Factors Affecting Mental Illness and Social Stress in Students Using Fuzzy TOPSIS

Izleen Ibrahim[1]*, Nurul Hidayah Mansor[2], Jasmani Bidin[3]
[1,2,3]Faculty of Computer and Mathematical Science, Universiti Teknologi MARA Perlis Branch, Arau Campus, Malaysia

Corresponding author: *izleen373@uitm.edu.my

HIGHLIGHTS

- Critical challenges that are becoming more prevalent among university students and society at large are mental illness and social stress.
- Academic stress, socioeconomic status, and financial issues are risk factors for mental illness and social stress.
- Fuzzy TOPSIS was used to rank the variables influencing social stress and mental illness in students.
- The proximity coefficient with the highest value shows the most influencing element.

ABSTRACT

A disorder known as mental illness alters a person's emotions, thoughts, or behaviour. Any of these elements alone or in combination may cause it. If stress cannot be managed, people of all ages, races, religions, sexes, and nationalities can develop mental illnesses. The development of mental diseases is significantly influenced by stress. Risk factors for mental illness and social stress include academic stress, socioeconomic position, and financial difficulties. All of these risk variables are challenging to pinpoint because they come from many environments. The purpose of this study is to identify the key aspects that students experience that contribute to mental illness and social stress, as well as to rank those factors by using Fuzzy Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). This study ranks social life, academic life, and financial status as the three factors that have the greatest influence on mental illness and social stress among college students. The following evaluation criteria are used to grade the components: family background, educational attainment, physical health, and mode of study. Additionally, Fuzzy TOPSIS is used to rank the variables according to correlation. The issues in this study are evaluated by three decision-makers using linguistic characteristics ranging from "very affected" to "not affected". With a proximity value of 0.469, the research demonstrates that academic life has a significant impact on student's mental health and social stress. With a closeness coefficient of 0.358, social life is the least significant factor. The results of this study may be useful to many people, including parents, counsellors, and the kids themselves. The project's scope could be expanded in the future by adding a range of criteria and options.

INTRODUCTION

According to the World Health Organization (2020), mental health is more than merely being free of psychological problems. The two most widespread mental illnesses are anxiety and depression. They can appear out of nowhere and affect people of various ages. In addition, one of the most prevalent mental health problems in the world is depression (World Health Organization, 2020). The most severe mental health issues are referred to as "serious mental illness" (SMI) by medical professionals. Any form of shift that puts strain onto the body, mind, or spirit is referred to as stress. It is a significant contributor to the development of mental diseases. Finding the molecular causes of stress's effect on the brain is necessary to comprehend the dynamic maladaptation that results in pathological stress-related mental states (Lindberg, 2019). The word "stress" is one that most people are all too familiar with. The most typical form of stress we experience on a daily basis is social stress. The complicated and multifactorial exact cause of psychiatric diseases includes social stress as a significant role (Troisi, 2020). Numerous symptoms are possible as a result of both short- and long-term stress. Chronic stress, however, may have long-term effects which may eventually result in suicide. Nearly 90% of suicides are caused by depression or another mental illness (Ward et al., 2022).

Some students acquire problems as they advance through the curriculum, while others already have stress issues when they first enrol in university. Mental illness and social stress typically do not start with just one cause. Instead, a variety of risk factors with varying degrees of influence and intensity on undergraduates' lives have an impact on their stress levels. Mental health issues can have a detrimental effect on their relationships with friends and family members, as well as their quality of life, academic success, and contentment with their university experience. These difficulties can endanger their chances of landing jobs in the future, ability to make money, and even their general health. Additionally, it affects the student's vitality, focus, dependability, mental capacity, and optimism, all of which impair performance (Keyes & Eisenberg, 2012). Therefore, the purpose of this study is to identify the variables that have the greatest impact on students' mental health. The study's primary determinants include social, intellectual, and financial status, with family background, mode of study, physical health, and educational level acting as its subfactors.

