The Effect of Exercise on School Life Satisfaction in Korean Children and Adolescents Considering the Mediation Effects of Physical Health Awareness, Self-Esteem, and Depression

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Abstract

Background: This study analyzed physical health awareness, self-esteem, and depression as mediation factors in the effect of exercise on school life satisfaction. It compared these between Korean children and adolescents.

Methods: Based on the 2020 Survey on the Human Rights of Children and Adolescents in Korea, data were extracted on 2,896 children in grades 4 to 6 and 5,727 adolescents in grades 7 to 12. A structural equation model was designed and multi-mediation analysis was conducted using phantom variables. To verify the differences between children and adolescents, latent means, path coefficients, and mediating effect confidence intervals were analyzed.

Results: Structural modeling and bootstrapping revealed that the direct and indirect paths were significant in both groups ($P<0.01$). Comparing the mean differences, children showed higher means than adolescents did in all variables. Among the direct paths, the paths of physical health awareness from exercise practice and school life satisfaction from physical health awareness were higher in adolescents ($P<0.01$), and the path of school life satisfaction from exercise practice was higher in children ($P<0.01$). The indirect paths showed that the mediating effect of health awareness between exercise and school life satisfaction was stronger among adolescents.

Conclusion: Physical and mental health directly and indirectly affect school life satisfaction, with different patterns in children and adolescents. This study emphasizes the need for different strategies for children and adolescents who are experiencing physical and mental health problems and difficulties adjusting to school life.

Keywords: Exercise; Health; Students; Satisfaction; Korea

Introduction

School life satisfaction refers to the overall evaluation of a student's subjective experience of personal happiness at school. It includes a perception of a sense of fellowship as well as a perception of the importance of school (1-2). According to a study on children and adolescents in Europe and North America in 2017–2018, most students felt pressured and unsatisfied in their school life (3). A report in Korea on school life satisfaction showed a similar trend, as well as the fact that student satisfaction declined with the spread of the coronavirus disease 2019 (COVID-19) in

2020 (4). Specifically, student satisfaction declined overall by 4.8%, 7% among elementary school students, and 6.1% among middle school students, respectively. The report suggests that COVID-19 influenced this outcome. However, even before COVID-19, student school life satisfaction in Korea was negative; this has been exacerbated by COVID-19 restrictions.

According to the WHO, physical activity is any movement of the body that requires skeletal muscle energy expenditure (5). Exercise is a type of planned physical activity, often structured and repeated to improve or maintain physical strength. There is a significant correlation between physical activity, such as exercise, and school satisfaction (5). Regular physical activity improves school satisfaction (6) and the level of physical activity serves as a parameter in improving school life satisfaction (7). In Korea, participation in sports not only had a positive effect on school life satisfaction (8), but also a long-term impact on life satisfaction (9). Physical activity also relates to mental health. Physical activity is not only associated with stress, anxiety, depression, and mood (10) but also with psychological health, such as life satisfaction and self-esteem (11).

In Norway physically active adolescents had higher self-esteem and less psychological distress (12). Physical activity is associated with improved physical self-concept, which helps promote mental health by reducing anxiety and increasing resilience (13).

