists' demographics, knowledge, practice behavior, attitude, and self-efficacy using the ProSCite Questionnaire at the baseline and post-intervention follow-up assessments, which occurred after three months. The Barriers in providing Tobacco cessation counselling were also documented.

Data Analysis

Data were entered into Microsoft Excel and analyzed with SPSS version 21.0, considering a P value <0.05 as statistically significant. Categorical variables (e.g.,

Gender, Educational Status) were shown in proportions with 95% C.I., while continuous variables (e.g., age, working experience) were presented as Mean (S.D). The Difference in Differences (DID) analysis, using the independent t-test, compared score changes between groups.

Results

The mean age (S.D) was 31.9 (6.1) for the intervention group and 36.4 (8.0) for the control group. Most participants in both groups were ≤ 35 years. Females comprised 35.9% of the intervention group and 38.5% of the control group. General dentistry was practiced by 41.0% of the intervention group and 35.9% of the control group. Non-smokers made up 89.7% of the intervention group and 82.1% of the control group. Urban practice locations were reported by 79.5% of the intervention group and 71.8% of the control group. About 70% of the intervention group and 72% of the control group were not currently providing tobacco cessation services (Table 1).

Changes in Knowledge, Attitude, Practice Behavior, Self-efficacy: Table 2 describes the intervention arm's mean total knowledge score changed by -0.03 (-0.73 to 0.67) and the control arm by 0.26 (-1.28 to 0.71), with no significant difference in identifying nicotine withdrawal symptoms (p = 0.573). Attitude scores decreased by 0.36 (-1.5 to 0.76) in the intervention arm and increased by 0.33 (-0.69 to 1.36) in the control arm. The difference between groups was -0.69 (-2.19 to 0.80), not statistically significant (p = 0.359).

In the self-efficacy domain, the intervention group showed a difference of 3.61 (0.26 to 6.97) and the control group 0.90 (-1.84 to 6.64), with difference between groups of 2.72 (-1.55 to 6.98) (p = 0.313). Practice behavior scores increased by 5.05 (1.15 to 8.95) in the intervention arm and 1.56 (-1.43 to 4.56) in the control arm. The mean score difference was 3.49 (-1.35 to 8.32), also not statistically significant (p = 0.155).

The scores in the knowledge and Attitude domain decreased after the intervention. This outcome was attributed to the distinction between perceived and actual knowledge, with the intervention leading participants to recognize their true level of understanding [10-11]. In the self-efficacy and practice behavior domains the intervention group showed a three point and five-point increase in the scores respectively which suggest improvement in these domains after the intervention.

Barriers

In the intervention group, majority of the participants (46.2 %) reported 'patients not interested in quitting' and 'patients not ready to change' as extreme barriers. Among the controls the most of them (46.2%) reported 'Patient not compliant to behavioral therapy as moderate barrier. In provider-related barriers 'lack of knowledge 'was reported as an extreme barrier by 51.3% of the intervention participants, followed by lack of time (28.2%). While in the control group only half of that proportion (25.6%) realized the lack of knowledge. 'Lack of reimbursement was perceived as an extreme system-related barrier by 28.2% of participants of both the groups (Figure 1).

Table 1. Sociodemographic Characteristics and Dental Practice Related Characteristics of the Study Participants Across the Two Study Groups (N=78)

