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RESEARCH ARTICLE

Evaluation of Knowledge, Attitude, and Protective Behaviors of Teachers Against Dust Phenomenon Based on the Health Belief Model

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Abstract:

Background:

Awareness of protective behaviors against haze plays an important role in disease prevention and control. Students, who are in turn educated by teachers, are one of the important groups that can transfer health-related concepts to families. Therefore, this study aimed to evaluate teachers' knowledge, attitudes, and behavior regarding adopting healthy behaviors upon exposure to haze using the health belief model (HBM).

Materials and Methods:

This descriptive-analytical (cross-sectional) study was performed on 250 primary school teachers from Zabol County by cluster sampling. Data were gathered by multi-section questionnaires. Its validity and reliability have been evaluated. The data were analyzed in SPSS software (version 21) using proper statistical tests at a significance level of $P < 0.05$.

Results:

Teachers were in the average age range of 38.66±6.81 years. Mean scores of behavior, perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy were obtained as 11.88±2.47, 26.42±43.10, 26.42±4.10, 22.43±4.10, 28.26±5.12, 10.73±2.06, respectively. There was a significant relationship between awareness and protective behavior (r= 0.61, P=0.0012). Health belief model constructs were able to predict about 39.8% of the variance of protective behavior, with the level of Education (B = 0.369) being the strongest predictor.

Conclusion:

Results show that the design and implementation of educational programs based on the HBM in schools are effective in the promotion of awareness and empowerment with the aim of increasing protective behavior in teachers in the face of the haze phenomenon.

Keywords: Dust, Health belief model, Behavior, Knowledge, Attitude, Elementary school teacher.

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1. INTRODUCTION

Dust storms which lead to the induction of suspended solids in the atmosphere cause relative turbidity, reduce the horizontal or vertical visibility, and decrease the relative humidity by less than 80 per cent [1]. These types of storms are among the biggest environmental problems in different parts of the world [2]. This phenomenon can occur due to climate change, such as reduced rainfall, rainfall pattern changes, and soil erosion due to drought [3]. Dust storms occur mainly in spring and summer and are less frequent in autumn and winter. In addition, most of the time, this phenomenon occurs between noon and sunset in different parts of the world [4].

A large percentage of dust in the atmosphere is made up of fine particles, which are more abundant in arid and semi-arid

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regions of the world [5]. On the other hand, the main cause of air pollution in most cities in Iran is mainly particles due to its location in the dust belt zone (from North Africa, the Mediterranean, and the Middle East to China). Among different cities of Iran, the Sistan region has more particles due to its geographical location, which is located close to Lake Hamoon and the seasonal phenomenon of 120-day winds. The intensity and frequency of these particles in this region are higher in June, July, August, and September. In addition, due to the severity of drought since 1999, storms happen more often in this region (five-fold more than before 1999) [6]. For example, 120-day winds in the Sistan region have increased to more than 150 days in a year [7].

According to the air quality index in 2011, the worst storms happened in the Sistan region in Iran, which was an experience of 107 days and very dangerous. This data confirmed that there is a critical situation in the Sistan region [8]. Moreover, this unhealthy air quality in the Sistan region and this pollution can affect the air quality of neighboring cities. Studies showed that in Zahedan and Kerman (two cities in Iran), the main cause of particulate pollution in these areas was due to winds and storms in the Sistan region [9, 10].

In addition, storms and dust phenomena can cause extensive damage to the economic, agricultural, industrial, transportation, telecommunication, and health sectors [11]. For example, the study cost of asthma-related dust in Australia in 2005 was between 20 and 50 million dollars. Moreover, dust storms hurt the Chinese economy and caused a loss of 6 billion dollars in 2003 [12]. Particles smaller than 2.5 microns in diameter have a dangerous effect on health and cause increased deaths from respiratory, cardiovascular, and lung diseases, so long-term exposure causes a 6% increase in mortality for every ten micrograms per cubic meter of particles. Moreover, these particles lead to cardiovascular disease and lung cancer (increased by 12 per cent and lung cancer by 14 per cent, respectively) [13]. The highest impact of the airborne dust on health is on eye sensitivity, nose and throat, respiratory tract infections, headache, nausea, and allergic reaction. In addition, studies have shown that long-term exposure to airborne dust changes the mood of residents and lowers the tolerance threshold. Aggression and depression are other effects of this phenomenon [13, 14].

