

Research Article

The Effect of Perceived Vaccination on Students' Online Learning Intentions: A Moderated Mediation Model

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The current study proposed and tested a moderated mediation model to reveal the effect of perceived vaccination (PV) on students' online learning intentions (SOLI) during the COVID-19 pandemic. A questionnaire was distributed to 663 full- and part-time students at Vietnamese universities, and 632 responses were analyzed. SPSS 20 software and Hayes SPSS Process Macro (model 5) were used to test five hypotheses, all of which were supported. The study found that students' online learning intentions decreased after being fully vaccinated against COVID-19 and that perceived invulnerability played a mediating role in the relationship between perceived vaccination and students' online learning intentions. The study also revealed that student age moderated a negative association between perceived vaccination and online learning intention, as this negative relationship was stronger for younger students than for older students. Theoretical and practical implications from our research contribute recommendations for governments, policymakers, and educators to consider adjusting educational management strategy, as well as adopting appropriate forms of learning in different epidemic contexts and vaccine coverage rates.

1. Introduction

COVID-19 has swept the globe, forcing half of the world's population to close down by April 2020 [1], and the impact of this pandemic can be observed throughout many industries, including education [2–7]. Since the outbreak of this coronavirus, containment measures have been taken quickly by numerous countries in order to limit community transmission, with a view to bringing the disease under control gradually [8]. In educational settings, distance learning (including e-learning and online learning) is being discussed again [6, 9] and has become a requirement in schools throughout the world [10, 11]. Educational institutions have had to switch from in-person to online approaches [5], because authorities believe that teaching and learning

methods have to be altered to meet the demands of social distancing [12]. Such methods have become fundamental to education [10].

Along with efforts to prevent and control epidemics and pandemics, research and development of vaccines have become urgent goals [13]. The scientific community hopes that the COVID-19 vaccine will help reverse the pandemic, bringing humanity into a “new normal” [14]. Currently, 11 types of COVID-19 vaccines have been licensed by the World Health Organization [15]. Thanks to the rapid pace of vaccine production and efforts to ensure equality in vaccine distribution and access through the World Health Organization's COVAX initiative, a growing number of people around the world have access to vaccines, including citizens of developing countries, in order to ensure that no one

will be left behind [16]. Access to vaccines will help people increase their protection against the risk of infection, as well as the serious complications brought by SARS-CoV-2 [17].

Several studies have been conducted on online learning and e-learning in the context of COVID-19. The majority of these works are based on well-known theories, such as the technology acceptance model [18–21] or extended versions of it [1, 22, 23]. These studies, however, focus primarily on exploring determinants that promote students' attitudes and intentions toward using e-learning or online learning. The main factors in these research models are perceived ease of use and perceived usefulness. Other approaches use qualitative methods to investigate the viewpoints of students and parents or to assess national policies in the conduct of online learning and e-learning during the pandemic [9, 10, 24], while relatively little attention has been paid to the factors that can cause a reduction in students' intentions to adopt online learning.

Girish et al. [22] demonstrated that when perceived risks of COVID-19 increase, students are willing to accept online learning, while other studies have indicated that as awareness of protection (e.g., perceived lower risks resulting from full vaccination) increases, people also become more subjective and more likely to change their behaviors [25–30]. Based on these views, along with increasing access to vaccines, we aimed to explore whether students' online learning intentions would be reduced after getting vaccinated through the mediating role of perceived invulnerability (PI) and the moderating role of student age, from that providing some theoretical and practical implications in educational management during the COVID-19 pandemic.

2. Literature Review

2.1. Online Learning in Vietnamese Higher Education. In Vietnam, online learning began as a distance learning model before evolving into e-learning. Two open universities were established in Hanoi and Ho Chi Minh City in the early 1990s, styled after the Open University in the United Kingdom and founded in response to the growing need for distance learning in rural areas [19, 31]. Similarly, computer access has increased rapidly in Vietnam since the late 1990s [32]. Instead of DVDs and VCDs, however, distance learning has traditionally relied on e-learning, which consists mostly of online courseware. Surprisingly, only 2% of all higher education students in the country (33,638 of 1,581,227) have participated in “distance learning” [10].