Studies on the direct relationship between mental health and school life satisfaction are limited. One study reported no relationship between self-esteem and depression (14)—which was set as a mediating variable in this study—while another indicated that self-esteem had a direct effect on student school satisfaction (8). Although school satisfaction was not examined, reports suggest that psychological health, such as self-esteem, is related to quality of school life, with stress affecting life satisfaction and quality of life in different ways (15). Psychological capital for schoolwork has a positive effect on school satisfaction (16). In the case of depression, according to a study of nursing students (17), microaggression increases student risk of depression and decreases satisfaction with school. Thus, a correlation between depression and school satisfaction can be inferred. The study hypotheses are presented in Fig. 1. By examining the differences in how exercise affects school life satisfaction in children and adolescents, the study results can provide direction for future efforts in regards to physical and mental health to improve school life satisfaction in Korea.
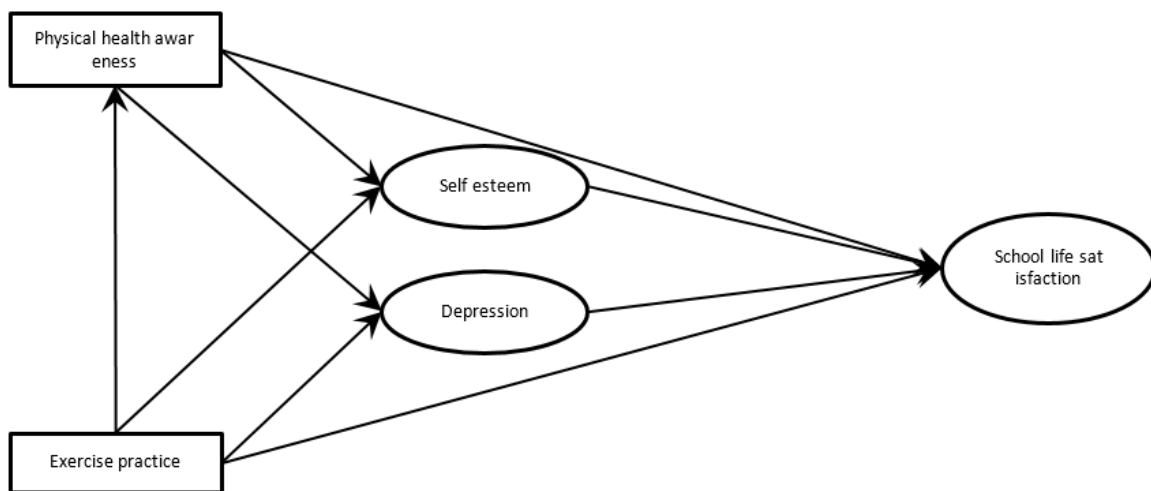

Fig. 1: Research model to verify hypotheses considered in this study

Materials and Methods

Participants

The research was based on the 2020 Survey on the Human Rights of Children and Adolescents in Korea (18). Students from grades 4 (10 years) to 12 (18 years) were surveyed, with group inter-

views and mail questionnaires conducted at each school simultaneously from July to October 2020. The survey was conducted by the National Youth Policy Institute (NYPI). A total of 8,623 students participated, including 2,896 children (grades 4 to 6, elementary school) and 5,727 adolescents (grades 7 to 12, middle and high school) (Table 1).

Table 1: Demographic characteristics of study participants (n=8,623)

Variables		Children (n=2,896)		Adolescents (n=5,727)	
		Frequency (n)	Ratio (%)	Frequency (n)	Ratio (%)
Sex	Boys	1,485	51.3	2,874	50.2
	Girls	1,410	48.7	2,853	49.8
City size	Large cities	1,068	36.9	2,276	39.7
	Middle-sized cities	1,513	52.2	2,701	47.2
	Small-sized cities	315	10.9	750	13.1
Family type	Adoptive parents	2,577	90.2	5,104	89.1
	Single parent family	151	5.3	479	8.4
	Grandparent family	44	1.5	48	0.8
	Other	84	2.9	96	1.7
Academic performance	Good	1,255	44.0	1,462	25.5
	Average	1,388	47.9	2,467	43.1
	Poor	212	7.3	1,798	31.4
Family economic status	Rich	1,986	69.5	2,884	50.4
	Average	780	27.3	2,273	39.7
	Poor	92	3.2	670	11.8

Note 1. Academic performance and family economic status were self-reported by the students.
Note 2. Other family type includes living alone or with siblings, raised by relatives, or living in a childcare center.

Measurement tool

The survey tool was based on the questionnaire initially developed by the NYPI in 2009 to survey the human rights of children and adolescents (19). Since 2009, Korea has designated this as a nationally approved statistic (No. 402001) and this study was approved by the Institutional Review Board of the NYPI (202007-HR-unique number-012).

Independent variable

Regarding exercise practice participants were asked, "Apart from exercise during physical education at school, do you exercise specifically for health? If you are exercising, how much do you do?" Responses were measured on a four-point

Likert scale: never (1 point), one to two times a month (2 points), one to two times a week (3 points), and three or more times a week (4 points); the higher the score, the higher was the amount of exercise.

