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# Is the Theory of Planned Behavior a good model for predicting salt consumption behavior in pregnant women? A structural equation modeling approach

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## Abstract:

**BACKGROUND:** Non-communicable illnesses are the leading reason for wide-reaching death. Reducing the burden of these illnesses is one of the significant objectives of the World Health Organization's action plan. In this respect, reducing salt consumption is one of the most cost-effective public health interventions. The present study aimed to adjust the Theory of Planned Behavior (TPB) in expecting salt consumption behavior in pregnant women visiting the health centers in Birjand.

**MATERIALS AND METHODS:** In this cross-sectional study, 273 pregnant women who visited the health centers in Birjand were selected through Quota sampling method. The data were collected using a self-administered questionnaire based on the TPB constructs. The data analysis was done in SPSS 19 and AMOS 24.

**RESULTS:** The mean age of participants was  $27.33 \pm 5.77$  years, and their mean gestational age was  $12.67 \pm 4.11$  weeks. The mean score of attitude construct was  $86.54 \pm 8.50$ , subjective norm construct  $36.59 \pm 4.47$ , perceived behavioral control construct  $41.63 \pm 7.01$ , intention construct  $16.01 \pm 2.65$  and behavior construct  $19.86 \pm 2.57$ . There was a statistically significant relationship between attitude construct ( $p < 0.001$ ), perceived behavioral control ( $p < 0.001$ ), and intention ( $p < 0.001$ ) with salt consumption behavior ( $p < 0.05$ ). The goodness of fit indices showed a proper fit of data ( $\chi^2/df = 1.94$ , PNFI = 0.6, TLI = 0.9, CFI = 0.9 and RMSE = 0.06).

**CONCLUSION:** The results of this study showed that the TPB is an appropriate model for reviewing the behavior of salt consumption. Hence, this model offers a suitable basis for designing an educational intervention to regulate the quantity of salt consumed by pregnant women and; thus, its usage in health promotion programs is suggested.

## Keywords:

Attitude, behavior, health care centers, pregnant women, salt consumption, Theory of Planned Behavior

## Introduction

Non-contagious diseases are the principal reason for death on a global scale.<sup>[1]</sup> Based on the WHO Action Plan, reducing salt intake to less than 5 g/day has recognized as one of the most cost-effective public health

interferences to control the burden of these diseases.<sup>[1,2]</sup> Nevertheless, the average salt intake worldwide is estimated at roughly 10 g/day, which is twice the WHO guiding principle.<sup>[2]</sup> In fact, the results of numerous studies show that more than 95% of the world's population consume too much salt.<sup>[3]</sup>

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It is normally predictable that excessive salt consumption accounts for approximately 3 million mortalities and a loss of 70 million DALY1.<sup>[4]</sup> Through time, high salt intake can lead to high blood pressure, cardiovascular disease,<sup>[2]</sup> stroke, osteoporosis, obesity, stomach cancer, chronic kidney sickness<sup>[5]</sup> and diabetes.<sup>[6]</sup> WHO member states are working to reduce salt consumption by 30% by 2025, set by the World Health Assembly in 2013.<sup>[2]</sup> One of the vulnerable groups that benefit from reduced salt consumption is pregnant women. Pregnancy is a vital stage in women's life and a proper nutrition of mothers has most important effects on maternal and child health.<sup>[7,8]</sup> According to the Academy of Nutrition and Dietetics, women of childbearing age should lead healthy lifestyles to decrease the risk of fetal malformation and the risk of chronic diseases of mother and baby.<sup>[9]</sup> So far, no study has been conducted to examine the status of salt consumption behavior among the population of Iranian pregnant women, but the results of other studies indicate a high salt intake among the general Iranian adult population. Indeed, the average salt consumption in Iran is about 9.52 g/day, which is at least twice as much as the recommended level among 40% of adults.<sup>[10]</sup>

