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Efficacy of SNAPPS in critical thinking and better understanding by dental undergraduates in Oral Medicine

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ABSTRACT

Objective: Any teaching method should emphasize on critical thinking and better understanding by the student which ultimately assists in decision making. The implication of SNAPPS (acronym for a six-step model), a new teaching–learning method could facilitate such learning outcome. Thus, this study was designed to assess the efficacy of SNAPPS to facilitate critical thinking and better understanding by dental undergraduates in Oral Medicine.

Methods: This educational research study included two equal groups of 40 students each. The study group students learned clinical skill by SNAPPS method while control group learnt by conventional method. The clinical reasoning and understanding of the students were assessed on the basis of seven variables which were pertinent to diagnosis and differential diagnosis of a given case, certainly associated with the steps of SNAPPS method. A validated pre-test, post-test, feedback on Likert scale, and mini clinical examination assessment method were used for the evaluation of efficacy of a new method.

Results: The significant difference was observed in mean post-test values and clinical competence between two methods, representing effectiveness of SNAPPS. In SNAPPS, 80% of the students agreed that the new method helped them to increase their confidence in diagnosis as well as narrowing the differential diagnosis. Students perceived that SNAPPS helped them to improve their skill in differentiating between similar conditions with justification as well as to improve knowledge.

Conclusion: Overall results showed that SNAPPS plays a promising role in critical thinking, and better understanding by undergraduate dental students, which enhances decision-making skills.

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KEYWORDS

SNAPPS; Oral Medicine; clinical reasoning; critical thinking

Introduction

Oral Medicine is basically an outdoor patient department in which precise diagnosis and differential diagnosis of a clinical case is imperative for correct management of the disease. The students are taught about diagnostic skills routinely by the teacher in Oral Medicine subject but by the conventional method, which is a teacher-centered and passive method. Therefore, the students develop minimal capacity to think about any disease and its differential diagnosis in depth or with justification. They are unable to apply learned concepts in new situations competently.

In student-centered learning, the student's attitude is entirely different. They find out their own ways of learning and understand the responsibility and importance of active participation to make their educational process an efficient one. Student-centered learning is an approach to learning in which learners choose not only what to study but

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also how and why [1,2]. Therefore, it is necessary to use creative, non-traditional teaching strategies to match with the demands of learners in medical education, which will ultimately have lifelong impact with reference to knowledge and skill. The implication of SNAPPS, a new method of teaching–learning could be an opportunity to facilitate such learning outcome.

SNAPPS is a learner-centered method of case presentations in the outpatient setting in which various alphabets denotes six steps of the method as follows [3,4].

1. **S**—Summarize briefly the history and findings.
2. **N**—Narrow the differential to two or three relevant possibilities.
3. **A**—Analyze the differential by comparing and contrasting the possibilities.
4. **P**—Probe the preceptor by asking questions about uncertainties, difficulties, or alternative approaches.
5. **P**—Plan management for the patient's medical issues.
6. **S**—Select a case-related issue for self-study.

SNAPPS can test higher cognitive skills, and can identify case related issues in day to day busy schedule of clinicians. It can facilitate clinical reasoning skills and better understanding by a learner, On the contrary, the problem in traditional case presentation is students' reasoning skills and knowledge is not explored. The utility of SNAPPS in medical curriculum and in ambulatory settings is studied and reported in the literature [3–5]. But there is no evidence showing its usefulness in dental curriculum. Therefore, the present study was undertaken to assess efficacy of SNAPPS to facilitate critical thinking and better understanding by dental undergraduates in Oral Medicine subject.

Methods

This Institutional Ethics Committee approved educational research study was conducted in Department of Oral Medicine and Radiology, Sharad Pawar Dental College, DMIMS, Wardha for a duration of 1 year after obtaining the written informed consent from each participant.

The study comprised of randomly selected two groups of 40 students each. (Group A—SNAPPS Group and Group B—conventional or control group). All the students were from final year of Bachelor of Dentistry course and were willing to voluntarily participate in the study. All the participants already had the basic theoretical knowledge about the clinical features, differential diagnosis, and management of some important oral diseases (core area) which were already taught to them in regular theory classes. Similar cases from those topics were given to both the groups for doing case presentations. The study protocol is depicted in Figure 1.

