

# Induction and comparison of craving for tobacco, marijuana and crack

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## Abstract

**Background:** The literature findings report that use of multiple substances can produce adverse clinical and behavioral effects, which may affect craving and the results of drug treatment. Also, the understanding of craving construct and its interaction in the use of smoked substances is underexplored. **Objectives:** To induce and compare craving for tobacco, marijuana and crack-cocaine on hospitalized dependents whose drug of choice is crack-cocaine. **Methods:** Quasi-experimental study with a convenience sample consisting of 210 males divided into 3 equal groups (Group-1: craving induced by crack; Group-2: craving induced by tobacco; and Group-3: craving induced by marijuana). All participants met ICD-10 dependence criteria for cocaine/crack, marijuana and tobacco, were aged between 18 and 65 and had used these substances for at least one year. Photos were used to induce craving and self-report instruments to evaluate possible alterations. **Results:** This study showed that craving for tobacco was more intense than for marijuana and crack, when the groups were compared by VAS. Using specific scales, both craving for tobacco and craving for marijuana were more intense than craving for crack. **Discussion:** These results would imply interventions at the initial stages of abstinence with cognitive-behavioural techniques and pharmacotherapy in order to reduce craving.

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**Keywords:** Craving, tobacco, marijuana, crack cocaine, multiple dependence.

Craving is an important concept in the area of drug dependence and has been discussed for more than a century; Merck's Manual of the Materia Medica<sup>1,2</sup> had, in 1899, already proposed that cocaine be used to relieve craving for alcohol, demonstrating one of the first attempts to "medicate" craving. In 1954, at a meeting of experts from the World Health Organization<sup>3</sup>, Jellinek, among others, concluded that the term "craving" was scientifically inaccurate, as it referred only to an urgent and intense desire. The group therefore decided to replace "craving" for physical dependence – in cases of craving related to withdrawal symptoms – and pathological desire – in cases of desire occurring after a longer period of abstinence<sup>4</sup>. Isbell<sup>5</sup> emphasized that craving was very difficult to define as it could mean different things to different people.

Currently, different concepts of craving can be verified. These range from the best known "intense desire to consume a particular substance"<sup>6</sup> to one that encompasses not only the desire but also "the expectation of a positive effect, the relief of withdrawal symptoms and negative affect and the intention to use the drug"<sup>7</sup>. Rankin et al.<sup>8</sup> argued that craving is a multi-dimensional construction and must therefore involve physiological, psychological and behavioural aspects.

Despite the importance of this issue, there is little research analysing and comparing craving for psychoactive substances. Tiffany et al.<sup>9</sup> considered, for example, that craving for cocaine was related to a different area than that experienced by tobacco<sup>7</sup>: the lack of control; however no research was conducted to prove this difference. On the other hand some studies have demonstrated evidence that craving for tobacco and smoked cocaine (crack) are associated<sup>10</sup> and that exposure to nicotine can increase cocaine self-administration<sup>11</sup> as well as trigger its craving, especially among crack users<sup>12</sup>.

Regarding craving for marijuana, on one hand, one study<sup>13</sup> verified that 93% of marijuana dependents reported only a mild

craving for the substance whereas, another research<sup>14</sup> observed that dependents reported a more intense craving than cocaine dependents. Budney et al.<sup>15</sup> when comparing craving for marijuana and tobacco, found that craving for tobacco was slightly more intense.

The literature findings report that cocaine/crack dependents have a history of other psychoactive substances use<sup>10</sup> and that such use of multiple drugs can produce adverse clinical and behavioural effects, cumulative and synergistic, via interaction between the substances, which may affect craving and the results of drug treatment<sup>16</sup>. Because of the need to better understand the craving construct and its interaction in the use of smoked substances, the purpose of this article is to induce and compare craving for tobacco, marijuana and cocaine (crack) on hospitalized dependents whose drug of choice is crack.

## Methods

### Design

This is a quasi-experimental study.

### Participants

The subjects were chosen "by convenience" which is defined<sup>17</sup> as a means of selecting data on which there is a no statistical randomness but a value judgment, for example, subjects' accessibility as a criterion. The sample consisted of 210 male subjects, admitted to the specialized chemical dependency unit of the São Pedro Psychiatric Hospital (Porto Alegre – RS), divided into 3 groups each comprising 70 subjects. Group 1 (induced craving for crack), group 2 (induced craving for tobacco) and group 3 (induced craving for marijuana).