In order to prevent the spread of COVID-19, the Vietnamese government enacted a strict policy that forced the closure of all schools nationwide at the onset of the pandemic on January 23, 2020 [19], although subsequent decisions to keep the schools closed were made on a weekly basis. The Vietnamese Ministry of Education and Training subsequently integrated online learning into all Vietnamese schools starting March 26, 2020 [19]. Since that time, online learning has emerged as a key approach in the educational system nationwide [10].

2.2. COVID-19 Pandemic and Vaccination Coverage in Vietnam. Vietnam has been hailed as one of Asia's most effective examples of the fight against COVID-19 [33]. Specifically, by the end of 2020, it had reported only 1,400 COVID-19 cases and 30 deaths [34]. By the time of the current study, however, Vietnam faced a violent COVID-19 surge. According to The Ministry of Health [35], as of September 20, 2021, Vietnam had 695,744 infections—an increase of approximately 497 times the number of cases recorded at the end of 2020—ranking it 47 out of 222 countries and territories. The number of COVID-19 cases increased rapidly to 1,084,625 on November 20, 2021, an increase of approximately 1.6 times in two months, and 775 times the number of COVID-19 cases at the end of 2020 [36].

Faced with this situation, the Vietnamese government has stepped up its measures to improve the rate of access to vaccines. As a consequence of these efforts, as of November 20, 2021, the total number of vaccine doses administered in Vietnam rose sharply, from 34,553,590 (27,913,529 first doses and 6,640,061 second doses) to 106,543,301 (66,483,363 first doses and 40,059,938 second doses) [35]. This represents an increase of approximately 3.1 times within only two months.

Although the COVID-19 vaccine has significantly reduced progression of the disease and the possibility of death, it cannot completely prevent infection [37]. For this reason, authorities consider it necessary to combine vaccination with raising people's awareness toward taking the recommended proactive measures of, for example, wearing masks and maintaining safe social distance, as well as increasing online learning when the pandemic surges and new variants emerge [38–42].

2.3. Theoretical Foundation. Elkind's [43] theory of teenage egocentrism introduced the idea of the “personal fable,” a corollary to the “imaginary audience,” which produces a sense of invulnerability and uniqueness that is often related to risk taking behavior. Risk taking is understood to be the result of cognitive immaturity, when considered a developmental phenomenon. Elkind [43] theorized that teenagers' difficulty considering perspectives other than their own leads to a sense of “personal fairytale” and invulnerability in which they believe they are safe from harm. Blos [44] also determined that invulnerability provides individuals with a false sense of power which weakens their judgment in critical situations, frequently with devastating effects. Scholars have since concluded that a variety of health harming habits (e.g., binge drinking and illicit drug use) peak during emerging adulthood [45], and PI has recently been identified as a plausible explanation for risk taking behaviors among youth [46]. These perspectives have also been applied in studies of college students and adults [25, 47].

2.4. Perceived Vaccination, Perceived Invulnerability, and Their Effects on Human Behavior Change. Currently, although there are many brands of COVID-19 vaccines, there are two major groups of them. The first group are vaccines that require two doses (AstraZeneca, Moderna, Pfizer, and BioNTech), and the second group are vaccines that require only single-dose efficacy (Johnson vaccine).

