

Parenting Style, Locus of Control, and Oral Hygiene in Adolescents

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Summary. *Objective.* The aim of the study was to test if variations in oral hygiene levels in adolescents were associated with locus of control and parenting styles after controlling for demographic factors.

Material and Methods. The study sample comprised 237 adolescents aged 12–13 years. The structured questionnaire included demographic characteristics and items about parenting style and locus of control. The Individual Quantitative Plaque % Index (IQPI) and toothbrushing frequency were used as clinical outcome measures.

Results. In the bivariate analyses, socioeconomic status ($P=0.012$), number of children in the family ($P=0.003$), and frequency of toothbrushing ($P=0.001$) were related to dental plaque levels. Gender ($P<0.001$), socioeconomic status ($P=0.022$), and external locus of control (Spearman rho, -0.144 , $P=0.027$) were statistically significantly associated with toothbrushing frequency.

In the multivariate analyses, only socioeconomic status and toothbrushing frequency were statistically significantly related to the IQPI. When toothbrushing frequency as the second outcome variable was used, the IQPI and gender were statistically significant. The association with socioeconomic status did not reach statistical significance ($P=0.07$).

Conclusions. Only socioeconomic status and toothbrushing frequency explained variation in dental plaque levels among adolescents. The expected relationship among parenting styles, locus of control, and oral hygiene levels was not confirmed.

Introduction

Relatively stable patterns of health-related behaviors are established during adolescence, and it is difficult to change these behaviors during the adult years (1–3). For adolescents, healthy teeth are even less valuable than their general health (4). Good oral hygiene has been considered of key importance for maintaining oral health. Consequently, irregular toothbrushing has been associated with high levels of dental caries (5, 6). Different patterns in oral hygiene behavior in boys and girls have been observed, with girls having more positive dental practices than boys (7, 8).

Among other factors, locus of control and low socioeconomic status (SES) have been related to oral health (9, 10). Locus of control shows the extent to which an individual believes his/her own health can be controlled by his/her own behavior, by chance, or by powerful others (9). SES has been associated with oral hygiene. However, differences in oral health behaviors have not been fully accounted for differences in socioeconomic status (11). Therefore, it is possible that SES is influencing health not only through known behavioral pathways, but also in some other unknown ways.

The parents' child-rearing practices have a strong influence on the child's development and socializa-

tion (12). In childhood, children adopt beliefs and competences regarding their personal health (13). In adolescence and young adulthood, parents and other family members act as facilitators of certain health-related behaviors (14, 15). With increased age, the responsibility for health shifts from parents to adolescents (16). However, the involvement of parents does not necessarily decrease (17) and is still very important (15, 18). By adolescence, teens usually have a fairly good understanding of how their parents will react to certain behaviors (19).

Adolescence is the life period with the highest prevalence of health risk behavior (20). Parenting was shown to be an important resource moderating the development of health-related behavior during this period (13, 17). Parenting style is defined by two dimensions: demandingness and responsiveness. Demandingness indicates the extent to which parents demand mature behavior, supervise activities, and discipline transgressions. Responsiveness reflects the extent to which parents are attuned to their children's physical, social, and emotional needs and support their growing autonomy. Parents who are both highly demanding and highly responsive are considered authoritative (19). Authoritative parenting has been associated with decreased soft drink consumption (21), decreased drug and alcohol use (22), high self-esteem, and an internal locus of control (23).

However, it is still unknown if a parenting style

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and oral hygiene are related. Therefore, the study hypothesized that oral hygiene levels in adolescents were associated with locus of control and parenting styles after controlling for demographic factors.

Material and Methods

The study was approved by the Bioethics Committee of the Ministry of Health of Lithuania. All 12- to 13-year-old adolescents from 3 randomly selected secondary schools were invited to participate in the study. Before the study, written informed consent was obtained from both adolescents and their parents or guardians. The response rate was 69.6%.

Participants were asked to fill out a structured questionnaire. The items regarding the demographic characteristics (gender, number of children in the family, number of adults with an income in the family, and SES) and toothbrushing frequency were included in the questionnaire because these variables have been commonly associated with oral health. A pretest of the questionnaire in a sample of 10 adolescents aged 12–13 years revealed that the majority of the adolescents did not know the income of the family or the education of their parents. Therefore, as a proxy measure for SES, parent occupation (separately for mother and father) was chosen. The participants were clustered into the following 3 groups: professional/managerial (highly skilled), skilled (skilled, semiskilled), and manual labor (unskilled) (24). The questionnaire also included items about a parenting style and locus of control.