In spite of the widespread knowledge of the damaging effects of salt intake, there is little information about the factors affecting salt intake in the population of pregnant women. Theories of health-related behaviors can be used to understand more carefully factors affecting behaviors.<sup>[11]</sup> One of the most comprehensive theories to predict factors affecting healthy behaviors is the Theory of Planned Behavior (TPB).<sup>[12]</sup> This theory focuses on the role of thought in decision-making about adopting behaviors.<sup>[13]</sup> Based on this theory, the most important determinant of each individual's behavior is behavioral intention, which is inclined by three factors: attitude towards behavior (instrumental or emotional assessment of behavior), subjective norms (social pressure perceived by the individual to achieve behavior) and perceived behavioral control (perception of the difficulty or ease of performing the desired behavior) [Figure 1].<sup>[14]</sup> The TPB has been used in many studies with topics such as consumption of low-value snacks, consumption of fast food, use of fruits and vegetables, and physical activity.<sup>[15,16]</sup>

In general, based on the researcher's review, no study has been conducted on factors affecting salt consumption behavior in pregnant women in Iran. On the other hand, women health might affect society health, that's why they need significant attention.<sup>[18]</sup> So, this study was conducted to examine whether the assumed TPB model is appropriate for predicting the salt consumption behavior in pregnant women in Birjand.

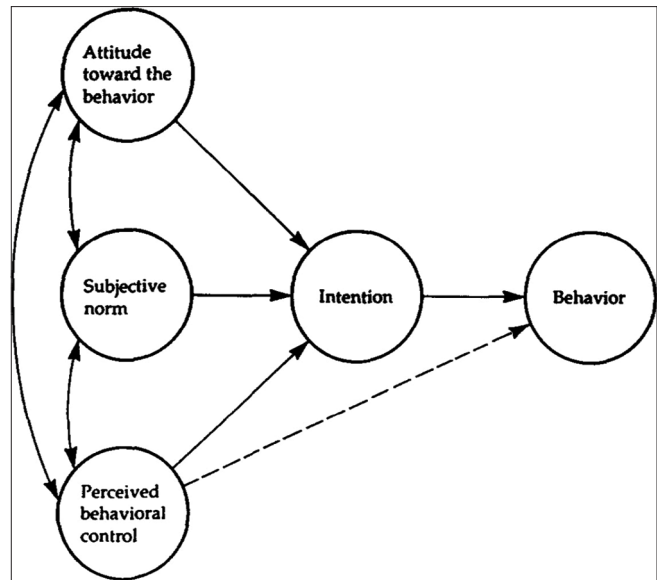


Figure 1: Theory of Planned Behavior Components and Linkages<sup>[17]</sup>

## Materials and Method

### Study design and setting

The present descriptive-analytical study was cross-sectional in type and was completed in 2021 on pregnant women visiting health centers in Birjand.

### Study participants and sampling

The sampling method was quota sampling. Since the city of Birjand has 8 health centers, according to the approximate number of pregnant mothers covered by each center and according to the total sample size of 273 people, the required sample size was determined proportional to size in each center. In this way, from all health centers sited in Birjand city and its committed bases, women who were in the first half of pregnancy and had conferred to health centers through the winter of 2021 to receive pregnancy care were carefully chosen. Other inclusion criteria were as follow:

No chronic hypertension (no medications or diets affecting blood pressure), lack of known advanced chronic diseases such as cancer, lupus, advanced heart failure, kidney disease, diabetes and stroke, non-addiction to drugs and alcohol, no mental disease based on the individual's medical record in the Integrated Health System, literacy (ability to read and write to answer the questions) and willingness to take part in the research. In addition, incomplete completion of the questionnaire was considered as an exclusion criterion.

The sample size in this study<sup>[19]</sup> was estimated at 273 people with 95% confidence level and a power of 80%.

### Data collection tool and technique

The data collection instrument was a two-part questionnaire, the first part of which inspected