Step 1—SNAPPS group students have done case presentation by SNAPPS method for which the standard protocol described by Wolpaw et al. [3] was used. All of them were instructed not to discuss anything about the SNAPPS technique and the evaluation methods with Group B students.

Step 2—Group B had performed case presentation by the conventional learning method using similar clinical cases. This was a teacher led method in which the clinical cases were directly explained by the tutor.

Step 3—A post-test was conducted and feedback of students regarding perception of both the learning methods was obtained from the students of both the groups. The clinical skill of the students was assessed by mini clinical examination (Mini CEX) assessment method.

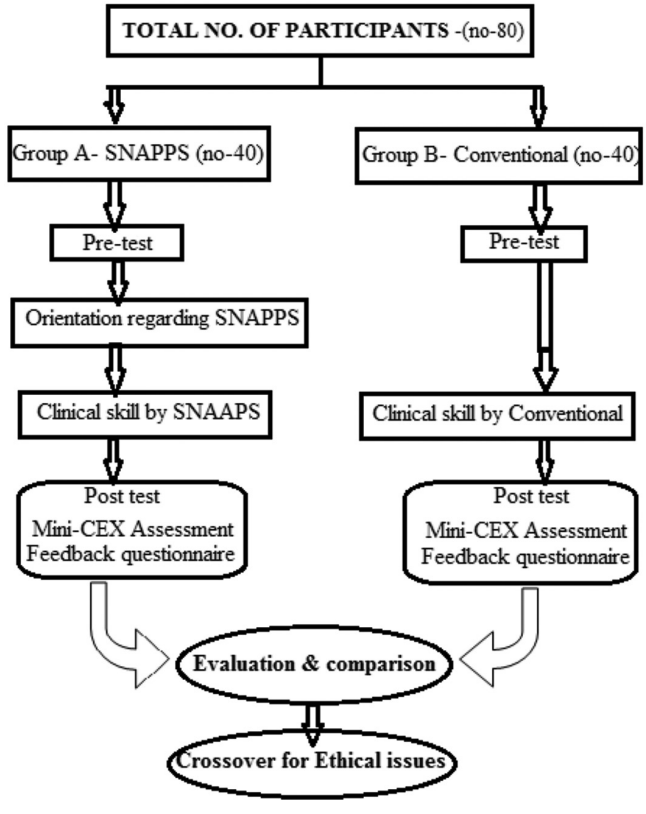


Figure 1. Flow chart showing all the steps in the study.

A validated pre-test and post-test questionnaire consisted of 10 close ended questions (multiple choice questions), which were linked to learning objectives to assure content validity and related to different domains, were used. The student's feedback regarding the perception of both the methods was taken on five point Likert scale which consisted of 13 closed-ended items and two open-ended (descriptive) items.

Step 4—For exposing all the students to both SNAPPS and conventional learning method for ethical issues a crossover was done.

The clinical reasoning and understanding of the student were assessed on the basis of following variables.

1. Number of basic clinical attributes covered by the students.
2. Number of diagnoses kept in differential diagnosis.
3. Number of justified diagnosis kept in the differential diagnosis.
4. Number of distinct comparisons made between two diseases.
5. Patient management plan.
6. Number of uncertainties expressed and obtained clarifications.
7. Selection of case related topics for self-directed learning.

The data were recorded in tabular format and analyzed using suitable statistical tests. The analysis of the pre-test and post-test scores of both the learning methods was carried out to compare cognitive learning gain. The statistical analysis was performed by using SPSS 22 Version and Graph Pad Prism-6.01 version. Mean, standard deviation (SD), and *t* value were assessed by using Students *t*-test to find out statistical significance. A difference with $p < 0.05$ was considered significant.

Results

The significant difference was observed between mean pre-test and post-test scores of 40 students subjected to SNAPPS as well as 40 students of conventional learning method, showing that both the methods were effective. But there was significant difference between mean post-test values of SNAPPS and conventional method, the *P* value was statistically highly significant (<0.001) as given in Table 1 representing more effectiveness of SNAPPS as compared to conventional method. Also, the absolute learning gain, relative learning gain, and normalize learning gain were more in SNAPPS as compared to conventional learning method as given in Table 2. The normalize learning gain "*g*" in SNAPPS was 0.78 and therefore the method was considered highly effective. However, normalize learning gain "*g*" was 0.44 in conventional and thus the method was considered moderately effective. There was statistically significant difference in the clinical skill scores of the students between both the learning methods as given in Table 3 ($P < 0.001$).