The Authoritative Parenting Index (API) (25) was used for assessing parenting styles. Reliability and validity of the API was tested in 3 studies in samples of adolescents, and the API was shown as

a reliable and valid tool for measuring parenting in studies of child and adolescent risk taking (25).

The adolescents themselves completed the API questionnaire, which measures their perceptions of parenting behaviors and includes multiple indicators related to two domains. The responsiveness domain inquires about parental warmth, acceptance, and involvement. The demandingness domain indicates parental supervision, assertive control, and monitoring (Table 1). The multiple items from each domain and for each parent (separately for mother and father) were used to allocate parenting into an authoritative, permissive, authoritarian, and uninvolved maternal, and respectively paternal, parenting style. If an adolescent resided in a one-parent home, only one parenting style (of the parent present in the family) was included in the subsequent analyses.

The previously validated dental beliefs questionnaire (9) was used to assess adolescents' locus of control (Table 2). This questionnaire comprises multiple items on 3 subscales, namely the internal locus of control, the external locus of control, and the chance locus of control. Each subscale item ranges from 1 (strongly disagree) to 6 (strongly agree).

For a clinical outcome, the assessment of individual dental plaque levels was chosen. The Individual Quantitative Plaque % Index (IQPI) is an interval scale measurement that has been shown to be suitable for describing the interindividual variations; it indicates the areas on teeth that are covered with plaque as a percentage of the total teeth area (26). The IQPI was based on digital images of disclosed plaque. In order to avoid possible measurement bias (Hawthorne effect), clinical examinations were performed at a time not announced in advance

Table 1. Items and Factor Structure of the Authoritative Parenting Index*

Domain and its Indicator	Mother's Indicator Loading	Father's Indicator Loading
Responsiveness		
She/he wants to hear about my problems	0.738	0.791
She/he tells me when I do a good job on things	0.735	0.798
She/he listens to what I have to say	0.680	0.725
She/he likes me just the way I am	0.604	0.762
She/he makes me feel better when I am upset	0.603	0.667
She/he is pleased with how I behave	0.598	0.664
	Cronbach α =0.729 KMO=0.782	Cronbach α =0.729 KMO=0.846
Demandingness		
She/he makes sure I tell her/him where I am going	0.751	0.756
She/he tells me times when I must come home	0.685	0.766
She/he asks me what I do with friends	0.652	0.640
She/he has rules that I must follow	0.622	0.735
She/he is always telling me what to do	0.590	0.672
She/he makes rules without asking what I think	0.589	0.680
She/he makes sure I go to bed on time	0.520	0.627
	Cronbach α =0.748 KMO=0.793	Cronbach α =0.823 KMO=0.804

*Exploratory factor analysis. Extraction method: principal component analysis. KMO, Kaiser-Meyer-Olkin measure of sampling adequacy.

to the participants. Clinical recordings were taken and subsequently evaluated by one examiner (V.B.). In order to secure blinding, all digital images were precoded for subsequent random assessments.

Two contextually different outcome measurements were chosen to test the present hypothesis. The first outcome was toothbrushing frequency, indicating the presence/absence of the toothbrushing behavior. The second outcome, the IQPI, evaluated the quality of toothbrushing behavior.

The Statistical Package for Social Sciences (PASW 18.0, Chicago, IL, USA, 2010) was used for all analyses, and the level of statistical significance for all tests was considered at $P < 0.05$.

The intraexaminer reliability was assessed by intraclass correlation comparing double recordings of

10 randomly chosen digital images. The intraclass correlation coefficient of 0.91 was considered an acceptable level of the intraexaminer reliability.

Factor analysis was used for all multi-item scales to study the relationships among interrelated variables in terms of a few conceptually meaningful and independent domains (27). Common domains were extracted employing the exploratory factor analysis by applying the principal component analysis with eigenvalue greater than 1 set as a default value.