## Inclusion criteria

Fulfil ICD-10<sup>18</sup> dependence criteria for cocaine/crack, marijuana and tobacco. Been using these substances for at least one year, with a minimum education level of fifth-grade elementary school and aged between 18 and 65 years old. Participants must have been abstinent for a period of 7-21 days. All were undergoing Nicotine Replacement Therapy (transdermal 21 mg) – which is part of the inpatient unit treatment protocol – and were using psychiatric medication. The inclusion of the subject in the study was only done if cocaine/crack was their “drug of choice” (favourite), since it is difficult to observe cocaine/crack dependents that do not use other substances. This criterion had already been used in previous studies<sup>9,19</sup>.

## Exclusion criteria

Presenting psychotic symptoms, acute symptoms of mood disorder (assessed by the SRQ-20; Mari & Williams, 1986), being dependent on other substances or having cognitive impairments that altered performance in the tests according to the Mini-Mental State Examination<sup>20</sup>.

## Instruments

### *Demographics and substance use*

Form with socio-demographic data and information related to pattern of psychotropic substance consumption.

### *Cognitive level*

Mini-Mental State Examination (MMSE)<sup>20</sup> – screening test to assess cognitive level at the time of the interview. 25/30 points suggests commitment, and < 20 points indicates, with certainty, that there is cognitive impairment<sup>21</sup>. For this research a cut-off point below 25 points was used to exclude patients with cognitive impairment from the sample group.

### *Presence of psychotic symptoms*

SRQ-20 – A scale previously validated in Brazil<sup>22</sup>, which screened the general population and classified adults either as neurotic (> 7), who could participate in the study, or psychotic (> 1), who were excluded.

### *Severity of dependence*

Severity of Tobacco, Cocaine/Crack and Marijuana dependence – as there are no validated instruments to assess the severity of dependence on Cocaine/Crack and Marijuana, only on tobacco, in order to standardize the assessment of the severity in all groups, their weekly consumption was taken as a parameter.

### *Anxiety symptoms*

Beck Anxiety Inventory (BAI)<sup>23</sup>: this is a scale that measures the severity of anxiety symptoms. It consists of 21 questions in which the subject must grade on a four point scale. The total score is obtained by summing the individual scores of each question. The cut-offs for psychiatric patients, according to the norms of the Portuguese version, are: 0-10 = minimal, 11-19 = mild, 20-30 = moderate and 31-63 = severe<sup>24</sup>. This will be administered to the three groups of participants.

### *Depression symptoms*

Beck Depression Inventory (BDI)<sup>25</sup>: is designed for measuring the severity of depression, both in psychiatric patients and in the general population. It consists of 21 multiple-choice questions, each with four alternatives; the subject must choose the most applicable feeling at

that moment. The total score is the sum of the points. The cut-offs for psychiatric patients were published in 2001 along with the Portuguese version by Cunha: 0-11 = minimal 12-19 = mild, 20-35 = moderate and 36-63 = severe<sup>24</sup>.

### *Craving intensity*

Visual Analogue Scale (VAS) – to assess *craving* this will be administered to all three groups, the individual will be asked to give their *craving* a grade, where 0 (zero) is the minimum grade (has no *craving*) and 10 the maximum (presents a very strong *craving*), this value is marked on a 10 cm scale. Several authors have used the Visual Analogue Scale to assess *craving* in their research<sup>26-29</sup>.

### *Cocaine craving*

Cocaine Craving Questionnaire Brief (CCQ-Brief)<sup>19</sup>: 10 scale statements compiled from the 45 statements Cocaine Craving Questionnaire – Now<sup>9</sup>. The CCQ-Brief is a Likert 7-point scale ranging from “strongly disagree” to “strongly agree”. The CCQ-Brief and its version adapted for crack were validated in Brazil<sup>30-31</sup>. The score of the CCQ-Brief – Adapted Brazilian version for Crack is obtained from the total sum of the points (with the statements 4 and 7 reversed should be added to the other); from Factor 1 (points) – on the *craving* itself (the sum of all issues except 4 and 7) and Factor 2 – associated with lack of control of crack use (sum of questions 4 and 7 inverted). The cut-offs in the Brazilian version, for the total scale points, are: 0-11 points, minimum *craving*; 12 to 16, mild; 17-22, moderate; and 23 or more points, intense *craving*. This questionnaire will only be applied to Group 1.