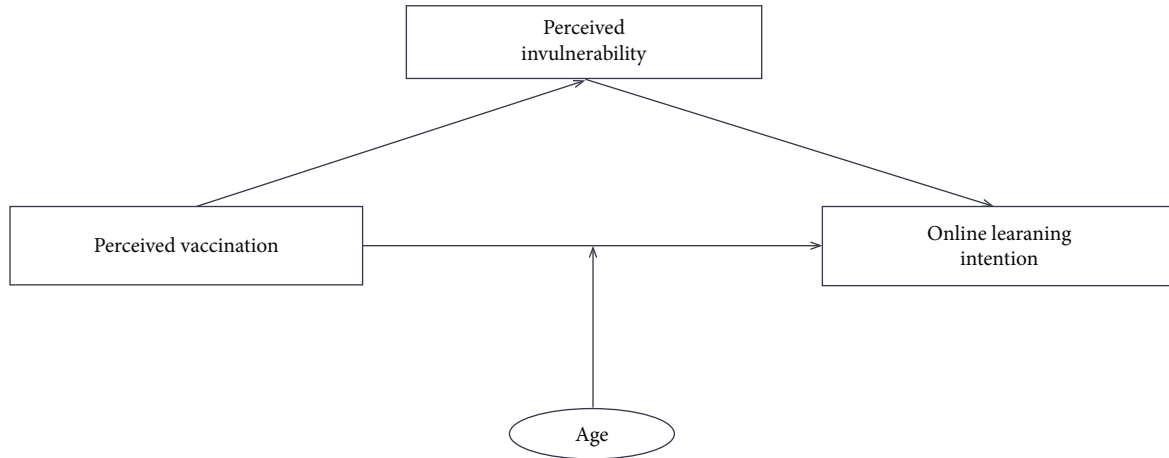


FIGURE 1: Research model.

In the current study, perceived vaccination (PV) refers to the research subjects' perceptions of their vaccination status, including two levels: fully vaccinated (having received two doses of a vaccine administered in two doses, or one dose of a vaccine with single-dose efficacy) and not fully vaccinated (not having been vaccinated at all, or having received the first dose of a vaccine administered in two doses).

PI, a positive bias, is defined as a personal fable of risk immunization (cognitive bias), which is frequently discovered to influence human behavior change and adolescent risk taking behavior [47–49]. For example, Chiou et al. [25] found that dietary supplements were thought to provide health benefits, even while their use might give the illusion of invulnerability. Users of such supplements may consequently change their habits, engage in behaviors that are otherwise harmful to their health (e.g., choosing to eat fast food instead of a healthy meal), or reduce participation in healthy behaviors (e.g., remaining sedentary instead of engaging in physical exercise). Research results also demonstrated that participants' perceptions of the positive affect of nutritional supplements (or that of other behaviors) on the inclination to engage in unhealthy behaviors was mediated by PI [25, 50].

Studies have also been conducted on the “licensing effect,” or the perceived liberty to participate in self-indulgent activities after engaging in healthy behavior [51, 52]. The authors also revealed that HPV-vaccinated participants were more likely to engage in risky sexual behavior than the unvaccinated participants [27–29]. In the current study, PV was also considered a positive behavior in which a person had previously engaged and which had a licensing effect, while online learning was considered one of the protective measures, a safe educational measure during the COVID-19 pandemic. Based on these ideas, we proposed the following hypotheses:

- (i) H1: PV has a positive effect on PI
- (ii) H2: PV has a negative effect on SOLI
- (iii) H3: PI has a negative effect on SOLI
- (iv) H4: PI mediates the relationship between PV and SOLI

TABLE 1: Demographic information of participants.

Measure	Class	Frequency	Percent
Gender	Male	324	51.3
	Female	308	48.7
Age	From 18 to 25	321	50.8
	Above 25	311	49.2
Type of education	Full-time	272	43
	Part-time	360	57
Perceived vaccination	Not fully vaccinated	328	51.9
	Fully vaccinated	304	48.1
Total		632	100

Prior studies also found age group differences in risk judgment and risk taking behavior [46, 53–56]. In particular, Steinberg [46] and Dariotis and Chen [53] demonstrated that youths and adolescents likely change behavior and take more risks than do adults. Gardner [57] also found a contrast between youth and adults in terms of risk taking behavior. In view of these findings, the following hypothesis was proposed, and the research model is described in Figure 1:

- (i) H5: age moderates the effect between PV and SOLI, such that a negative effect is weaker for older students than for younger students.

3. Methodology

3.1. Data Collection and Procedure. A questionnaire was distributed to 663 full- and part-time students studying in Vietnamese universities between October 20 and November 20, 2021. A nonprobability convenience sampling method was used, and 632 replies were considered usable after extensive data cleaning (removal of outliers and those with missing answers). Participants' information is summarized in Table 1.

TABLE 2: Items' descriptive statistics and reliability test.

Construct	Items/code	Mean	SD	Factor loading	Cronbach's alpha > 0.6
Perceived invulnerability (PI)	PI1	2.61	1.15	0.947	0.96
	PI2	2.52	1.34	0.939	
	PI3	2.66	1.29	0.935	
	PI4	2.64	1.27	0.934	
	PI5	2.73	1.19	0.927	
Students' online learning intentions (SOLI)	SOLI1	3.91	0.726	0.907	0.87
	SOLI2	4.08	0.66	0.899	
	SOLI3	3.99	0.78	0.816	
	SOLI4	4.01	0.75	0.785	

TABLE 3: Descriptive statistics and correlations for study variables.