The consequences of the airborne dust can be the induction of health problems, patients' hospitalization, and increased mortality rate in vulnerable groups. Moreover, closure of offices, schools, universities, and airports, disconnection from cities and villages, vehicle depreciation, burnout, medical equipment, and residents living in poor sanitation pointed out the consequences of fine dust in this area [15]. One way to reduce the effect of airborne dust on health issues is to perform personal protective behavior [16, 17].

The Health Belief Model is one of the most important models that shows the relationship between health beliefs and behavior, and it is based on the hypothesis that protective behavior is based on beliefs. This model focuses on individual experiences, motivation, and belief changes, and can also describe long-term and short-term behaviors.

This model consists of several constructs, including perceived susceptibility (depending on one's knowledge of the disease), perceived severity (one's abstract belief about the extent of the damage that can occur as a result of the disease or a harmful condition resulting from a particular behavior), perceived benefits (one's perception of the benefits of one's behavior), perceived barriers (one's perception of the real problems and costs of a behavior), cues to action (forces promoting a behavior), and self-efficacy (one's ability to perform a behavior) [16].

The results of previous studies are indicative of the low level of public awareness regarding environmental issues [16 - 18]. Considering the proper context of schools, teachers can have an efficient role in implementing educational and disease prevention programs to raise students' awareness and protective behaviors in the face of the haze phenomenon [19]. Moreover, to the increased dust storms in recent years in this province, the aim of the present study was to determine the level of teachers' knowledge, attitude, and protective behaviors of teachers against the haze phenomenon based on HBM.

2. MATERIALS AND METHODS

The present cross-sectional descriptive-analytical study was conducted with 250 elementary school teachers in the Sistan region, Zabol County, located in Iran. The participants were selected through the cluster sampling method. Initially, a list of primary schools was prepared; then, 30 schools were randomly selected as a cluster. The inclusion criteria for this study entailed no respiratory and cardiovascular disease, at least five years of continuous work experience, formal workers of the Ministry of Education, and consent to participate in this research study. Moreover, the exclusion criteria included infliction of respiratory diseases, temporary employees of schools located in other cities, and newly hired teachers.

The data were collected through a researcher-made questionnaire. The questionnaire was organized based on the research objectives in four sections; the first part is related to measuring demographic factors (age, level of education, marital status, economic situation, household size, spouse occupation, spouse education, and owning a car with 13 questions). The economic situation was divided into 5 options: first level (very high), second level (high), third level (medium), fourth level (low), and fifth level (very low). The second part is related to awareness questions with 14 questions (score range = 42-42) which were designed as three options (right, wrong, and I do not know). We assigned three scores to the correct answer, two scores for the "I do not know" answer, and one score to the wrong answer.

The third part was related to the questions measuring the constructs of the health belief model (37 questions), including perceived sensitivity (perception of disease susceptibility), perceived severity (perception of disease severity), and perceived benefits (perception of behavioral benefit) with seven questions (score range = 7-35), perceived barriers (individual perception of problems on the way to behavior) with nine questions (score range = 45-9), guidance for action with three questions (Score range = 15-3) and self-efficacy (belief in the ability to perform the behavior) with four

questions (Score range = 20-4) and the fourth section related to measuring protective behaviors against dust with six questions (Score range = 18 -6) was; which were designed as 5-choice questions. Since some of the questions in these sections were designed in the opposite direction to prevent the induction of answers; therefore, the scoring of these questions was also calculated in reverse. In this study, the maximum score for each question was five, and the minimum score for each question was one. Incidentally, the score for the "no Idea" option was three. About the action guidance, which included one question; for each question, a maximum of two points and a minimum of one point were considered.

In this study, protective behaviors included reducing time spent outdoors, using air conditioning, not exercising outdoors on dusty days, not using foods without protective shields, and using proper nutrition on dusty days, which was measured based on teachers' answers to the questionnaire questions.