1 Disability Adjusted Life Years

demographic information (24 questions about demographic characteristics and fertility history) and the second part included 54 questions related to TPB constructs). To develop this instrument, Rahimdel et al.'s<sup>[20]</sup> questionnaire enquiring about the determinants of salt consumption was used as a basis and based on the characteristics of the target group, the required changes were made. Accordingly, at first, the face validity of the first draft (of the questionnaire) was evaluated by 14 pregnant women and based on their comments; the problems with form and comprehension were solved. Then, in order to check the content validity, the questionnaire was given to 6 health education specialists. Based on the experts' points of view, the content validity index and content validity ratio for the questionnaire items were approved (CVI = 0.99 and CVR = 0.99). To check the reliability of this questionnaire, the internal consistency method was used and Cronbach's alpha coefficient for each of the TPB constructs was estimated: Behavioral beliefs ( $\alpha = 0.86$ ), evaluations of behavioral outcomes ( $\alpha = 0/8$ ), normative beliefs ( $\alpha = 0.72$ ), motivation to comply ( $\alpha = 0.81$ ), control beliefs ( $\alpha = 0.73$ ), perceived power ( $\alpha = 0.90$ ), Intention ( $\alpha = 0/90$ ) and behavior ( $\alpha = 0/55$ ). The final questionnaire included the following constructs: Behavioral belief (12 questions), Outcome Evaluation (12 questions), Normative belief (5 questions), Motivation to comply (5 questions), Control beliefs (6 questions), Perceived power (6 questions), Intention (4 questions), and salt consumption behavior (4 questions).

The array of responses in all constructs of TPB followed a Likert scale with five options, which for all the items except the evaluations of behavioral outcomes ranged from *strongly agree* to *strongly disagree*—and for the evaluations of behavioral outcomes ranged from—*completely important* to *not important at all*. The responses to three questions of the behavior construct were given on 3-point Likert scale including yes, to some extent and no. In the question "How many times a week do you typically eat fast food, salty snacks and canned foods?" the options were "once a week, 2–3 times a week, 4–5 times a week, every day, or not at all."

The score of each question except for the behavior construct ranged from 1 to 5. Therefore, the maximum score that could be obtained from behavioral belief and evaluation of belief was 60, in the normative beliefs and motivation to comply 25, in perceived control and power 30, and in the intention construct 20. Correspondingly, the maximum score obtained from the 3 questions of behavior construct (containing a score range of 1 to 3) was 9. In the question of normal food intake per week, it was 15. It should be noted that attitude score was the sum of behavioral belief and evaluations of behavioral outcomes, subjective norm score was the sum of

normative belief and the motivation to comply questions and perceived behavioral control scores were the sum of perceived control beliefs and perceived power questions, respectively.

### Statistical analysis

In this study, SPSS 19 (SPSS Inc, Chicago, IL) and AMOS24 (Arbuckle & Wothke, 2009, IBM SPSS AMOS 18, Small water Corporation, Meadville PA.) were used for data analysis. Mean and standard deviation were used to describe interval variables and frequency and percentage were used to report non-interval variables. Pearson correlation coefficient was also used to test the relationship between the model constructs. For data analysis, Structural Equation Modeling (SEM), a robust multivariate analysis technique, was employed.<sup>[21]</sup> The use of structural equation modeling ranges from the analysis of simple relationships between variables to complex analyzes for first- and higher-order constructs.<sup>[22]</sup> This model affords a flexible framework for developing and analyzing multifaceted relationships between manifold variables and allows researchers to test the validity of a given theory using empirical models. Conceivably, the biggest advantage is the ability to estimate the measurement errors, as one of the main limitations of most studies.<sup>[23]</sup> More specifically, the  $\chi^2/df$ , PNFI, TLI, CFI, and RMSE indices were used to evaluate the extent to which the hypothetical model adequately defined the sample data. If  $\chi^2/df$  is less than 5 and PNFI exceeds 0.5, RMSE is less than 0.08, and other indicators are more than 0.90, the model shows a good fit.<sup>[24]</sup>

### Ethical consideration

All the procedures were approved by the Ethics Committee of the Birjand University of Medical Sciences (IR.BUMS.REC.1401.112). Also, the purpose of study was revealed to the participants of the study and oral informed consent was obtained from them all.