Variable	<i>M</i>	SD	1	2	3	4
1. Age	1.49	0.50	—			
2. Perceived vaccination	1.48	0.50	-0.27**	—		
3. Perceived invulnerability	2.63	1.17	-0.59**	0.78**	—	
4. Students' online learning intentions	4.00	0.62	0.64**	-0.76**	-0.92**	—

3.2. *Measures.* A questionnaire comprised of two sections was developed. The first section consisted of four questions to collect participants' personal and demographic information, such as gender, age, type of education, and PV. The second section included subscales to measure two factors, PI and SOLI.

In the first section, gender was categorized as male, female, or other, while type of education was either full-time or part-time. Participant age included two ranges: 18 to 25 years old and above 25 years old. We divided the participants' ages into these two categories because several previous studies had identified 25 years as the age of transition from youth to adulthood [53, 58, 59]. Gardner [57] also claimed that "youth" refers to an age range from 15 to 25 years, while in Vietnam, college students must be at least 18 years old. As mentioned in the literature review above, many scholars also demonstrated that youth and adults exhibited differences in psychology, intentions, and behaviors [46, 54–56]. In the final part of the first section of the questionnaire, participants selected one of two PV options: fully vaccinated or not fully vaccinated.

In the second section of the questionnaire, PI included five items adapted from Clark et al. [60]—for example, "I am less likely than most people to get COVID-19," and "My body could fight off COVID-19 infection." SOLI (four items) represented revisions from Cheng [61]. An example item was, "I prefer to take online learning at this time." In the current study, all of the measure constructs employed a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), and these constructs had an original Cronbach's alpha value exceeding the threshold of 0.6 [62] (PI ($\alpha = 0.68$), SOLI ($\alpha = 0.97$)). The questionnaire was first developed in English and then rendered into Vietnamese by a professional translator, before being confirmed by a second Vietnamese researcher. In order to guarantee content

validity, three educational experts were consulted before conducting the official survey.

3.3. *Data Analysis Strategies.* Prior to conducting further analysis, SPSS 20 software was used to check outliers, normal distribution, descriptive statistics, correlations, and reliability tests. The normal distribution was also tested using skewness and kurtosis values. Hayes SPSS Process Macro (model 5) was then used to test the proposed hypotheses. This software has been considered to be appropriate to test the moderated mediation model [63, 64]. According to Hayes [65], unstandardized metrics are preferred in the mediation model. Hence, unstandardized regression coefficients are reported in this article.

4. Findings

4.1. *Descriptive Statistics, Correlation, and Reliability Analysis.* The skewness value in the current study was less than 2 and the absolute Kurtosis (proper) was less than 7, indicating that the data were normally distributed [66]. All variance inflation factors were also less than 10; as a result, multicollinearity was not present [67, 68]. The factor loading of individual items was higher than 0.70, which is greater than the acceptable value of 0.50 [69]. Cronbach's alpha was also used to confirm the data's reliability, and the value for two constructs was above 0.80, higher than the minimum acceptable value of 0.60 [62], as shown in Table 2.

Correlations between constructs were also analyzed. Table 3 shows that student age ($r = 0.64^{**}$, $p < 0.01$) was positively and significantly associated with SOLI, while PV ($r = -0.76$, $p < 0.01$) and PI ($r = -0.92$, $p < 0.01$) were negatively and significantly associated with SOLI (see Table 3).