### *Tobacco craving*

Questionnaire of Smoking Urges Brief – Brazilian Version – QSU-B<sup>32</sup> – is an abbreviated scale developed by Cox *et al.*<sup>33</sup> from the Questionnaire of Smoking Urges (QSU)<sup>7</sup> used to assess *craving* for tobacco. It is comprised of 10 affirmative statements, to which the individual must state their position using a Likert 7-point scale ranging from “strongly disagree” to “strongly agree”. The QSU-B in its Brazilian validation<sup>32</sup> can be analysed by the sum total of points and by the points of factor 1 related to *craving* for the positive reinforcing properties of tobacco (statements 1, 3, 7 and 10) and by factor 2 related to *craving* of the negative reinforcing properties of this substance (statements 4, 8 and 9). The cut-offs in the Brazilian version for the scale points total are: 0-13 points, minimum *craving*; 14-26, light; 27-42, moderate; and 43 or more points, intense *craving*. This questionnaire will only be applied to Group 2.

### *Marijuana craving*

Marijuana Craving Questionnaire – Short Form – MCQ-SF<sup>34</sup> – It is a self-reporting scale of 12 items, using Likert 7 points ranging from “strongly disagree” to “strongly agree”. It is an abbreviated version of the MCQ<sup>35</sup>, a multidimensional scale of 47 items. In Brazil, the semantic validation was made by Pedrosa *et al.*<sup>36</sup>. In his psychometric<sup>37</sup> the MCQ-SF was divided into three factors: Emotionality (questions 1, 9 and 11), Intentionality (questions 3 and 10) and Compulsivity (questions 2 and 7) and may be analysed in addition to the method of the points in each factor by the sum of the total points (of 12 questions). The cut-off points in the Brazilian version for the total of the scale points are: 0-23 points, minimum *craving*; 24-38, light; 39-53, moderate; and 54 or more points, intense *craving*. This will only be applied to Group 3.

### *Materials to induce craving*

¼ A4 size images of marijuana, crack cocaine and tobacco. Before being employed in this research the photos were considered faithful substance representations, with the potential to elicit *craving*, by a group of 20 hospitalized patients.

## Ethical aspects

Data collection was only initiated after the research project had been approved by the Research Ethics Board of São Pedro Psychiatric Hospital. Before participants were accepted to be part of the research project its purpose was explained to them and they were provided with a written informed consent, which was read with the individual and any possible doubts clarified. The signing of this form was a precondition for the participant to be included in the sample. This research was also conducted in accordance with the Helsinki Declaration as revised 1989.

## Procedures for data collection

Each participant who fulfilled the inclusion criteria was sent individually to a room where an assessment interview was conducted and a record containing socio-demographic data and pattern of psychoactive substance consumption was completed. The SRQ-20, on how they felt at that moment was administered its diagnosis evaluated using ICD-10. During the experimental study, we recorded the period of abstinence from the last crack, tobacco or marijuana consumption, which determined whether the participant would be part of Group 1, 2 or 3 (if evaluated to be part of the marijuana group they would go there, if possible, if not they would go to another group with priority given to the group with less participants).

After deciding into which group the participant would be placed, they were individually shown, for 3 minutes, a photo of the desired *craving* (crack, tobacco or marijuana) related to their group after which other evaluation instruments were administered in the following order: CCQ-Brief (only for patients in Group 1), QSU-B (only for patients in Group 2), MCQ-SF (only for patients in Group 3), VAS, BAI and BDI (for all groups).

## Data analysis

The data collected was processed in the SPSS statistics software (v.20; SPSS Inc., Chicago, IL). Exploratory data analysis consisted of descriptive and frequency statistical tests. The inferential analysis employed the tests: Chi-squared and Analysis of Variance (ANOVA) with Tukey's test. As the QSU-B and CCQ-Brief scales have ten statements each but the MCQ-SF has twelve, the following calculation: "Total points MCQ-SF/12 x 10" was used to allow different substance *craving* results to be compared. The result of this calculation and the raw scores of the QSU-B and CCQ-Brief will be presented in table 1. The significance level used as a parameter was 5%.