The perception of the participants of both the groups with reference to diagnosis of a condition revealed noticeable differences as depicted in Table 4. In SNAPPS, 80% ($n = 32$) students agreed that the new method helped them to increase the confidence in diagnosing the condition as well as narrowing the differential diagnosis as compared to 58% ($n = 23$) and 55% ($n = 25$) students, respectively, of conventional method. Regarding the method helped to improve the skill in differentiating between similar conditions with justification, 83% ($n = 33$) students of SNAPPS method, and 63% ($n = 25$) students of conventional method have given positive reply.

Also, SNAPPS method was found to be more effective than conventional method with reference to 1) opportunity to clarify the areas of confusion by asking questions to the preceptors; 2) chance to improve knowledge by discussing on knowledge deficient areas with preceptor; 3) method helped in better understanding the patients problem and its management; 4) articulating previous knowledge,

Table 1. Comparison of post-test scores of two teaching methods by unpaired "*t*" test.

Teaching method	Mean ± SD		*t*-value	*p*-value
SNAPPS with	Post test	8.90 ± 1.42	4.90	< 0.001** S
conventional	Post test	7.15 ± 1.74		

** Highly significant.

Table 2. Comparison of learning gain between two methods.

Learning gain	SNAPPS learning	Conventional learning
Absolute	41%	22%
Relative	85%	44%
Normalize	0.78	0.44

Table 3. Comparison of clinical skill scores between two methods by Mini CEX assessment.

Teaching method	Mean	SD	*t*-value	*p*-value
Conventional	6.20	0.42	6.65	0.001** S
SNAPPS	7.80	0.63		

** Highly significant.

Table 4. Perception of students to both methods with reference to diagnosis of a condition.

S. No.	Questions/items	Number of students agreed in SNAPPS method (no. - 40)	Number of students agreed in conventional method (no. - 40)
1.	This method helped me to increase the confidence in diagnosing the condition	32 (80%)	23 (58%)
2.	This method helped me to improve my skill in differentiating between similar conditions with justification	33 (83%)	25 (63%)
3.	This method assisted me in narrowing the differential diagnosis	32 (80%)	22 (55%)

Table 5. Perception of students to both methods with reference to improvement in knowledge.

S. No.	Questions/items	Number of students agreed in SNAPPS method (no. - 40)	Number of students agreed in conventional method (no. - 40)
1.	This method gave me an opportunity to clarify the areas of confusion by asking questions to the preceptors	37 (92.5%)	19 (47.5%)
2.	This method gave me a chance to improve my knowledge by discussing on knowledge deficient areas with preceptor	38 (95%)	29 (72.5%)
3.	It helped me in better understanding the patients problem and its management	34 (85%)	28 (70%)
4.	It helps in articulating previous knowledge, problem solving, and decision making	34 (85%)	26 (65%)
5.	It increases conceptual learning and independent critical thinking	32 (80 %)	28 (70%)

problem solving, and decision making; and 5) increasing conceptual learning and independent critical thinking, as many students (n > 32, more than 80%) of the students from SNAPPS agreed to these questions. Observations are indicative of efficacy of SNAPPS pertaining to improvement in knowledge than conventional method as given in Table 5. Last but not least, in response to open ended questions, 83% (n = 33) students in the present study stated that they would like to have more sessions of SNAPPS in future.

With reference to the clinical reasoning and better understanding by the student on the basis of seven variables, findings are depicted in Graph 1.