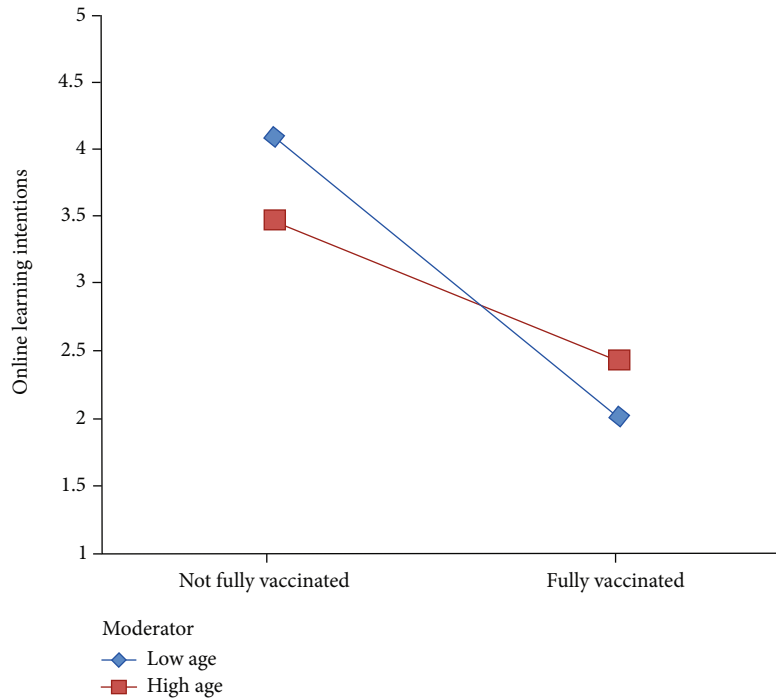


FIGURE 2: Effect of age on the association between perceived vaccination and students' online learning intentions.

TABLE 4: Summary of hypothesis testing.

Hypothesis	Relationship	Result
H1	Perceived vaccination has a positive effect on perceived invulnerability.	Accepted
H2	Perceived vaccination has a negative effect on students' online learning intention.	Accepted
H3	Perceived invulnerability has a negative effect on students' online learning intention.	Accepted
H4	Perceived invulnerability mediates relationship between perceived vaccination and students' online learning intention.	Accepted
H5	Age moderates the effect between perceived vaccination and students' online learning intention, such that this negative effect is weaker for older students than for younger students.	Accepted

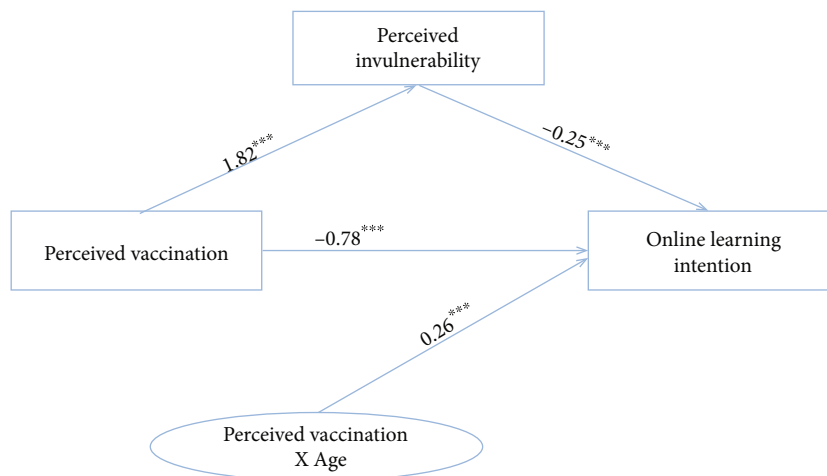


FIGURE 3: Results of the study (** $p < 0.001$).

4.2. Hypothesis Testing. In order to test the proposed hypotheses, Preacher and Hayes [70] mediation analysis, i.e., PROCESS Macro (model 5) was used, and results of

the PROCESS (model 5) indicated that perceived vaccination positively influenced perceived invulnerability ($\beta = 1.82, p < 0.001$), supporting H1. Perceived vaccination

negatively affected students' online learning intentions ($\beta = -0.78, p < 0.001$), supporting H2. Moreover, perceived invulnerability has a negative effect on students' online learning intentions ($\beta = -0.25, p < 0.001$), supporting H3. In addition, the PROCESS (model 5) also revealed that perceived invulnerability mediates the association between perceived vaccination and students' online learning intentions ($\beta = -0.46, LLCI = -0.54, ULCI = -0.37$), supporting H4.