Parameters

Regarding physical health awareness participants were asked "Do you think your body (physical) is healthy?" Responses were measured on a four-point Likert scale: very poor (1 point), poor (2 points), healthy (3 points), or very healthy (4 points). A higher score indicated a more positive evaluation of one's health.
Depression consisted of three items. (a) I have been lonely for no reason. (b) I have been anx-

ious for no reason, and (c) I have been sad or depressed for no reason. The responses ranged from not at all (1 point) to very much (4 points) on a four-point Likert scale. Statistical analyses were converted to reverse scoring, with higher scores indicating lower depression levels. The reliability coefficient (Cronbach's α=0.892) for the three items was very good.

Self-esteem consisted of three items. (a) I consider myself valuable. (b) I think I have many advantages. (c) There is not much to be proud of. Responses ranged from not at all (1 point) to very much so (4 points) on a four-point Likert scale. For statistical analysis, item (c) was converted to reverse scoring, with a higher score indicating higher self-esteem. The reliability coefficient (Cronbach's α=0.726) for the three items was good.

Dependent variable

School life satisfaction consisted of four items. (a) My school mates respect and care for me. (b) Teachers respect students. (c) Class time is fun. (d) I enjoy going to school. The responses ranged from not at all (1 point) to very much (4 points) on a four-point Likert scale. Higher scores indicated higher school life satisfaction. The reliability coefficient (Cronbach's α=0.777) for the four items was good.

Control variable

According to the 2020 Comprehensive Report on the Human Rights of Children and Adolescents in Korea (4), the study found statistical differences in the response distributions of the variables according to demographic characteristics. Therefore, sex, city size, family type, academic performance, and family economic status were controlled.

Statistical analysis

Demographic characteristics were confirmed using frequency analysis. Correlation and multicollinearity between variables were confirmed through correlation analysis, and skewness and kurtosis were reviewed to confirm satisfaction with the normal distribution conditions. To ana-

lyze the measurement model, confirmatory factor analysis was conducted, and then a structural model was constructed to confirm suitability. Bootstrapping was performed to confirm the mediating effect, and multi-mediating effects were verified using phantom variables. We conducted a multigroup analysis to identify differences between children and adolescents. After verifying configural, metric, and scalar invariances, we conducted a latent mean analysis. Additionally, we verified metric invariance and equivalence constraints between groups and analyzed differences in the direct and indirect paths. The analyses were performed using IBM SPSS and AMOS (version 24.0; IBM Corp., Armonk, NY, USA), with the significance level set at $P<0.05$.

Results

Correlation and descriptive statistics

Through the Pearson correlation analysis, all correlations between the variables were found to be statistically significant (Table 2). The skewness in the children group (adolescent group) was 0.34 to 1.25 (0.10 to 0.50) based on the absolute value, and the kurtosis was 0.28 to 0.70 (0.06 to 1.42), indicating that the normal distribution conditions of skewness $<\pm2.00$ and kurtosis $<\pm4.00$ were satisfied.

Structural model analysis

Confirmatory factor analysis was conducted for depression, self-esteem, and school life satisfaction—the latent variables. The fitness index values of the overall model were TLI>0.9, CFI>0.95, RMSEA<0.10, and SRMR<0.08. The standardized regression coefficient and AVE values were all over 0.50, and the CR value was over 0.60, thus ensuring convergent validity. The correlation was examined to ensure discriminant validity; the distribution was 0.322~0.370. The square of the maximum value of 0.370 was 0.137, which was smaller than the AVE values of all the latent variables; thus, discriminant validity was also ensured.

The structural model was verified by including observed and control variables (Table 3). All direct paths of the structural model were significant ($P<0.001$), and the distribution of the standard-ized regression coefficients (non-standardized regression coefficients) ranged from 0.038 (0.026) to 0.259 (0.325).