Characteristics	Intervention (n = 39), n (%)	Control (n = 39), n (%)	P value
Age categories (Years)			
<=35	24 (61.5)	29 (74.3)	0.436
36-49	13 (33.3)	8 (20.5)	
>=50	2 (5.1)	2 (5.1)	
Gender			
Men	25 (64.1)	24 (61.5)	0.815
Women	14 (35.9)	15 (38.5)	
Level of highest Education			
Under Graduate	18 (46.1)	16 (41.0)	0.648
Post Graduate	21 (53.8)	23 (59.0)	
Dental specialty			
General Dentistry	16 (41.0)	14 (35.9)	0.166
Oral Medicine	3 (7.7)	2 (5.1)	
Oral Surgery	4 (10.3)	5 (12.8)	
Oral Pathology	1 (2.6)	1 (2.6)	
Prosthodontics	3 (7.7)	8 (20.5)	
Orthodontics	2 (5.1)	2 (5.1)	
Endodontics	1 (2.6)	4 (10.3)	
Periodontics	3 (7.7)	1 (2.6)	
Public Health Dentistry	2 (5.1)	0	
Tobacco Status			
Current Smoker	1 (2.6)	4 (10.3)	0.38
Years of Working Experience (Years)			
<=5	12 (30.8)	18 (46.2)	0.326
6-10	12 (30.8)	11 (28.2)	
>=10	15 (38.5)	10 (25.6)	
Place of Practice			
Urban	31 (79.5)	28 (71.8)	0.429
Rural	8 (20.5)	11 (28.2)	
Type of Clinic			
Single clinic	34 (87.2)	37 (94.9)	0.658
Poly clinic	5 (12.8)	2 (5.1)	
Number of patients seen/ day			
<=10	37 (94.9)	32 (82.1)	0.076
>10	2 (5.1)	7 (17.9)	
Previous Training in Tobacco Cessation			
Yes	10 (25.6)	6 (10.4)	0.262
No	29 (74.4)	33 (84.6)	
Currently providing Tobacco Cessation services			
Yes	12 (30.8)	11 (28.2)	0.804

Discussion

This randomized controlled trial evaluated the effectiveness of a capacity-building intervention for brief tobacco cessation counseling in dental practice. It demonstrated changes in dentists' knowledge, attitudes,