Finally, hypothesis 5 predicts that students' age will moderate the association between perceived vaccination and students' online learning intentions. Results of the PROCESS indicated that the interaction between perceived vaccination and students' age ($\beta = 0.26, SE = 0.05, t = 5.18, p < 0.001, F \text{ value} = 26.85, LLCI = 0.003, ULCI = 0.04$) positively affected students' online learning intentions. Slope test explored that the negative effect of perceived vaccination on students' online learning intentions was found to be weaker in older students ($\text{age} > 25, \beta = -0.26, t = -8.75, p < 0.001$) than in younger students ($\text{age} 18\text{-}25, \beta = -0.52, t = -9.48, p < 0.001$). Accordingly, H5 was supported. The interaction plot was shown in Figure 2, the results of hypothesis testing were summarized in Table 4, and the result model was presented in Figure 3.

5. Discussion and Conclusion

Our study explored the negative association between PV and SOLI and the mediating role of PI in the association. The findings are in line with the view that people tend to forego protective measures and that they are more inclined to change their behavior or practice risky behaviors after engaging in positive behaviors [25, 27–29, 51, 52, 71]. Our results are also in accord with prior studies' findings on the role of PI in human behavior change [25, 47, 50]. This is a new discovery in terms of detecting factors that negatively affect SOLI, especially in the complicated context of the COVID-19 pandemic. PI was determined to be one of the antecedents of SOLI reduction.

It is clear that, when fully vaccinated, students are more likely to reduce their online learning intentions and that the mediating mechanism of this action is an increase in the level of PI. Our findings demonstrate that PI was an adequate explanation for the change in SOLI after being fully vaccinated. Meanwhile, students' learning intention has been shown to have a positive impact on their learning outcomes ([72]); one conclusion to draw from this is that governments and educators should consider reopening schools and switching from online learning to face-to-face learning when vaccination rates among students have been raised and the epidemic situation is basically under control.

However, if the epidemic situation is still complicated and online learning is still considered one of the necessary solutions, it is essential to build up students' awareness of the seriousness of the COVID-19 pandemic even after they have been fully vaccinated, in order to reduce their subjectivity and PI. Regardless of whether they are fully vaccinated, individuals can maintain realistic, positive attitudes, and practice the prescribed protective measures only when they perceive the danger level of COVID-19 accurately on an ongoing basis

[73–75]. To that end, governments should increase and diversify the types of information they disseminate about the dangers of COVID-19. Students should also fully understand the protective ability of the COVID-19 vaccine, being aware of the possibility that they can still become infected after vaccination. This will reduce the level of PI and enhance students' sense of protection to be prepared for future emergency measures and prophylactic actions. UNICEF [76] also reminds us that, although they may prevent the majority of individuals from getting sick, vaccines alone cannot provide full protection. Because our study found that the negative effect between PV and SOLI was stronger for younger students, authorities should target freshmen and young adults when there must be adjustments in the education management strategy due to the influence of the epidemic situation.

Our study does not aim at promoting nonvaccination or to reduce people's intentions to get vaccinated, but rather to explore the process of behavioral change related to people's subjective perceptions after being fully vaccinated. We explored a new model to predict SOLI in order to mine its theoretical implications, especially in the context of an emergency situation such as the COVID-19 pandemic. Our findings have practical implications for planning education policies and educational management strategies at each specific stage based on the situation of the epidemic and the rate of vaccine coverage among students, and community. They also contribute to public policy making, especially in countries where COVID-19 vaccination rates are increasing and people are becoming more subjective about the dangers of the pandemic—as is evidenced in behaviors such as going unmasked, gathering in large numbers, and not maintaining safe social distancing. While the global infection rate is constantly increasing, the emergence of new variants raises new concerns.

Limitations and Suggestions for Further Study. Our research has a few drawbacks. Firstly, we used a convenience sampling strategy in our research and, as such, the level of generalizability of our results will be limited. We therefore recommend that future research use a random sampling strategy. Secondly, a wider variety demographic characteristics (e.g., type of education and year of study) should be considered, in order to examine their moderating role in the relationship between PV and SOLI. Thirdly, online learning can be influenced by a range of factors related to the individual and institution, so future research can further explore the controlling role of some factors, such as attitudes towards online learning, student's major, and level of education. Fourthly, age might also play a moderating role in the negative effect of perceived vaccination on perceived invulnerability, so we suggest future research should be paid attention to explore this moderating role. Finally, the present study's model can be extended to future research that explores the transformation of human behavior in other areas of society during the COVID-19 pandemic, particularly as vaccine availability increases throughout the world.

Data Availability

The primary data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declared no potential conflicts of interests with respect to the authorship and/or publication of this article.

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