The adequacy of items forming multi-item scales for both parenting and locus of control measures was assessed by the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) and Cronbach α measure of multi-item internal consistency.

The KMO reflects the degree of common variance among the indicators and ranges from 0 to 1, where 0 indicates that there is no common variance among indicators, while 1 means that all indicators from the domain share the same common variance. The domain and its indicators were validated when the KMO values were 0.6 or higher. The Cronbach α determined the internal consistency of these items and assessed an overall reliability of each multi-item scale. The items that reduced the internal consistency of the scale were further excluded from subsequent procedures. The chosen item loadings indicate a correlation of an item to its corresponding multi-item domain (e.g., locus of control subscales or responsiveness and demandingness scales). A higher loading indicates a higher contribution to a common domain.

Pearson and Spearman correlations were used to relate the locus of control variables with the outcome measures. For other bivariate comparisons, the independent sample t test, the chi-square test, or 1-way ANOVA with post hoc Bonferroni adjustment were applied.

Regression analyses were employed to evaluate the joint associations between different independent variables and the outcome measures. In order not to lose information inherent in multi-item scales, factor scores were calculated for each locus of control subscale and further introduced into regression models.

Results

The study sample comprised 237 adolescents aged 12–13 years. The majority of them ($n=204$, 86.07%) lived with both parents, while 33 participants (13.93%) resided in a one-parent home. Table 3 presents the distribution of the study participants regarding their demographic characteristics.

Exploratory Factor Analyses. In the responsiveness domain, 7 items were tested, and the item “*She/he is too busy to talk to me*” was removed because it did not contribute to the commonality of this domain. The items maintained in the responsiveness domain and their loadings are presented in Table 1. For example, items “*She/he wants to hear about my problems*” and “*She/he tells me when I do*

Table 2. Items and Factor Structure of the Revised Dental Beliefs Questionnaire (9)*

Domain and its Indicator	Indicator Loading
Internal Locus of Control	
I believe I can help prevent dental disease	0.657
I believe if I brush my teeth every day I am less susceptible to dental disease	0.693
I am directly responsible for preventing the loss of my teeth	0.668
I believe brushing my teeth can help prevent dental disease	0.646
I believe brushing my teeth helps to prevent dental caries	0.552
	Cronbach $\alpha=0.640$ KMO=0.755
External Locus of Control	
The fate of my teeth is in the hands of the dentist no matter how much time I spend taking care of my teeth	0.782
I believe that brushing my teeth daily is more trouble than going to the dentist frequently and having the dentist take care of them	0.749
If both my parents have bad teeth, toothbrushing will not help my teeth	0.726
Only the dentist can prevent dental disease	0.723
	Cronbach $\alpha=0.731$ KMO=0.701
Chance Locus of Control	
I cannot seem to do much to take care of my teeth	0.817
There is not much I can do to prevent dental problems	0.719
I believe that toothbrushing is important and could possibly prevent dental disease, however I do not care about something that may happen in 20 or more years from now	0.680
	Cronbach $\alpha=0.731$ KMO=0.593

*Exploratory factor analysis. Extraction method: principal component analysis.
KMO, Kaiser-Meyer-Olkin measure of sampling adequacy.

a good job on things” (both loadings more than 0.7) contributed most to this domain.

Regarding the demandingness domain, 9 items were tested (Table 1). Two items, namely “*She/he knows where I am after school*” and “*She/he checks to see if I do my homework*” did not belong to the commonality of this domain; therefore, these items were subsequently dropped from further analyses. The items mostly contributing to the demandingness domain were “*She/he makes sure I tell her/him where I am going*” and “*She/he tells me times when I must come home.*”

Further, the items maintained in both responsiveness and demandingness domains were used to calculate the total summed score for each domain. The median values of the summed score in each domain were used to allocate individuals either into a group of low or high responsiveness or demandingness. For the specific details regarding how these 2 domains were used to allocate adolescents into the type of parenting style they receive refer to Table 4.

In the internal locus of control domain, 7 items

were tested for their interitem consistency. After this testing, 2 items “*I am directly responsible for my dental health*” and “*I believe teeth should last a lifetime*” were excluded as they did not substantially contribute to this domain (Table 2).