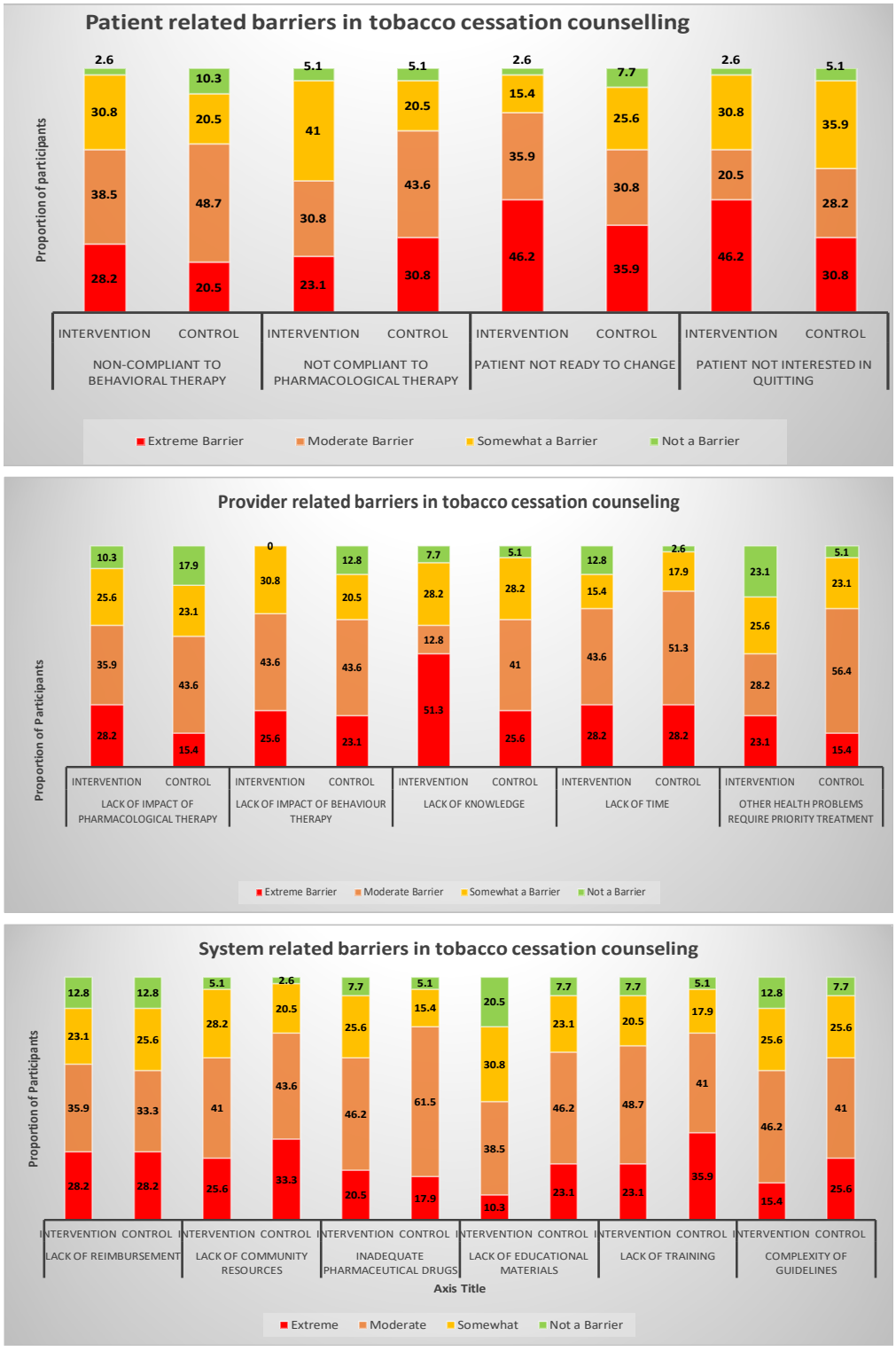

Figure 1. Barriers in Provision of Tobacco Cessation Counseling

self-efficacy, practice behaviors and barriers, marking the first such study in India. Dentists, through routine examinations, are well-placed to identify tobacco-related oral lesions and can use these moments to encourage patients towards cessation a process that is both effective and efficient within the span of a routine visit [10]].

In this study, knowledge about nicotine withdrawal symptoms (affective, somatic, and cognitive) was evaluated, revealing that post-intervention, the intervention group's mean knowledge score decreased compared to the control group. This outcome was attributed to the distinction between perceived and actual knowledge, with the intervention leading participants to recognize their true level of understanding [11–13]. This phenomenon can be explained by the Dunning–Kruger effect, as discussed in the study by Zhike Jia et al., which examined smoking perceptions among Chinese adults [14].

Dentists demonstrated a positive attitude toward the impact of provider advice on patients' likelihood of quitting tobacco. This aligns with findings from a study

Table 2. Comparison of the Knowledge, Attitude, Self-Efficacy and Practice Behavior between the baseline and end line in the Intervention group and Control group – Intention to treat (n=78)

Domains	Intervention (n=39) Mean (S.D)		Mean Difference (95% C.I)	Control (n=39) Mean (S.D)		Mean Difference (95% C.I)	Difference of Mean Difference (95% C.I)	P-value
	Baseline	End line		Baseline	End line			
Knowledge	4.02 (2.51)	4 (2.51)	-0.03(-0.73 to 0.67)	4.23 (2.79)	4.49 (2.74)	0.26(-0.47 to 0.98)	-0.28(-1.28 to 0.71)	0.573
Attitude	32.74 (4.08)	32.38 (3.77)	-0.36 (-1.5 to 0.76)	32.64 (3.88)	32.97 (4.13)	0.33(-0.69 to 1.36)	-0.69(-2.19 to 0.80)	0.359
Self-efficacy	39.77 (9.71)	43.39 (9.88)	3.61 (0.26 to 6.97)	37.84 (7.95)	38.74 (8.58)	0.9(-1.84 to 6.64)	2.72(-1.55 to 6.98)	0.313
Practice Behavior	53.46 (14.05)	58.51 (15.27)	5.05 (1.15 to 8.95)	52.49 (11.05)	54.05 (13.59)	1.56(-1.43 to 4.56)	3.49(-1.35 to 8.32)	0.155

in Hong Kong, where nurses and social workers trained in smoking cessation counselling also showed supportive attitudes. In that study, nurses reported a higher mean positive response (M = 3.06, SD = 0.57) compared to social workers (M = 2.84, SD = 0.62) when asked whether they should advise patients to quit smoking even if not explicitly requested [15].

Despite these positive attitudes, a decrease in post-intervention attitude scores was observed in the intervention group. This decline may reflect the practical challenges encountered in delivering tobacco cessation counselling.

A three-point increase in self-efficacy scores was observed in the intervention group compared to the control group, suggesting improvement from training. Sheffer et al. also noted that training healthcare providers, especially dental professionals, greatly benefits their practice [16]. Improvements were seen in all self-efficacy items based on the 5A's technique, including motivating patients, assessing smoking stages and nicotine dependence, and assisting recent quitters. However, 'Ask' and 'Advice' showed little difference, as they are simpler tasks supported by existing systems, while 'Assess' and 'Assist' require more complex skills [7].