## Results

Each of the three groups was composed of 70 participants, regarding marital status, in accordance with the chi-squared test, there was no significant difference between groups ( $\chi^2 = 8.217$ ;  $p = 0.223$ ), with a prevalence of singles: 74.3% ( $n = 52$ ) in the Crack Group, 80.0% ( $n = 56$ ) in the Marijuana Group and 67.1% ( $n = 47$ ) in the Tobacco Group. Group comparison regarding other socio-demographic variables, patterns of substance use and symptoms of depression and anxiety can be seen in table 2.

The comparison of *craving* in the three groups via the Visual Analogical Scale and other Scales to assess *craving* (CCQ-Brief, QSU-B and MCQ-SF), can be seen in table 1. In both tables, ANOVA with Tukey's test was used.

Table 3 shows the severity of *craving* according to the analysis of the total of points from the scales and according to the points of its factors considering its cut-offs, which were published in their respective psychometric validation.

## Discussion

When analysing the results of this study, it was observed that the marijuana group was younger, had first begun by using alcohol (earlier than the tobacco group), had used crack and inhaled cocaine (earlier than

the other two groups) and had spent less time without using inhaled cocaine (compared to the tobacco group) and without using marijuana (than either of the other two groups). In addition, they used an extreme amount of marijuana (about 30 joints per week), independent of this variable there didn't appear a significant difference in the three groups. Such findings may be due to the convenience sample since most patients stopped using marijuana for a period greater than 21 days and before hospital admission (an inclusion criteria). Those who remain using marijuana seem to have a more serious drug use profile, which may have interfered with the *craving*. This result associated with the interruption of marijuana use, well before hospitalization, had already been highlighted in previous studies<sup>38,39</sup> while researching crack addicts hospitalized for detoxification.

The Tobacco group was hospitalized for some time, but this difference did not affect the results, since the controlled variable was time in abstinence and not length of hospitalization and, the tendency of smokers to continue using tobacco. The Crack group used higher amounts of inhaled cocaine than the tobacco group, however, patients tended to be abstinent from this form of cocaine use during hospitalization, which cannot be taken as an intervening variable when comparing *craving* in the three groups. The interruption of inhaled cocaine when given crack was discussed by Balbinot and Araujo<sup>38</sup>.

The abstinent period of marijuana, however, may have affected the intensity of *craving*, but this variable cannot be controlled because of the characteristic of the sample, who had – as observed in other studies<sup>38,39</sup> – a longer period abstinent from marijuana. However, the association between the length of abstinence of marijuana and *craving* was not found in a previous study<sup>37</sup>.

There was no significant difference in the three groups for symptoms of depression and anxiety, mental states that could have interfered with *craving*, as already highlighted in other studies<sup>7,31-32,40-42</sup>.

When comparing *craving* using the Visual Analogue Scale, the tobacco group demonstrated a more intense *craving* than the other groups; however when the specific assessing scales for *craving* were used, the tobacco and marijuana groups had a more intense *craving* than the crack group. That the *craving* result for marijuana is more intense than for crack resembles the one found by McRae *et al.*<sup>14</sup>, however, with respect to inhaled cocaine it contrasts with another study<sup>13</sup> which didn't find an intense *craving* for marijuana.

The more intense tobacco *craving*, than that for other substances, might be associated with the fact that many patients – contrary to what occurs with crack – are not motivated to stop using this substance, this association had already been emphasized<sup>43</sup>. Haller *et al.*<sup>44</sup> also observed this phenomenon while researching the motivation for change in female smokers, however, it should be noted that other studies found no correlation between *craving* and motivation for change in smokers<sup>32,40</sup>, which means this would be just one of the aspects to explain this finding, since dependence, abstinence and all corresponding phenomena with *craving* have multifactorial etiology.

Analysing *craving* for the three substances from their sub-factors, adding the rates of moderate and severe degrees, it can be observed that factor 2 of *craving* for crack (which refers to uncontrolled crack use), the emotionality factor *craving* for marijuana and factor 2 (negative reinforcing capacity) the *craving* for tobacco had higher scores. These results demonstrate that *craving* associated with the use of the substance for the relief of negative affect (such as anxiety and depression) or withdrawal symptoms was more intense than that for obtaining pleasure (positive reinforcement). The relevance, in this sample, of emotional aspects and negative reinforcing potential of substances to induce *craving* had already been verified in research concerning the *craving* for tobacco<sup>7,43</sup>, and marijuana<sup>37</sup>.