The validity of the questionnaire was assessed by the content validity method. Thus, after preparing the questionnaire, they were examined by ten professors of health education, epidemiologists, and statistics; and their opinions were applied to the questionnaire, which was finally approved after eliminating some problems and ambiguities regarding its validity. The reliability of the questionnaire was measured by Cronbach's alpha test method with 30 teachers who were similar to the study population in terms of demographic characteristics, which was equal to 0.71.

After obtaining permission from the province's education, the questionnaires were distributed among teachers, followed by explaining the type of study, reassuring teachers about the confidentiality of the answers, and taking the satisfaction form teachers.

Obtaining an ethics code from the Research Deputy of Zabol University of Medical Sciences (IR.ZBMU.REC.1399.081), obtaining informed consent, the participant's freedom to participate in the study, maintaining the confidentiality of the participant's personal information, and the impartiality of researchers in all stages of collection, data analysis, and reporting were among the ethical considerations observed in this study. The data were analyzed in SPSS software (version 21) using such tests as the Pearson correlation coefficient, regression and ANOVA. A p-value less than 0.05 was considered statistically significant. In this study, the Kolmogorov-Smirnov test was used to test the data normality. Since the p-value was greater than 0.05, the normality of the data was confirmed.

3. RESULTS

3.1. Demographic Information of the Subjects

In this study, 250 elementary school teachers with a mean age of 38.66±6.18 years were studied in Sistan and Baluchistan Province. About 90.4% of the teachers were married, and 57.2% had a bachelor's degree. The spouse occupation of most of the subjects (48.4%) was an employee. The socioeconomic status of most teachers was average (80%) (Table **1**). The average household size of the study population was five people, and the highest percentage of children (30%) belonged to families with three children.

Based on the results, 70.8% of the teachers did not have any educational experience in protective behaviors against the haze. The elementary school teachers whose work experience and education level were evaluated in this study had a mean teaching experience of 18.5±5.7 years. Most of the participants (89.6%) reported television as the source of information on haze and the adoption of appropriate behaviors. Consequently, proper television programs can be effective in raising awareness in this domain.

Table 1. Frequency Distribution of Teachers by Demographic Characteristics

Demographic characteristics	Frequency	Percent
Level of Education	17	6.8
Diploma	78	31.2
Associate Degree	143	57.2
BSc	12	4.8
MSc		
Spousal Job	8	3.2
Worker	17	6.8
Unemployed	70	28
Freelance job	131	48.4
Employee	14	5.6
Retired	10	8
Unknown		
Marital Status	20	8
Single	226	90.4
Married	4	1.6
Widow		
Economic Status	26	10.4
Top	200	80
medium	20	8
low	4	1.6
Very low		

Table 2. The relationship between demographic information and behavior.

Demographic Characteristics	Overall Score of the Behavior (Mean ± SD)	P-Value
Level of Education	11.32±0.56	0.001
Diploma	11.70±0.32	
Associate Degree	11.94±0.19	
BSc	13.13±0.15	
MSc		
Spousal Job	10.84±4.05	0.001
Unemployed	11.40 ±1.06	
Worker	11.51±2.41	
Freelance job	12.12±2.43	
Employee	11.41±2.30	
Retired	13.12±0.52	
Unknown		
Marital Status	13.12±0.52	0.001
Single	11.79±2.56	
Married	10.40±0	
Widow		
Economic Status	12.40±2.47	0.001
Top	11.86±2.68	
Medium	11.72±1.17	
Low	12.10±1.56	
Very low		

3.2. Protective Behavior Against Dust P

The mean score of the behavior was 11.88 ± 2.47. The minimum behavior was 5.20, and the maximum behavior was 15.60. Regarding protective behavior, 59.2% of the teachers used masks on stormy days, and only 8% of them informed their students about air pollution. Our results showed that 47.5% of the evaluated teachers used more fruit and vegetables on hazy days, and 72% of them hardly consumed more milk during hazy days. In addition, 8% of the participants used paid time off on hazy days, and 56.8% of them used air conditioners at home on stormy days.

Participants with high economic status (12.40±2.47), single (13.12±0.52), and MSc (13.13±0.15) had the highest average protected behavior. Behavior showed a statistically significant relationship with the spousal job (P=0.001), Economic Status (P=0.001), Spousal job (P=0.001), and education level (P=0.001) (Table **2**).