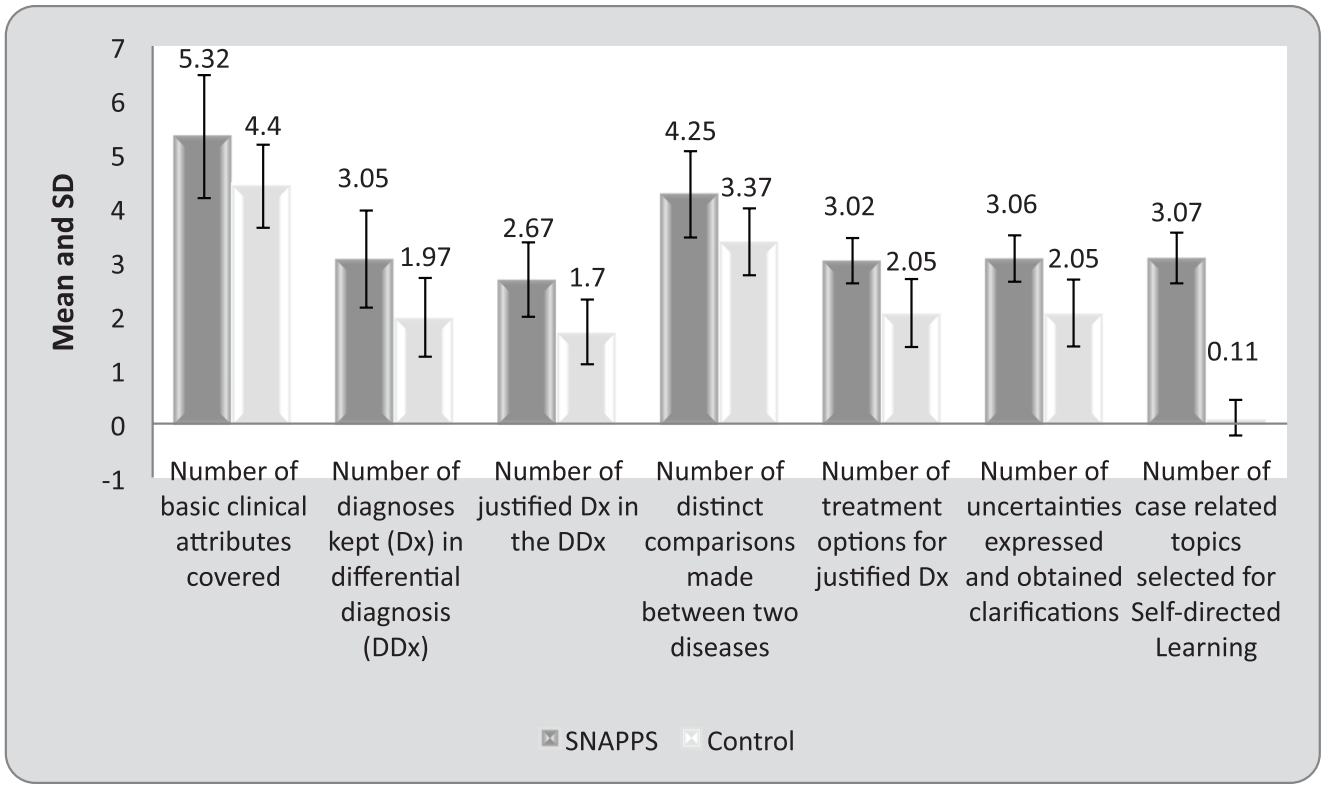
The mean of number of basic clinical attributes covered by SNAPPS group was 5.32 ± 1.14 and by control group was 4.40 ± 0.77. The basic clinical attributes (total 7) were considered as follows:

1. Demographic profile
2. Chief complaints—chronology and sequence
3. Relevant sequencing of complaints in history
4. Additional relevant positive history and significant negative history
5. Correlation of complaints with each other
6. Matching conclusions on history
7. Other significant past, personal, or family histories

About the second and third variable concerning the clinical reasoning and understanding of the student, gross difference was observed between SNAPPS group and control group with reference to the mean of number of diagnoses and justified diagnosis kept in differential diagnosis. The mean of number of diagnoses and justified diagnosis was 3.05 ± 0.90 and 2.67 ± 0.69 in SNAPPS while 1.97 ± 0.73 and 1.70 ± 0.60 in control group, respectively. The students in SNAPPS group have given more number of diagnoses and diagnosis with justification as compared to the students of control group.

As far as the number of distinct comparisons made by students between two diseases and the number of treatment options considered by students for justified diagnosis are concerned, the SNAPPS group students performed better than conventional group students. The results about the mean of number of uncertainties expressed and obtained clarifications and the mean of number of case related topics selected for self-directed learning by SNAPPS as well as conventional group are shown in Graph 1.