## Results

In this study, 273 pregnant women visiting the health centers in Birjand in winter 2021 were studied. Among them, 34 subjects were excluded from the study due to their incomplete questionnaires, and finally 239 questionnaires remained for analysis. The mean age of the participants was  $27.33 \pm 5.77$  years, and their mean gestational age was  $12.67 \pm 4.11$  weeks. Most of the pregnant women in the study held a diploma (37.3%), a master's degree (37.3%). They mostly were homemakers (87.2%). Moreover, their spouses were more probable to have a diploma (42.1%) and be freelancers (49.1%). Most of the participants (40.2%) self-reported their family income status at an average level. Fifty subjects (21%) stated that their pregnancy was unwanted and out of 97 (35%) whose gender was

determined, 92 (94.8%) were pleased with their child's gender. Most of the pregnant women craved for sour things. The demographic characteristics of the subjects are summarized in Table 1.

In this study, the mean score of attitude construct was  $86.54 \pm 8.50$ , subjective norm construct was  $36.59 \pm 4.47$ , perceived behavioral control construct was  $41.63 \pm 7.01$ , intention construct was  $16.01 \pm 2.65$  and behavior was  $19.86 \pm 2.57$ . There was a statistically significant relationship between attitude, perceived behavioral control and intention with salt consumption behavior ( $p < 0.05$ ). Additionally, there was a statistically significant relationship between attitude, perceived behavioral control, and intention ( $p < 0.05$ ). Also, subjective norm showed to have a significant relationship with subjective norm and perceived behavioral control and intention ( $p < 0.05$ ). Finally, a statistically significant relationship was found

**Table 1: Demographic characteristics of research participants (n=239)**

Variable	Mean±Standard deviation
Age (year)	27.33±5.77
Gestational age (week)	12.67±4.11
Number of family member	2.91±0.94
Person's education	n (%)
Under Diploma	43 (18.2)
Diploma	88 (37.3)
Post-diploma and bachelor's degree	88 (37.3)
Master's degree and higher	17 (7.2)
Spouse's education	
Illiterate	4 (1.8)
Under Diploma	37 (16.7)
Diploma	93 (42.2)
Post-diploma and bachelor's degree	67 (30.3)
Master's degree and higher	20 (9)
Person's job	
Housewife	190 (87.2)
Employed	28 (12.8)
Spouse's job	
Manual work	40 (18.2)
Office work	72 (32.7)
Freelance	108 (49.1)
Income Status	
High	38 (16)
Medium	171 (72.2)
Low	28 (11.8)
Craving	
Longing salinity/brininess (yes)	52 (25)
Longing pickle (yes)	83 (40.3)
Longing sweets (yes)	42 (20.6)
Longing bitter (yes)	13 (6.4)
The pregnant woman oversees cooking	
Yes	230 (96.6)
No	8 (3.4)

between intention and perceived behavioral control ( $p < 0.05$ ) [Table 2].

In this study, SEM was used to test the constructs affecting salt consumption behavior [Figure 2]. The hypothetical model was based on the TPB Conceptual Model [Figure 1]. The findings showed that the final model was adequately fit with the data; to summarize,  $\chi^2/df = 1.94$ , PNFI = 0.6, TLI = 0.9, CFI = 0.9, and RMSE = 0.06.

## Discussion

Lack of adherence to the amount of salt consumed can have permanent consequences for people's health. Conversely, pregnant women are one of the important populations in society, and paying attention to their health can significantly affect the health of society. Hence, it is essential to know the underlying factors that account for pregnant women's tendency to consume excessive salt. Consequently, the present study was conducted to examine whether the TPB model was a good model to predict salt consumption behavior in pregnant women.

The results of the present study showed that the TPB is a suitable model for studying salt consumption behavior. It is consistent with the results of Whitaker *et al.*<sup>[25]</sup> indicating that TPB is a useful framework for assessing and predicting pregnant women's intention to eat healthily throughout pregnancy. Also, the results of a study by Dormanesh *et al.*<sup>[16]</sup> also showed that the TPB meaningfully predicts behaviors connected to sodium restriction, potassium restriction, and regular physical activity among patients on hemodialysis. In addition, in Karimi *et al.*'s<sup>[26]</sup> study, it was observed that the TPB is effective in explaining oil consumption behavior. In the study of Rezabeigi Davarani *et al.*,<sup>[27]</sup> constructs of the TPB, could predict 37% of nutritional behaviors. Also, in Babazadeh's study in Chaldoran, the TPB could foresee 39% of fruit and vegetable consumption in students.<sup>[28]</sup> These results are different from that of Yarmohammadi *et al.*<sup>[29]</sup> based on which the constructs of this theory were a poor predictor (6%) of fast food consumption behavior in Isfahan students. The weak relationship between behavioral intention and behavior can be due to other individualistic and social/environmental possible factors that effect on the consumption of fast food.