Regarding the perceived susceptibility to HBM, 83.5% of the participants believed that based on the current living situation in Zabol, they were likely to get respiratory diseases. Due to the perceived severity of HBM, 95.2% of the teachers were concerned about asthma caused by haze. In the Perceived benefits section, to avoid these kinds of problems, 72% of the participants preferred to stay home during stormy days as the best way to reduce exposure to harmful dust particles. In addition, in the perceived barrier part, 38.4% of the teachers reported that they were not able to consume excessive amounts of milk on hazy days due to their financial problems. On the other hand, 77.6% of the subjects believed that staying home during stormy days would result in financial problems. Finally, concerning self-efficacy, 92% of the teachers believed that they could partially prevent the effects of haze on stormy days by using a regular mask.

3.3. Awareness

The mean score of participants' awareness was 33.19 ± 5.84. The minimum level of awareness was 17, and the maximum level of awareness was 39. According to the results, participants with high economic status (35.38±3.71), widow (37.21±0), and MSc (35.85±2.63) had the highest mean awareness. Data showed a significant relationship between education level, economic status, and spousal occupation (P=0.001). However, no significant relationship was observed between awareness and marital status based on the ANOVA test (P=0.10) (Table **3**).

3.4. Health Belief Model Constructs

The mean perceived sensitivity score was 26.42 ± 4.10, perceived severity was 26.43 ± 4.10, perceived benefits were 22.43 ± 4.10, perceived barriers were 28.26 ± 5.12, and perceived self-efficacy was 10.73 ± 2.06 (Table **4**). Furthermore, the results of the Pearson test showed a significant relationship between awareness and protective behavior (r= 0.61, P=0.0012).

Table 3. The relationship between demographic characteristics and awareness.

Demographic Characteristics	Overall Score of the Participants' Awareness (Mean ± SD)	P-value
Level of Education	32.11±8.22	0.001
Diploma	33.28±5.49	
Associate Degree	33.05±0.49	
BSc	35.85±2.63	
MSc		

(Table 3) contd.....

Demographic Characteristics	Overall Score of the Participants' Awareness (Mean ± SD)	P-value
Spousal Job	31.02±6.65	0.001
Unemployed	23.10±4.23	
Worker	33.48±5.60	
Freelance job	33.60±5.66	
Employee	32.98±6.36	
Retired	35.78±1.92	
Unknown		
Marital Status	35.78±1.92	0.10
Single	32.89±6.04	
Married	37.21±0	
Widow		
Economic Status	35.38±3.71	0.001
Top	32.92±6.09	
medium	34.58±4.61	
low	27.07±0	
Very low		

Table 4. Mean, standard deviation, minimum, and maximum scores of teachers on knowledge, health belief model constructs, and protected behavior

Variables	Mean± SD	Maximum Scores	Minimum Scores
Knowledge	**33.19± 5.84**	**39**	**17**
Health Belief Model Constructs	26.42± 4.10	30	6
Perceived susceptibility	26.43± 4.10	30	7
Perceived severity	22.43± 4.10	31	12
Perceived benefits	28.26± 5.12	40	16
Perceived barriers	10.73± 2.06	16	4
Self-efficacy			
Protected Behavior	11.88± 2.47	15.60	5.20

Table 5. The prediction regression coefficient of factors related to protective behaviors against dust in the study population

Independent Variables	B	SD	Standardized Coefficients(SB)	t	P	R^2
Constant	1.20	1.87	-	0.643	0.05	R= 0.650
Spousal job	-0.096	0.129	-0.046	-0.742	0.459	R^2 adj=0.398
Marital Status	-0.595	0.488	-0.087	-1.220	0.224	
Level of Education	0.369	0.185	0.103	1.992	0.047	
Economic Status	0.208	0.274	0.042	0.759	0.448	
Awareness	0.250	0.023	0.591	11.05	0.000	
Perceived Sensitivity	-0.49	0.035	-0.081	-1.40	0.162	
Perceived Benefits	0.109	0.038	0.181	2.83	0.005	
Perceived Barriers	-0.001	0.026	-0.003	-0.049	0.961	
Perceived Self-Efficacy	0.046	0.077	0.038	0.594	0.553	

There was a relationship between perceived benefits, level of education, and awareness of protective behaviors. The strongest correlation was observed between the level of education and protective behaviors. Linear multiple regression analysis was used to evaluate the prediction of protective behaviors against dust phenomenon by health belief model constructs and other variables. The studied variables predicted approximately 39.8% of the variance of protective behaviors (Table **5**).