After testing the external locus of control domain, 3 items were excluded, namely “*Whenever I have trouble with my teeth I should consult a dentist,*” “*Regular visits to the dentist are the best way for me to avoid dental disease,*” and “*It is important to me that my friends think my teeth are healthy*” (Table 2).

In the chance locus of control domain, 4 items, i.e., “*I am likely to get dental caries in the next year or two,*” “*I am likely to lose a tooth in the future,*” “*I believe tooth loss is a normal part of getting older,*” and “*Once tooth disease has started it is almost impossible to stop*” had to be excluded (Table 2).

Bivariate Analyses. Moreover, 4 demographic variables, toothbrushing frequency, parenting styles of both parents, and 3 locus of control measures were associated with the IQPI (Table 3). There was a statistically significant difference among socioeco-

Table 3. Demographic Factors, Toothbrushing Frequency, Parenting Styles, Dental Beliefs, and the Individual Quantitative Plaque % Index

Factor	Individual Quantitative Plaque % Index	
	Mean (SD)	P Value
Gender*		
Boys (N=124)	42.03 (20.40)	0.347
Girls (N=113)	39.57 (19.65)	
Number of children*		
One child (N=53)	39.97 (21.66)	0.003
Two children (N=146)	38.58 (18.55)	
Three or more (N=37)	51.08 (20.95)	
Toothbrushing frequency*		
Twice per day (N=110)	37.31 (20.02)	0.001
Once per day (N=98)	41.28 (19.84)	
Less than once per day (N=29)	52.92 (16.12)	
Socioeconomic status*		
Low (N=49)	47.60 (19.91)	0.012
Medium (N=124)	40.47 (18.98)	
High (N=64)	36.45 (21.07)	
No. of adults with income in the family*†		
One (N=90)	43.38 (20.62)	0.112
Two or more (N=144)	39.12 (19.33)	
Mother's parenting style*‡		
Authoritative (N=57)	42.14 (18.96)	0.729
Permissive (N=47)	40.39 (19.36)	
Authoritarian (N=54)	38.04 (22.98)	
Uninvolved (N=76)	41.22 (18.89)	
Father's parenting style*‡		
Authoritative (N=46)	40.33 (20.02)	0.958
Permissive (N=35)	39.15 (18.78)	
Authoritarian (N=51)	41.52 (21.13)	
Uninvolved (N=75)	40.04 (20.73)	
Dental beliefs (locus of control subscales)§		
Internal (N=235)	$r=0.019$	0.770
External (N=235)	$r=0.056$	0.394
Chance (N=235)	$r=0.103$	0.115

*Independent sample *t* test or 1-way ANOVA with post hoc Bonferroni adjustment.

†Three individuals indicated that their families were supported by social support institutions; therefore, they were not included in this analysis.

‡Some individuals indicated that they lived in a single-parent family.

§Pearson correlation.

conomic status groups ($P=0.012$). There was also a statistically significant difference between families having one child and families having 3 or more children ($P=0.003$). Higher frequency of toothbrushing was related to lower levels of dental plaque ($P=0.001$).

Although the specific parenting styles of mothers and fathers were related (e.g., mother authoritative and father authoritative, $r=0.466$; $P<0.001$), these variables did not associate significantly with oral hygiene levels.

None of locus of control variables presented statistically significant associations with the IQPI.

The same variables as presented in Table 3 were associated with the second outcome variable, i.e., toothbrushing frequency. Of all, gender ($P<0.001$), SES ($P=0.022$), and external locus of control (Spearman rho, -0.144 ; $P=0.027$) were statistically significantly associated with toothbrushing frequency.

Multivariate Analyses. Two regression analyses were employed: linear multiple regression (outcome, IQPI) and binary logistic regression (outcome, toothbrushing frequency). The normality testing of the IQPI showed that this variable was normally distributed (skewness, 0.210; kurtosis, -0.433); therefore, the assumption for normality was fulfilled and subsequently the linear multiple regression was employed.