Table 2: Pearson correlation between each variable and descriptive statistics

Variables	Physical health awareness	Exercise practice	Depression	Self-esteem	School life satisfaction
Physical health awareness	1.000				
Exercise practice	0.177** (0.243**)	1.000			
Depression	0.298** (0.272**)	0.090** (0.142**)	1.000		
Self-esteem	0.304** (0.313**)	0.156** (0.162**)	0.303** (0.346**)	1.000	
School life satis-faction	0.281** (0.296**)	0.159** (0.097**)	0.258** (0.274**)	0.321** (0.361**)	1.000
Average	3.33 (3.13)	3.06 (2.42)	3.42 (3.06)	3.05 (2.97)	3.18 (3.00)
Standard devia-tion	0.63 (0.66)	0.99 (1.15)	0.76 (0.89)	0.69 (0.72)	0.59 (0.63)
Skewness	-0.58 (-0.39)	-0.70 (0.10)	-1.25 (-0.52)	-0.34 (-0.28)	-0.61 (-0.28)
Kurtosis	0.30 (0.116)	-0.66 (-1.42)	0.70 (-0.84)	-0.51 (-0.57)	0.28 (-0.06)

Note. Values in the correlation are for children, and the values in parentheses are for adolescents. **$P<0.01$

Table 3: Structural model analysis

Models	β	B	Standard error	t
Exercise practice→physical health awareness	0.230	0.133	0.006	21.583***
Exercise practice→depression	0.038	0.026	0.008	3.383***
Exercise practice→self-esteem	0.057	0.036	0.007	5.083***
Exercise practice→school life satisfaction	0.054	0.014	0.003	4.730***
Physical health awareness→depression	0.269	0.325	0.013	24.292***
Physical health awareness→self-esteem	0.259	0.284	0.012	23.036***
Physical health awareness→school life satisfaction	0.153	0.071	0.006	12.569***
Depression→school life satisfaction	0.182	0.070	0.005	13.296***
Self-esteem→school life satisfaction	0.227	0.096	0.006	15.727***

χ^2=2147.213, df=65, $P<0.001$, Turker–Lewis index=0.904, comparative fit index=0.948, root mean square error of approximation=0.061, standardized root mean square residual=0.048, ***$P<0.001$

Total effect, direct and indirect effects

The coefficient values and significance of the direct pathways were confirmed using the structur-al model. Phantom variables were used to decompose the indirect effects and applied the bootstrap method to verify significance (Table 4).

Table 4: Total, direct and indirect effects

Path				Direct effect	Indirect effect	Total effect
Exercise practice			→school life satisfaction	0.054 (0.014)**	0.080 (0.021)**	0.133 (0.036)**
Exercise practice		→self-esteem	→school life satisfaction		0.013 (0.003)**	
Exercise practice		→depression	→school life satisfaction		0.007 (0.002)**	
Exercise practice	→physical health awareness	→self-esteem	→school life satisfaction		0.011 (0.004)**	
Exercise practice	→physical health awareness	→depression	→school life satisfaction		0.014 (0.003)**	
Exercise practice	→physical health awareness		→school life satisfaction		0.035 (0.009)**	
	Physical health awareness		→school life satisfaction	0.153 (0.071)**	0.108 (0.050)**	0.261 (0.120)**
	Physical health awareness	→depression	→school life satisfaction		0.049 (0.023)*	
	Physical health awareness	→self-esteem	→school life satisfaction		0.059 (0.027)*	

Note. Values are standardized coefficients and values in parentheses are unstandardized coefficients. **$P<0.01$

Latent mean analysis

For the latent mean, the analysis reviewed whether configural, metric, and scalar invariance were established. Success was based on the proposal and the criterion was applied that identity is established if $\Delta CFI<-0.01$, $\Delta SRMR<0.030$, and $\Delta RMSEA<0.015$ when the sample size exceeds 300. To verify the configural invariance, both groups were an acceptable level (children: $\chi 2=286.592$, df=23, *P*<0.001, TLI=0.953, CFI=0.970 RMSEA=0.063, SRMR=0.052, adolescents: $\chi 2=1245.598$, df=23, *P*<0.001,

TLI=0.925, CFI=0.952 RMSEA=0.096, SRMR=0.079). Metric invariance was rejected from the $\Delta\chi 2$ verification, but was established because the $\Delta CFI=-0.003$, $\Delta SRMR=0.010$, and $\Delta RMSEA=-0.002$ met the criteria. For scalar invariance, the $\chi 2$ difference verification was rejected, while the $\Delta CFI=-0.01$, $\Delta SRMR=0.001$, and $\Delta RMSEA=0.004$ established partial scalar invariance. Factor variance invariance for effect size calculation was also established because the difference was within the standard value compared

with the partial scalar invariance model (ΔCFI=-0.005, ΔSRMR=0.005, ΔRMSEA=-0.001). In the latent mean analysis (Table 5), children showed lower levels of depression and higher self-esteem, school life satisfaction, exercise practice, and physical health awareness than adolescents (*P*<0.001).