4. DISCUSSION

This study was performed to identify the level of teachers' knowledge, attitude, and protective behaviors of teachers against the haze phenomenon based on HBM. In this research study, the mean score of teachers' awareness regarding protective behaviors against the haze phenomenon was 33.19. The study, which was done by Liu *et al*. revealed that people in Megawatts, China, had a good level of awareness about air pollution and appropriate behavior during emergency situations (46.23%). They also recommended the use of media like television, radio, internet, newspapers, and magazines to raise public awareness related to air pollution and its consequences [20]. Qian *et al*. attributed the adoption of protective behaviors in the face of air pollution and environmental health to people's improved awareness and attitudes in Ningbo, China [21]. The result of a study done by Yazdanpour *et al*. on parents' awareness of daily air quality indicated the parental lack of information on how to prevent their children from exposure to air pollution despite their children's tendency such that children in Tehran are still exposed to the danger of air pollution [22]. After two decades of drought and its consequences like air pollution and thunderstorms in Zabol, it

seems that the level of awareness is increasing due to media raised awareness. Therefore, due to the importance of social media and social networks, it is possible to use the high potential and capacity of social media to educate, increase awareness, and change people's behavior to perform protective behaviors against the dust phenomenon.

Based on the results, the mean score of the perceived sensitivity of teachers was 26.4. Ramezankhani *et al*. reported 27.2 as the mean score of perceived susceptibility, which was close to the value obtained in the present study [16]. Tola *et al*. have indicated that the mean score of perceived susceptibility in tuberculosis patients was 28 [23]. In another study which was done by Doostipour, the mean score of perceived susceptibility of teachers in the face of haze was 29.6 [24]. Additionally, Ghaffari reported the significance of improving students' behavior in preventing illness [25]. Overall, this result indicated that more than half of the teachers were sensitive to the haze phenomenon and adoption of appropriate behaviors in the face of storms. This sensitivity could lead to the adoption of protective behaviors during a storm and haze.

The obtained mean score of the teachers regarding the perceived severity construct was 26.43. Ramezankhani *et al*. reported 28.89 as the mean score of perceived severity, which was consistent with our obtained value [16]. The results of a study done by Sarani showed that the perceived severity construct was significant in the healthy behaviors of tuberculosis patients, which was due to observing the disease in friends or observing injuries caused by the disease [26]. Fouladi also obtained a relatively similar mean score (23.84) [27] to our results on the perceived severity of breast cancer screening. This study has shown that more than half of the teachers believed in the importance of this health issue and the dangers of exposure to the haze phenomenon. This could, in turn, lead to the adoption of protective behaviors against dust and, eventually the reduction of respiratory diseases.

The mean score of perceived benefits of protective behaviors on hazy days was higher than average (22.43). A study conducted by Doosti *et al*. in Ahwaz, Iran, showed that the mean score of perceived benefits (30.5) was higher than the average [24], which was consistent with the results of the present study. The findings of the study conducted by Hazavehei *et al*. were significant regarding the students' perceived benefits of protective behaviors [28]. Heydari also reported a mean score of 26.96 for teachers' perceived benefits regarding protective behaviors [29]. Therefore, the proper behavior of teachers during stormy days reduces complications and prevents diseases.

The mean score of barriers to protective behavior was 28.26, which seems to be higher than the average. In the present study, most of the barriers which was reported by teachers were economic and financial problems for buying standard or even regular masks, dealing with haze, infliction with respiratory diseases, heart diseases, and allergies, sweating while wearing masks, shortness of breath, lack of access to masks on stormy days, lack of sufficient masks, financial problems for buying fruits, vegetables, and milk on hazy days, and feeling embarrassed or having problem in communication with others when using masks. In a study conducted by Ramezankhani *et al*., protective behaviors were at an average level with a mean score of 16.18 [16]. According to Airhihenbuwa, the modification of negative behaviors and elimination of the barriers to the adoption of healthy behaviors require the incorporation of positive health behaviors into the community and cultural contexts, followed by the implementation of the intervention based on the model [30]. The awareness of teachers about health education by emphasizing the construct of perceived benefits can reduce the barriers in the way of increased protective behaviors in the face of the haze phenomenon.