In the current study, it was also detected that salt consumption behavior had a statistically significant relationship with the constructs of attitude, perceived behavioral control, and intention. Moreover, there was a statistically significant association between attitude construct and perceived behavioral control and intention. Similarly, a significant relationship was observed amongst the construct of subjective norm with

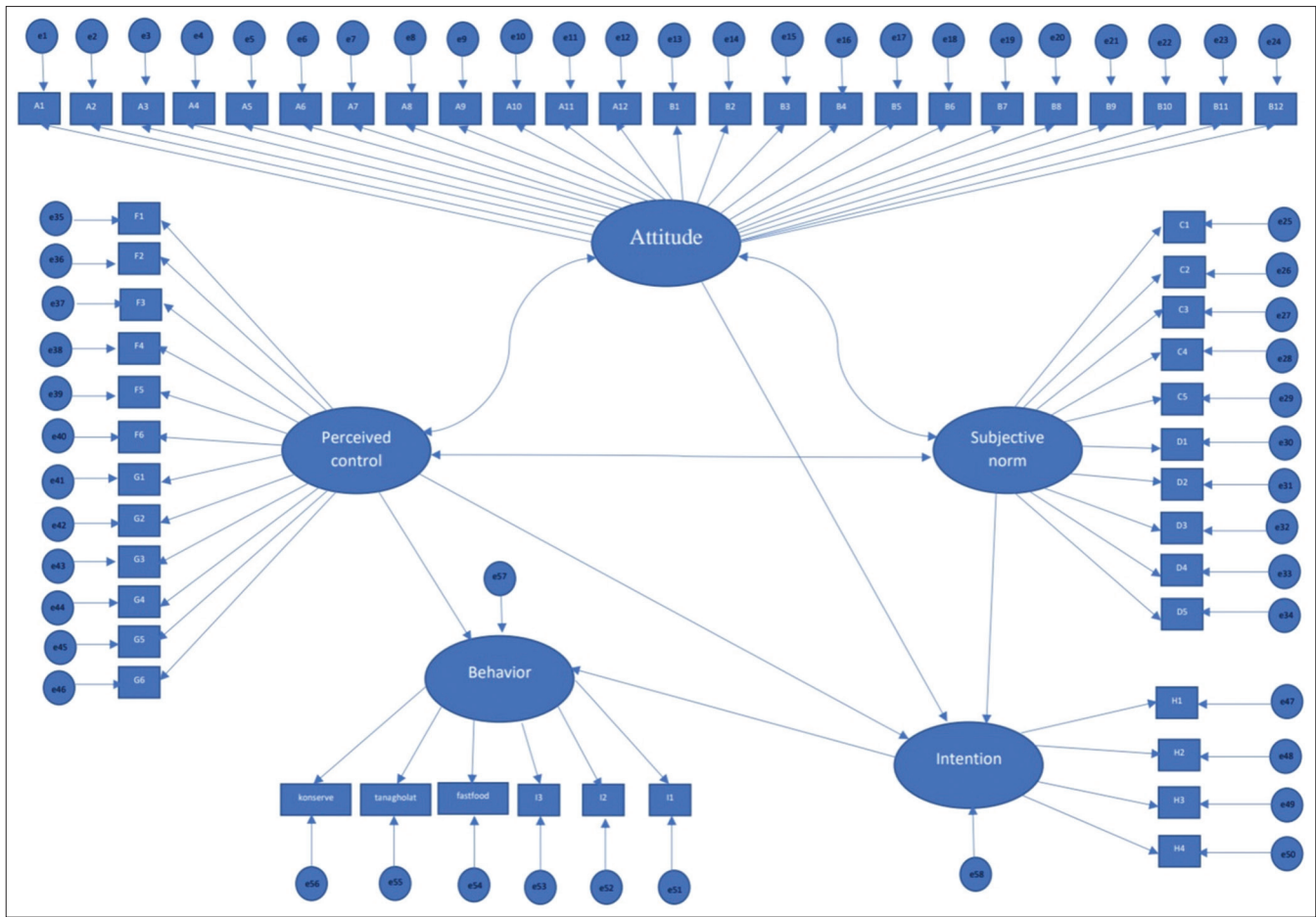


Figure 2: A structural equation (SEM) for defining TPB constructs affecting salt consumption behavior in pregnant women