The patient management plan was discussed by all the students in both the groups. The case-related topics and resources were discussed by all the students in SNAPPS group, whereas only five students in control group discussed the case related topics



Graph 1. Assessment of clinical reasoning and understanding of the students on the basis of variables.

and resources. All the above-mentioned variables showed statistically significant difference between two groups (p-value < 0.005).

Discussion

The successful implementation of any teaching–learning method is based on the student's attitude towards learning. This study was an attempt to study the efficacy of SNAPPS model for dental undergraduates in Oral Medicine subject by comparing with the conventional method.

In this study, considerable learning occurred in both the methods which recommend that though there are advantageous innovative methods for clinical learning such as One minute preceptor (OMP), SNAPPS, and Aunt Minnie pattern recognition as well as activated demonstration, the utility of conventional method cannot be underestimated during routine clinical teachings [4,6,7]. At the same time, significant difference between the post-test scores of SNAPPS and control group implies that SNAPPS was certainly more effective than the conventional learning method in this study.

The difference in overall clinical competence of the students both in terms of knowledge and skill can be attributed to the learner-driven nature of SNAPPS method which motivates the students to become self-learner, self-responsible, and take up a more self-directed move towards their learning [3]. For effective clinical practice in future, such facts are of great value. SNAPPS method promotes active participation of the students which fosters activation of prior knowledge which ultimately helps in articulating previous knowledge, problem solving, and decision making [3].

SNAPPS students were better in diagnosis, differential diagnosis, and narrowing the diagnosis with justification in the present study. The reason for increasing the confidence in diagnosing the condition by the SNAPPS students could be again active participation of students in the process. The correct diagnosis is the back bone of whole management protocol. The diagnosis as well as differential diagnosis is critically dependent on clinical reasoning and understanding of the student and this is a key requirement at every level of medical education [8]. In this study, 80% students opined that, SNAPPS method helped them to increase the confidence in diagnosis, differential diagnosis, and narrowing the diagnosis.

With reference to the assessment of clinical reasoning on the basis of clinical attributes, number of differential diagnosis, and number of justified diagnosis, the results of this study are similar to those

from original SNAPPS study by Wolpaw et al. [4] in 2009 with American students. The findings are also comparable to another study by Wolpaw et al. [5] in 2012 and the similar study on SNAPPS case presentations in a Thai internal medicine ambulatory care rotation by Sawanywisuth et al. in 2015 [9].

Assessing student's diagnostic reasoning and case-related uncertainties is one of the characteristic features of SNAPPS model. With reference to this point, the findings of the present study are comparable to previous studies [3,4,10,11,12]. In an earlier study by Wolpaw et al. [4] in 2009, students in the SNAPPS group formulated nearly eight times more questions and uncertainties than the students in the comparison group and more than twice as many as the students in the usual-and-customary groups (84.38% vs. 10.77% and 33.33%, $P < 0.000$). In a study by Kapoor et al. [10], also residents of SNAPPS group raised uncertainties more often by probing preceptors; 15 residents out of 20 in SNAPPS as compared to one in 20 residents of the traditional case presentations. In a study by Wolpaw et al. [5], SNAPPS students expressed uncertainties in all case presentations, nearly twice (24/44 [55%]) as many as the comparison group (9/38 [24%]) and those were focused on diagnostic reasoning.

Similar findings are reported in a recent study by Seki et al. [13], in which they concluded that SNAPPS may induce more meaning units related to questions and uncertainties and give more satisfaction to residents than OMP. Wolpaw et al. [5] broadly categorized the uncertainties in three groups as diagnostic reasoning, clinical findings, and medications/management.

Modi et al. [14] stated that clinical reasoning is a core competency expected to be acquired by all the clinicians and they have described some educational strategies which can be used to encourage acquisition of clinical reasoning skills including SNAPPS.

In this study, there was gross difference in responses between two groups related to the item, opportunity to clarify the areas of confusion by asking questions to the preceptors, and chance to improve knowledge by discussing on knowledge deficient areas with preceptor. The possible reason for this could be again the active participation of students in SNAPPS and passive nature of conventional method. For example, the students in conventional method passively listened to teacher and accept the facts narrated by the teacher without critical thinking. There was no brainstorming and thus no question of raising the queries in their mind. These findings are comparable to the previous study by Wolpaw et al. [4].