Table 5: Latent mean differences between children and adolescents

Variables	Children (n=2,896)		Adolescents (n=5,727)		P	Cohen's d
	Latent mean	Mean±standard deviation	Latent mean	Mean±standard deviation		
Depression	0	3.42±0.76	-0.346	3.06±0.89	<0.001	0.54
Self-esteem	0	3.05±0.69	-0.123	2.97±0.72	<0.001	0.20
School life satisfaction	0	3.19±0.59	-0.065	3.00±0.72	<0.001	0.78
Exercise practice	.	3.06±0.99	.	2.42±1.15	<0.001	0.50
Physical health awareness	.	3.33±0.63	.	3.13±0.66	<0.001	0.29

Comparison of group paths

To compare the path coefficients between the groups, cross-validation was conducted. Preconditions for the analysis of the path coefficients between groups were the metric invariance and cross-group equality constraints. The metric invariance model appeared as the ΔCFI=-0.003, ΔSRMR=0.006, and ΔRMSEA=0.000 compared with the baseline model. In addition, comparing the cross-group equality constraints and metric invariance models, the ΔCFI=0.000, ΔSRMR=0.001, ΔRMSEA=-0.001 showed that the criteria for path analysis were met.

Table 6 shows the path coefficients for children and adolescents. The path from exercise practice to depression was not statistically significant in either children or adolescents. The path from adolescent exercise practice to school life satisfaction and all remaining variable paths were significant.

Table 6: Path coefficients for children and adolescent groups

Models	Standardized regression coefficient (non-standardized regression coefficient)	
	Children (n=2,896)	Adolescent (n=5,727)
Exercise practice→physical health awareness	0.151 (0.096)***	0.237 (0.137)***
Exercise practice→depression	0.004 (0.003)	-0.003 (-0.002)
Exercise practice→self-esteem	0.083 (0.057)***	0.058 (0.039)***
Exercise practice→school life satisfaction	0.095 (0.027)***	0.028 (0.007)*
Physical health awareness→depression	0.299 (0.321)***	0.252 (0.312)***
Physical health awareness→self-esteem	0.284 (0.307)***	0.239 (0.280)***
Physical health awareness→school life satisfaction	0.105 (0.047)***	0.178 (0.079)***
Depression→school life satisfaction	0.176 (0.073)***	0.187 (0.067)***
Self-esteem→school life satisfaction	0.234 (0.096)***	0.214 (0.081)***

*P<0.05, ***P<0.001

The significance between path coefficients for the children and adolescent groups were verified through the Δχ2 of the equivalent constraints model using the metric invariance model as the baseline (Table 7).

Table 7: Verification of differences in path coefficients in children and adolescent groups

Models	∆ DF	∆ χ2	P	∆ Turker–Lewis index
Exercise practice→physical health awareness	1	8.672	0.003**	0.000
Exercise practice→depression	1	0.074	0.785	-0.001
Exercise practice→self-esteem	1	1.252	0.263	-0.001
Exercise practice→school life satisfaction	1	9.286	0.002**	0.000
Physical health awareness→depression	1	0.121	0.728	-0.001
Physical health awareness→self-esteem	1	1.049	0.306	-0.001
Physical health awareness→school life satisfaction	1	8.159	0.004**	0.000
Depression→school life satisfaction	1	0.311	0.577	-0.001
Self-esteem→school life satisfaction	1	1.603	0.205	-0.001
All strained	9	28.070	0.001**	-0.005

**P<0.01

Table 8 shows the significance test results for the children and adolescent groups for the indirect paths. The 95% CI of all pathways, except for the path from exercise practice to school life satisfaction through depression, did not include <0.001 and showed statistical significance.