Four demographic variables (gender and 3 social variables), toothbrushing frequency, parenting styles, and 3 locus of control measures were jointly assessed with the IQPI applying the linear multiple regression analysis (Table 5). For this testing, 4 dummy variables related to parenting styles were created, e.g., authoritative parenting style vs. others, permissive parenting style vs. others, etc. Subsequently, the collinearity testing was used to identify the potential multicollinearity effects, i.e., if 2 or more interrelated variables may be simultaneously introduced into linear multiple regression. This collinearity analysis showed that dummy variables related to parenting styles were interrelated, i.e., they violated the assumption for independence among the set of independent variables (multicollinearity problems); therefore, only one parenting style variable could be introduced into the linear multiple regression model at a time. The further testing showed that among all parenting variables the authoritarian parenting style had the greatest contribution to explaining variations in the IQPI. The results of the final linear multiple regression are presented in Table 5. The tolerance values in the final linear multiple regression were above 0.6, which means that there the assumption for independence was fulfilled.

Although the final linear multiple regression was statistically significant ($P=0.005$), only 2 independent variables, namely socioeconomic status and toothbrushing frequency, were statistically significantly related to the outcome (Table 5).

Toothbrushing frequency as the second outcome variable was tested employing the binary logistic

Table 4. Allocation of Adolescents into Groups of Different Parenting Styles*

Authoritative	Authoritarian
Demandingness High	Demandingness High
Responsiveness High	Responsiveness Low
Mothers (n=57, 24.4%)	Mothers (n=54, 23.1%)
Fathers (n=46, 22.2%)	Fathers (n=51, 24.6%)
Permissive	Uninvolved
Demandingness Low	Demandingness Low
Responsiveness High	Responsiveness Low
Mothers (n=47, 20.1%)	Mothers (n=76, 32.5%)
Fathers (n=35, 16.9%)	Fathers (n=75, 36.2%)

*A median value for each attribute was used to allocate individuals into high/low groups.

Table 5. Individual Quantitative Plaque % Index and Toothbrushing Frequency (Regression Analyses)

Dependent Variable: Toothbrushing Frequency		
Independent Variable	Odds Ratio	P Value
IQPI	1.0	0.004
Gender	5.9	0.002
Socioeconomic status	1.9	0.070
Number of children	1.2	0.655
Number of incomes	0.7	0.546
Internal locus of control	1.3	0.314
External locus of control	0.7	0.295
Chance locus of control	0.8	0.544
Mother authoritarian	1.5	0.491

Model summary: -2 Log likelihood 137.114, Nagelkerke $R^2=0.285$, $P<0.001$

Dependent Variable: Individual Quantitative Plaque % Index			
Independent Variable	Standardized Coefficients	P Value	Tolerance
Gender	0.025	0.718	0.842
Toothbrushing frequency	0.200	0.004	0.863
Socioeconomic status	0.147	0.038	0.833
Number of children	0.116	0.074	0.984
Number of incomes	0.029	0.674	0.866
Internal locus of control	0.009	0.894	0.894
External locus of control	0.039	0.634	0.618
Chance locus of control	0.115	0.157	0.634
Mother Authoritarian	0.053	0.413	0.981

Model summary: adjusted $R^2=0.065$, $P=0.005$

IQPI, Individual Quantitative Plaque % Index.

regression. Only 2 independent variables, i.e., the IQPI and gender, were statistically significant in this model. The association with SES did not reach statistical significance ($P=0.07$).

Discussion

The present hypothesis that oral hygiene levels in adolescents are associated with locus of control and parenting styles after controlling for demographic factors was not confirmed.

Two outcomes, i.e., the IQPI and toothbrushing frequency, were associated with a number of different factors. However, only 2 variables, namely SES and toothbrushing frequency, contributed to explaining the variation in dental plaque levels (the IQPI) among adolescents.

When toothbrushing frequency outcome was used, the association with SES was of borderline significance ($P=0.07$). Finding SES as an important factor was not surprising as SES has commonly been found to be a good predictor in models including oral health and oral health-related behaviors (28).

When toothbrushing frequency was studied as an outcome variable, gender was statistically significant. However, gender was not statistically significant in the model where outcome variable was the IQPI. Seemingly, girls tend to brush their teeth more frequently than boys, but neither girls nor boys focus on the quality of toothbrushing. It is possible that adolescents understand the importance of toothbrushing, but they do not have sufficient knowledge about the quality of toothbrushing.

In bivariate analyses, the number of children in the family was statistically significantly related to the IQPI. However, the importance of this variable diminished in multivariate analyses when it was controlled for several other variables. In contrast, the study of Christensen et al. (28) found a number of social variables including the number of children in the family as good predictors of high levels of dental caries.