One of the distinctive features of SNAPPS is an opportunity to clarify the areas of confusion by probing questions to the preceptors, which enables students to improve their knowledge and understanding the areas where they are not proficient [4]. Wolpaw et al. [5] mentioned that a student's question stimulates the learning process and adopt his mind to think in depth about the content of the learning conversation.

With reference to diagnostic reasoning and case-related uncertainties, one of the observations in a study by Wolpaw et al. [4] was SNAPPS students required one additional minute for giving case presentation than those given by students in the comparison group. According to them, failure to express uncertainties and obtaining clarification may have contributed to the shorter overall presentation length in comparison group.

According to Spencer [15], effective teaching depends crucially on the teacher's communication skill. The student should be encouraged to clarify the areas he or she felt difficult by expressing their problem or question to the teacher without any hesitation. This will definitely enrich the student with additional information. Based on the comparative findings between SNAPPS and conventional method related to this item, it can be said that multitasking role of teacher and new educational strategies assist in strengthening the education process as mentioned in the previous studies [16,17].

A study of medicine clerkship students evaluated the impact of extending SNAPPS to the inpatient setting and including "educational prescriptions" [18]. The goal was to facilitate the formulation and answering of clinical questions by using the patient, intervention, comparison, and outcome (PICO) format for step 6 (selecting a case-based issue to learn about). Dubbing this "SNAPPS-Plus," the authors found that 99% of cases included a question and 93% of those were answered. Most questions related to therapeutics, and there was a positive correlation between questions more closely corresponding to the PICO format and higher quality answers [18].

In this study, 85% ($n = 34$) students considered that SNAPPS helps in articulating the previous knowledge, problem solving, and decision making. SNAPPS learning method stimulated them to read more literature and books, and gathering and analyzing information which is a foremost requirement

for problem solving and decision making. In conventional group also 65% ($n = 26$) students were in favor of this item. In contrast to this, previous studies have shown that in conventional method, students focus mainly on factual information, and seldom express their clinical reasoning or case-based uncertainties [4]. Wolpaw et al. [4] stated that in SNAPPS, each step explicit and gives learners, rather than preceptors, the responsibility for expressing their clinical reasoning, and uncertainties. The skill of history-taking, diagnosis, differential diagnosis, and decision-making can be improved by exposure of the students to actual patients during their basic science classes as stated by Peacock [12].

Amongst students of SNAPPS group, most of the students contemplated (52.5% agreed and 25% strongly agreed) that SNAPPS learning method increases conceptual learning and independent thinking. According to Cayley [6], both one-minute preceptor technique and SNAPPS are meant for improvization of clinical reasoning skill and independent learning of the learner. However, an additional feature of SNAPPS is to inculcate self-directed learning [17].

All the students in SNAPPS group of the present study discussed about the case related topics and resources, whereas only five students in control group discussed this issue, findings are more or less comparable to a previous study by Kapoor et al. [10]. In their study, 12 residents out of 20 of SNAPPS group selected case related topics and resources while not a single resident from a traditional case presentations group selected case-related topics and resources.

In response to feedback regarding perception to SNAPPS, the comments of the students were enlightening. They were enthusiastic about a model that allows them to take an active role while the students of conventional group agreed that the method was usually a passive learning. Considering the advantages of SNAPPS method, the students have stated various reasons for their strong acceptance of SNAPPS which revealed positive attitude of the students regarding the method. Rather they have suggested having more sessions of SNAPPS in future.

Limitation of the present study was only the researcher plays a role of preceptor for all students. Thus, perception of many preceptors regarding SNAPPS as a method of learning clinical skills could not be evaluated. Nevertheless there is a scope, as similar educational research study can be carried out by appointing the number of preceptors as well as SNAPPS can be used in other subjects of dental curriculum to enhance critical thinking, clinical reasoning and better understanding of the students.

Conclusion

SNAPPS—a student centered case presentation model plays a promising role in critical thinking, clinical reasoning, and better understanding by the undergraduate dental students that enhances decision-making skills.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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