Table 2: Correlation Coefficients between the constructs of TPB

Variable	Attitude	Subjective norm	Perceived behavioral control	Intention	Behavior
Attitude	1				
Subjective norm	$r=1.48, P=0.22$	1			
Perceived behavioral control	$r=0.49, P<0.01$	$r=0.20, P=0.002,$	1		
Intention	$r=0.28, P<0.01$	$r=0.35, P<0.01$	$r=0.35, P<0.01$	1	
Behavior	$r=0.21, P=0.001$	$r=0.08, P=0.22$	$r=0.31, P<0.01$	$r=0.35, P<0.01$	1

perceived behavioral control and intention. A statistically significant relationship was also observed among the construct of intention and perceived behavioral control. The results of a study by Matlabi *et al.*<sup>[30]</sup> also showed that eating behaviors are significantly correlated with attitudes, perceived behavioral control, and behavioral intention. Correspondingly, in the study of Mazloomi Mahmoodabad *et al.*<sup>[19]</sup> it was observed that there is a significant correlation between the behavior of consuming less than one teaspoon of salt while cooking with the intention, between the behavior of avoiding salt while eating with the intention and attitude and between the behavior of avoiding consuming salt-rich foods and the attitude. In the study of Dormanesh *et al.*<sup>[16]</sup> it was observed that perceived intention and behavioral

control are significant predictors of low-sodium and low-potassium diets. According to the findings of Murnaghan *et al.*<sup>[31]</sup> perceived behavioral control had a great impact on fruit and vegetable consumption among adolescents.

Conflicting to the results of the present study, in the study of Babazadeh *et al.*<sup>[28]</sup> it was observed that there is a weak relationship among behavioral intention and fruit and vegetable consumption behavior in students. Likewise, in the study of Wu *et al.*<sup>[32]</sup> perceived behavioral control could not play an important role in predicting sodium intake in patients with heart failure. In Karimi *et al.*'s<sup>[26]</sup> study, perceived behavioral control had no significant effect on oil consumption behavior.

The findings of Rezabeigi Davarani *et al.*,<sup>[27]</sup> Emanuel *et al.*,<sup>[33]</sup> and Gholami *et al.*<sup>[34]</sup> showed that the subjective norm cannot predict nutritional behaviors, which was consistent with the results of the present study. Also, contrary to the results of these studies, the subjective norm was the most imperious predictor of Fast-Food consumption in Romania in the study of Bîlbîie *et al.*<sup>[15]</sup>

One of the strengths of the present study was the use of a regular framework to classify factors affecting salt consumption behavior.

### Limitation and recommendation

Concerning the limitations of this study, the participants were designated only from pregnant women referring to Birjand urban health centers and this study did not include those from private offices. So, the results of this study should be generalized with caution since they were developed based on a regional sample. Further research should be conducted on the other samples of the pregnant women from different socio-cultural backgrounds. Besides, due to the cross-sectional nature of this study, it was not conceivable to find a cause-and-effect relationship between the studied variables. Additionally, in this study, only the constructs of the theory of planned behavior were used for salt consumption behavior. However, we should note that the occurrence of salt consumption behavior can be predisposed by quite a lot of other factors.

### Conclusion

The current study tested the effectiveness of TPB in predicting the salt consumption behavior in pregnant women. The results of the study imply that salt consumption behavior among pregnant women is more connected to attitude, perceived behavioral control, and behavioral intention than any other factors. Consequently, it is suggested that an intervention study should be designed and applied in this vulnerable group using the theory of planned behavior to control the amount of salt consumed regularly with the emphasis on the attitude, perceived behavioral control and behavioral intention.

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### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in

the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

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