Table 8: Verification of differences in mediating effects in children and adolescent groups

Paths	Non-standardized regression coefficient		95% confidence interval (Bias-corrected)		Difference
	Children	Adolescent	Children	Adolescent	
Exercise practice→self-esteem→school life satisfaction	0.006**	0.003**	0.003-0.009	0.002-0.005	No
Exercise practice→depression→school life satisfaction	<0.001	<0.001	-0.002-0.002	-0.002-0.001	No
Exercise practice→physical health awareness→ self-esteem→school life satisfaction	0.003**	0.003**	0.002-0.004	0.002-0.004	No
Exercise practice→physical health awareness→ depression→school life satisfaction	0.002**	0.003**	0.001-0.003	0.002-0.004	No
Exercise practice→physical health awareness→ school life satisfaction	0.005**	0.043**	0.003-0.007	0.036-0.050	Yes
Physical health awareness→depression→ school life satisfaction	0.023**	0.021**	0.017-0.032	0.016-0.026	No
Physical health awareness→self-esteem→ school life satisfaction	0.030**	0.023**	0.021-0.039	0.018-0.028	No

**P<0.01

Discussion

The comparison of exercise, physical health awareness, depression, self-esteem, and school life satisfaction among children and adolescents shows that children have higher values than adolescents for all the variables. The proportion of students who exercise vigorously at least three

days a week was 59.41% for elementary school students, 32.73% for middle school students, and 24.28% for high school students, which supports the results (20). In Germany, during the COVID-19 pandemic, it was reported that adolescents aged 14 to 17 had a lower risk of mental health problems than adolescents aged 7 to 10 (21). However, suicide is the leading cause of death among Korean adolescents, and their mental health is very poor, with the biggest risk factor being academic stress. This factor is significantly higher than in other countries owing to the competitive entrance exam climate in Korea (22). Korean students spend considerable time studying for university entrance exams at the school level. This inevitably leads to low physical activity and sedentary habits. Thus, academic stress caused by long hours of study adversely affects mental health and school life satisfaction.

The comparison of the pathways between the children and adolescent groups revealed that exercise did not affect depression in either group, which contrasts with prior studies. Previous studies reported a correlation between physical activity and depression in children and adolescents (12-13). However, in Korea, there was no direct correlation between exercise frequency and depression (8). Studies conducted abroad have been systematic reviews that synthesize multiple studies over a long period (13-14). This study and previous studies in Korea are cross-sectional studies conducted at specific points in time (8). However, additional research is needed to determine the special environment in South Korea that engenders such results. Additionally, all pathways were significant in both children and adolescents. In particular, the paths of school life satisfaction in physical health awareness and physical health awareness in exercise practice were higher in adolescents. However, school life satisfaction in exercise practice was found to be higher in children, and this difference was statistically significant.

Considering the mediating effects, depression did not have a significant effect on exercise and school life satisfaction in either children or adolescents. This contrasts with the results for all

children and adolescents, which showed a direct path between exercise practice and depression. Thus, the results imply the need for further examination of exercise and depression not only in direct relationships but also in indirect relationships. All other mediating effects from exercise to school life satisfaction and health recognition to school life satisfaction were significant. In particular, the mediation effect of health recognition was higher in adolescents than in children, and the difference was significant. Thus, the direct and indirect relationships between exercise, health awareness, and school life satisfaction are stronger in adolescents than in children. In the context of COVID-19, children and adolescents showed a significant decrease in physical activity (23). Additionally, mental health deterioration, including anxiety and stress, intensified and weight gain increased the risk of obesity and threatened physical health (24). Students complained of severe fatigue in school and learning, and their overall quality of life worsened (25).

Several limitations of this study warrant comment. First, exercise and physical health awareness, although verified by experts, were measured as a single item; therefore, this limited the statistical validity and reliability of the study. Second, adolescents were targeted at both middle school and high school grades, while children in grades one to three were excluded; only those in grades four to six were included, considering the level of understanding needed to complete the survey. Despite these limitations, the study was able to identify the relationship between physical and mental health and school life satisfaction and the differences between children and adolescents, through a large sample at the national level. This knowledge is beneficial, as the results suggest specific measures to improve Korean students' school life experience through greater physical activity.

Conclusion

Exercise improves school life satisfaction, and among the variables, physical health recognition,

self-esteem, and depression were directly and indirectly involved. Additionally, children and adolescents confirmed that there were significant differences in some paths. These results have important implications for establishing exercise strategies to increase satisfaction with school, which comprises a large part of the lives of children and adolescents.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of Interest

The author declares no conflicts of interest.

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