Practice behavior improved more in the intervention group, consistent with findings of Carson KV et al. that training enhances health professionals' performance in smoking cessation.[17] A five-point increase was observed in practice behavior scores in the intervention group, although not statistically significant. The high baseline scores for 'Ask' and 'Advice' likely caused a ceiling effect, limiting observable changes [18]. In the intervention group, scores for providing educational materials, using the Fagerstrom test, and recommending nicotine replacement therapy increased, likely due to the desk calendar provided as part of the intervention, which covered all aspects of the 5A model.

About half of the participants in the group which received the intervention (46.2%) reported that patients not interested in quitting and not willing to change as extreme patient related barriers after they tried to implement tobacco cessation counselling within the practice. Chris Girvalaki et al. also mentioned similar barriers like the lack of compliance of patients and lack of interest from the patients [19]. Lack of impact of pharmacological therapy and behavioural therapy, lack of knowledge, lack of time, and the perception that other health problems require priority treatment were the documented patient-related barriers (Figure 1).

In the current study, about half of the participants in the group which received training (51.3%) reported "lack of knowledge" an extreme provider related barrier when compared to one-fourth of the participants in the control group. (Figure 1) The intervention has made the participants realize the gap existing in the knowledge of tobacco cessation and the need for in-depth training. An equal proportion of the participants (28.2%) in both groups perceived "lack of time "as an extreme barrier. The barriers of lack of time and fear that the patients may not come back to them were also reported by Shanthi et al. in their study among private practitioners in Bhopal

[20]. Chris Girvalaki et al. also mentioned that healthcare professionals described a lack of adequate time during their everyday clinical life as a barrier to provide tobacco cessation advice [19]. The barriers of limited knowledge about cessation counselling and lack of confidence in being able to conduct tobacco cessation counselling were also reported by Arezoo Ebn Ahmady et al. in their study conducted among Iranian dentists [21].

The system-related barriers included were lack of reimbursements, community resources, inadequate pharmaceutical drugs, educational materials, inadequate training, and complexity of guidelines. Lack of reimbursement has been reported as an extreme barrier by an equal number of the participants in the intervention and the Poster group (28.2%). (Figure 1) Many studies conducted have reported lack of reimbursements as an important barrier [22]. Dental professionals can readily influence patients' behavior, as they frequently encounter patients who use tobacco products and can provide timely, personalized advice on quitting [10]. Despite evidence suggesting the efficacy of clinical interventions in dental settings for tobacco cessation, the potential of dental clinics remains underutilized, marking the dental fraternity as a key but untapped resource [23].

In conclusion the randomized controlled trial study design was intended to reduce bias and find the real effect of the capacity building intervention. However, limitations included the inability to link changes in knowledge, attitude and self- efficacy to practice without patient data. Potential response shift bias, and reliance on self-reported outcomes also may have affected accuracy. Blinding was not possible due to the nature of the intervention. Tailored training programs and evidence-based guidelines could address identified barriers and empower dentists to play a more impactful role in tobacco cessation efforts, contributing to just and sustainable healthcare systems.

We propose a pragmatic capacity building intervention in the short term and integration into the dental curriculum in the long run, to help translate tobacco cessation activities into clinical practice. Such practical, brief, and customized training for dentists will help in improving their performance in tobacco-dependence treatment and fulfil their role in combating the Tobacco epidemic.

Author Contribution Statement

Monika A: Conceptualization, Methodology, Validation, Writing- Original draft, manuscript reviewing and editing, Data analysis. Subitha. L: Methodology, data analysis, reviewing and editing, Supervision. Sitanshu Sekhar Kar: Manuscript reviewing and editing, Supervision. Rambha Kubendiran: Validation.

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Study Registration

The study was registered with Clinical Trial Registry of India – India on July 29, 2021 under the reference number CTRI/2021/07/035269.

Approval

The study was discussed in the Post-Graduate Research Monitoring Committee and the Institute Ethics Committee, and necessary corrections were made

Conflict of Interest

None.

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