Unexpectedly, none of the parenting styles related to variations in dental plaque levels. In medical research, the authoritative parenting style has been associated with higher levels of positive and lower levels of negative health-related behavior compared with the 3 other parenting styles (13). The present study did not find the same pattern although the adolescents' perceptions of maternal and paternal parenting were related as reported elsewhere (13). Unhealthy behaviors, such as smoking, drug use, alcohol use, and unsafe driving, might be more directly associated with a parenting style as compared with oral hygiene behavior, which possibly has a less tangible effect. Moreover, it has been suggested that the authoritative parenting style may not prevent the increase of all problematic behavior patterns during adolescence (13).

In dental research, the authoritative parenting style has been related to a child's compliant behavior, while other parenting styles showed substantially less compliance to dental treatment (29). In contrast, the present study found that another parenting style, namely the mother's authoritarian parenting, was the only one that had some relationship with oral hygiene.

Internal locus of control was expected to relate to lower levels of dental plaque in adolescents; however, this association was not found. The multidimensional health locus-of-control scales have been validated and used in many medical studies, and the scales have subsequently contributed to a better understanding of the role of control cognitions in influencing health behaviors (30). As the present study had to exclude multiple items particularly from the

chance locus of control subscale, possibly the locus of control scales adapted for different purposes might not be well suited for oral research. It is also possible that locus of control does not associate with oral hygiene. In contrast to the present study, an association between toothbrushing and locus of control has been demonstrated in a slightly older age group, i.e., in 14–15-year-olds (31). Possibly, in the present study, the absence of the expected association between locus of control and oral hygiene behavior may be attributed to the fact that locus of control has not been fully developed in 12–13-year-olds.

The advantages and limitations of the present study need to be considered. An interval scale measurement for assessing dental plaque was chosen for the present study. This measurement was acquired by summing interval scale measurements taken at a tooth level. Having a truly interval (continuous) outcome variable should be considered as an advantage compared with previous studies where dichotomous (32), ordinal scale (7), or not truly interval scale (33) measurements were chosen for a similar purpose. For example, in the study by Saied-Moallemi et al. (33), dental plaque was recorded at a tooth level with no plaque (0), plaque on gingival margins only (1), and plaque elsewhere (2). Further, these tooth-specific scores were summed into a total individual score, which was treated as an interval scale measurement in subsequent parametric statistics. This way of acquiring an individual score might be problematic at least for the reason that summing nominal scores into an interval scale measurement is not an accurate indicator, and also it can hide a true variation in oral hygiene levels. The information is also lost when the ordinal scale measurement (e.g., 5 categories) is collapsed into a dichotomous measurement (32); using this method causes the interindividual variation to be recorded inaccurately.

Concomitantly, the present study used a nominal variable related to parenting styles, which could be seen as a limitation. As no previous studies presented specific principles regarding how to allocate subjects into 4 different parenting styles based on the Authoritative Parenting Index, the present study had to arbitrarily define values for thresholds (using a median value for allocation) regarding responsiveness and demandingness domains. These values were subsequently used to allocate subjects depending on the parenting styles they received. However, this arbitrary allocation may have a limitation as two multi-item domains (both interval scale variables) were recoded into one nominal variable. This could contribute to inaccurate allocation into parenting styles.

Although the present study did not find the relationship among oral hygiene, locus of control, and parenting styles, the presence of such relationship cannot be excluded. In order to acquire the necessary evidence, studies specifically focused on the quality of an oral hygiene habit, including measures of ado-

lescent's self-efficacy, parent-facilitated efficacy, parenting styles, and locus of control measures specifically designed for this inquiry should be performed.

Gender and socioeconomic status were associated with differences in dental plaque levels and toothbrushing frequency. A potential implication of these findings is that health education programs should be targeted at specific socioeconomic and gender groups.

Conclusions

Socioeconomic status and toothbrushing fre-

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quency contributed to explaining the variation in dental plaque levels among adolescents. The expected relationship among parenting styles, locus of control, and oral hygiene levels was not confirmed.

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Statement of Conflict of Interest

The authors state no conflict of interest.

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