Limitations of this study are related to their possible interference with *craving*. They are: the large average amount of marijuana used by the three groups, the length of marijuana abstinence (which is higher in the marijuana group), the fact that psychiatric medication was not controlled<sup>45</sup> and the motivation to change addictive behaviour not being assessed; which mainly may have affected the tobacco *craving* values<sup>43,44</sup>, which most patients did not intend to stop after hospitalization.

**Table 1.** Comparison of the averages in the three groups of scores on the craving scales

Variable	Total Sample			Group 1 – Crack			Group 2 – Marijuana			Group 3 – Tobacco			ANOVA	
	M (SD)	Min	Max	M (SD)	Min	Max	M (SD)	Min	Max	M (SD)	Min	Max	F	p-value
Craving according to Visual Analogic Scale	3.41 (3.39)	0	10	2.39 (2.82) <sup>a</sup>	0	10	3.15 (2.27) <sup>a</sup>	0	10	4.71 (3.64) <sup>b</sup>	0	10	9.287	< 0.001
Craving according to specifics scales for each group	28.60 (17.31)	10	70	19.68 (11.49) <sup>a</sup>	10	55	32.26 (15.86) <sup>b</sup>	10	64.17	33.70 (20.12) <sup>b</sup>	10	70	16.683	< 0.001

M: means; SD: standard deviation; Min: minimum; Max: maximum; <sup>a, b</sup>: means significant differences according to the Tukey's test; F: F-ratio test.

**Table 2.** Sample characteristics regarding sociodemographic variables, pattern of use of substances and symptoms of depression and anxiety

Variable	Total Sample			Group 1 – Crack			Group 2 – Marijuana			Group 3 – Tobacco			ANOVA	
	(n = 210)			(n = 70)			(n = 70)			(n = 70)			F	p-value
	M (SD)	Min	Max	M (SD)	Min	Max	M (SD)	Min	Max	M (SD)	Min	Max		
Age	28.02 (7.41)	18	50	29.35 (6.82) <sup>a</sup>	18	49	25.89 (7.26) <sup>b</sup>	18	50	28.89 (7.73) <sup>a</sup>	18	48	4.671	0.010
Years of Education	7.93 (2.37)	5	15	7.96 (2.28)	5	14	8.14 (2.61)	5	15	7.70 (2.37)	5	15	0.621	0.538
Days of hospitalization	8.68 (3.92)	2	30	8.04 (3.79) <sup>a</sup>	2	30	8.33 (3.74) <sup>a</sup>	2	20	9.64 (4.08) <sup>b</sup>	2	27	3.345	0.037
Age at first use of crack	21.39 (6.39)	10	48	22.94 (6.58) <sup>a</sup>	10	48	19.15 (5.31) <sup>b</sup>	12	35	22.09 (6.65) <sup>a</sup>	13	45	6.864	0.001
Amount of crack use (in rocks)/week	23.02 (27.37)	1	168	24.97 (30.66)	1	168	25.03 (28.10)	2	140	19.04 (22.67)	1	112	1.060	0.348
Last use of crack (days)	55.87 (303.96)	1	3600	9.54 (3.79)	7	21	38.58 (129.45)	1	780	138.54 (555.58)	4	3600	2.639	0.074
Age at first cocaine use	16.75 (3.08)	10	35	17.05 (2.41) <sup>a</sup>	13	25	15.73 (2.42) <sup>b</sup>	10	25	17.42 (3.94) <sup>a</sup>	11	35	5.236	0.006
Amount of cocaine grams/week	11.67 (20.12)	0	140	17.60 (24.97) <sup>a</sup>	0	100	9.74 (20.23) <sup>ab</sup>	0	140	7.80 (12.05) <sup>b</sup>	0	70	3.953	0.021
Last use of cocaine/ days	576.14 (1208.89)	2	7300	631.09 (1078.60) <sup>ab</sup>	2	5040	277 (759.21) <sup>b</sup>	6	5400	912.49 (1667.36) <sup>a</sup>	10	7300	3.400	0.036
Age at first use of marijuana	15.06 (3.05)	9	30	15.46 (3.51)	10	30	14.41 (2.54)	9	20	15.34 (2.98)	9	24	2.452	0.089
Amount of marijuana cigarette/week	24.35 (28.71)	1	160	22.59 (23.67)	1	140	30.07 (35.03)	2	160	19.86 (24.67)	1	140	2.365	0.097
Last use of marijuana (days)	357.21 (1040.44)	1	6480	506.32 (1121.44) <sup>a</sup>	2	5040	10 (3.89) <sup>b</sup>	7	21	732.27 (1508.07) <sup>a</sup>	1	6480	7.822	0.001
Age at first tobacco use	13.82 (3.43)	5	36	13.83 (3.04)	5	20	13.22 (2.80)	7	20	14.39 (4.19)	7	36	1.985	0.140
Amount of tobacco cigarettes/week	167.41 (103.11)	5	700	144.98 (70.65)	20	280	181.88 (127.07)	5	700	173.86 (100.10)	5	560	2.351	0.098
Last use of tobacco (days)	8.64 (3.49)	0	20	8.31 (3.20)	2	15	8.73 (4.01)	0	20	8.84 (3.12)	7	16	0.343	0.710
Age at first alcohol use	13.58 (3.24)	4	25	13.62 (2.98) <sup>ab</sup>	4	20	12.84 (3.52) <sup>a</sup>	5	25	14.26 (3.10) <sup>b</sup>	6	25	3.158	0.045
Units of alcohol* use/ week	63.66 (100.82)	0.80	560	63.17 (94.59)	1	373	61.82 (96.37)	1	560	65.89 (111.52)	0.80	560	0.026	0.974
Last use of alcohol (days)	89.22 (355.85)	1	4015	88.10 (241.96)	2	1440	40.03 (100.11)	1	540	155.67 (596.31)	5	4015	1.392	0.252
BDI total	15.93 (11.10)	0	55	14.23 (8.83)	0	37	17.82 (12.48)	0	55	15.69 (11.47)	0	52	1.898	0.152
BAI total	10.95 (10.43)	0	48	9.70 (9.79)	0	44	11.54 (10.96)	0	47	11.59 (10.51)	0	48	0.743	0.477