In this study, the perceived self-efficacy of teachers (10.73) was at an average level, and the mean score for performing protective behavior was more than the average (11.88). A study conducted by Grace-Leitch *et al*. indicated an average self-efficacy score that is consistent with the results of the present study [31]. A study which was done by Wdowik showed that self-care could prevent the complications of illness [32]. The results of a study conducted by Downing-Matibag demonstrated that students' evaluation of themselves, their peers, and acquaintances regarding protective behaviors in the face of sexually transmitted diseases could influence their appropriate behavior [33].

Praphant showed that most participants (50.5%) showed the least preventive behaviors [34]. In general, it seemed that the most important reason for performing protective behaviors was to receive information through television. This can indicate that people are influenced by the media. Therefore, it is recommended to design appropriate educational programs through mass media or using posters and pamphlets to sensitize teachers to the benefits of protective behaviors.

In this study, there was a significant relation among spousal Economic Status, spousal job, and education level and behavior. Education level and Economic Status are important socio-demographic factors related to protective behavior [35]. For example, a study of personal protection behaviors against Covid 19 showed that socioeconomic characteristics such as low income and low education were associated with increased Covid 19 mortality [36]. Moreover, knowledge had a significant relationship with education level, economic status, and spousal occupation. This finding is consistent with the results of the study by Khmer *et al*. [37].

Regression analysis showed that perceived benefits, level of education, and awareness variables significantly predicted protective behavior. Dust storms and haze in recent years have become a major health and environmental problem in cities and villages in the south and southeast of Iran. Therefore, the recognition of the needs and priorities of the audience based on the HBM can help to design and implement an appropriate training program to reduce the effects and consequences of haze on public health and reduce the risk of disease.

The perceived barrier construct of HBM was found to be a significant factor in adopting protective behaviors in the face of haze. This signifies the elimination of the barriers to improve adopting preventive behaviors against the haze. Awareness is one of the barriers inducing the greatest effect on these behaviors. Consequently, the design and implementation of

educational programs based on HBM is an effective measure in raising awareness and empowerment with the aim of increasing protective behaviors among teachers in the face of haze. Therefore, it is significant to improve the level of knowledge, attitude, and performance of individuals regarding the appropriate and protective behaviors in the face of haze phenomena in urban and rural areas by considering the educational needs and perception of the target group and formulating useful scientific content and educational packages. This awareness raising can be accomplished using national media and through the implementation of appropriate education in proper contexts such as schools and health centers. It is also recommended to perform timely educational evaluation and intervention at the final stage.

CONCLUSION

The results of this study can help policymakers, managers, and educational planners align their current plans with the obtained data to increase the adoption of protective behaviors among people exposed to haze and its complications, including respiratory and cardiovascular diseases.

With the study done so far, few limited studies have been done on teachers in the field of protective behaviors based on the health belief model related to the dust phenomenon, which is the strength of the present study. However, one of the limitations of this study was the gathering of questionnaire information in a self-report manner. In addition, the cross-sectional nature of the study was another limitation that suggests intervention studies in this area.

AUTHORS' CONTRIBUTIONS

MS and NS designed the research; MS and AH conducted the research; MS and NS, extracted data; and AH, HS, SMH, MH, MB and PI wrote the paper. PI had primary responsibility for the final content. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was approved by the Research Deputy of Zabol University of Medical Sciences (IR.ZBMU.REC.1399.081).

HUMAN AND ANIMAL RIGHTS

No animals were used for studies that are the basis of this research. All human procedures followed were in accordance with the guidelines of Helsinki Declaration of 1975.

CONSENT FOR PUBLICATION

Informed consent was obtained from all participants of this study.

STANDARDS OF REPORTING

STROBE guidelines were observed during this study.

AVAILABILITY OF DATA AND MATERIALS

Not applicable.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest, financial or otherwise.

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