M: means; SD: standard deviation; Min: minimum; Max: maximum; \* Unit of alcohol: 10 grams of alcohol; <sup>a, b</sup>: means significant differences according to the Tukey's test; F: F-ratio test.

**Table 3.** Levels of craving for crack, marijuana and tobacco

Variable	Craving levels							
	Minimum		Mild		Moderate		Severe	
	n	%	n	%	n	%	n	%
CCQ-Brief Total	23	32.9	14	20	15	21.4	18	25.7
Craving	0	0	38	54.3	6	8.6	26	37.1
Lack of control	27	38.6	5	7.1	4	5.7	34	48.6
MCO-SF Total	22	31.4	13	18.6	21	30	14	20
Emotionality	15	21.4	19	27.1	18	25.7	18	25.7
Compulsivity	0	0	50	71.4	6	8.6	14	20
Intentionality	0	0	50	71.4	7	10	13	18.6
QSU-B Total	14	20	17	24.3	15	21.4	24	34.3
Craving positive reinforcing	16	22.9	18	25.7	12	17.1	24	34.3
Craving negative reinforcing	0	0	23	32.9	23	32.9	24	34.3

CCQ-Brief: Cocaine Craving Questionnaire-Brief; MCO-SF: Marijuana Craving Questionnaire-Short Form; QSU-B: Questionnaire of Smoking Urges-Brief.

Crack, marijuana and tobacco dependent patients have proven to have a more intense *craving* for tobacco measured by generic scale (Visual Analogue Scale), and for tobacco and marijuana measured by specific scales. *Craving* has been associated with relief of negative emotional symptoms (such as anxiety and depression). Thus, taking into account the patient's suffering in the initial phase of treatment – acute period of abstinence – and the high rates of emotional episodes, it is important to link the cognitive-behavioural techniques with pharmacotherapy to relieve *craving*.

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## Conflicts of interest

The authors declare that there are no conflicts of interest regarding this manuscript.

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