Social Life

Our health and well-being are improved by having friends and other social connections. On the other hand, isolation and loneliness can have a detrimental effect on both mental and physical health. Students who can stay connected to others and preserve strong relationships are more likely to live happier lives. Social distance and security precautions have an impact on how people relate to one another and how they perceive others (Saladino et al., 2020). The parents' status, such as whether they are single parents or divorced, can affect their children's mental health and social stress, making it one of the factors that can be analysed from the family history. Divorce hurts the entire family emotionally, but it may be especially scary, confusing, and traumatic for kids. Researchers found that many youngsters feel less connected to their fathers as a result of reduced contact between parents and children (Morin, 2021). Furthermore, having a large family is associated with parents giving their children less of their time, attention, and financial support. The living space of most families, last but not least, is a factor in how students indirectly experience social stress. Students who live in rural locations were particularly impacted by this. Those with more siblings may not be in as good of physical and mental form as children with fewer siblings as a result (Woodgate et al., 2016).

Furthermore, as they move from youth to adulthood, students will experience a distinct period of psychosocial development. Major effects of mental health problems at this time include dropping out of

college, poor academic performance, strained relationship, and diminished emotional functioning. When these elements come together, they could have negative impact on future possibilities for professional work as well as physical health (Saeri et al., 2018).

Academic Life

The typical image of academic institutions is as welcoming, inclusive spaces where stigma is dismantled, discussed, or contested (Hernández-Torrano et al., 2020). In higher education, there are increased concerns about students' mental health (Hamza et al., 2021). The transition to higher education is, nonetheless, enjoyable for many individuals, who do well with it. However, some people find it more challenging. It is asserted that part-time students who typically enrol in online and distance learning programmes get bad grades because they do not take their studies seriously (Muthuprasad et al., 2021) due to the conflicting demands of work, school, and family responsibilities as well as mental health issues that have been linked to exam performance and higher education dropout rates. Some students must deal with the challenging demands of individuation from their families in addition to scholastic pressure, while others must juggle a range of jobs and duties to their families (Pedrelli et al., 2015). Numerous factors, such as increasing academic obligations, test anxiety, financial stress, and modifications in social support networks brought on by moving away from home, might contribute to the symptoms of common mental disorders getting worse during higher education. As a result, students developed bad lifestyle choices and faced stress.

Academic pressure and the difficulties of starting and finishing college can have a negative impact on one's mental health as well as physical health. Academic success, involvement in the workforce, and societal participation are all correlated with physical health. Additionally, the evolution of nations and cultures, changes in family structure, and financial and technological breakthroughs all have an impact on the current and future state of physical health outcomes (Sarama & Clements, 2019). As a result, having a bad mental health might harm your physical health.

Financial Position

Many students have financial difficulties due to their low financial resources and high cost of living, including running a deficit budget, failing to set spending priorities, failing to keep track of expenses, lacking in planning, and failing to pay debts. Thus, there is an imbalance in the income to expenditure ratio (Daud et al., 2018). Due to the need to use alternative financial means, such as self-funding, family funding, borrowing from others, or applying for emergency loans from their individual higher education institutions, the delay is quite stressful for the students. The only thing the folks can do at this point is to wait for financial assistance to be provided because this situation is out of their control (Daud et al., 2018). Financial difficulties prevent students from concentrating on their education, which causes them to lead unhealthy lives and affects their academic achievement. This circumstance significantly contributes to their academic stress and mental health problems.

Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

The TOPSIS method, which was developed by Hwang and Yoon, is the most well-known method for solving MCDM problems (Nadaban et al., 2016). Fuzzy TOPSIS uses fuzzy numbers rather than crisp numbers to determine how important a criterion is and how well an option performs. The Fuzzy Positive Ideal Solution (FPIS) and the Fuzzy Negative Ideal Solution (FNIS) are defined by using the TOPSIS

concept. The ranking order of all options is then determined by computing the closeness coefficient for each alternative.

Fuzzy TOPSIS has been used in previous studies to analyse data in a variety of domains. Additionally, Jusoh @ Hussain et al. (2021) did research on the main element influencing the frequency of floods in Kedah. The proximity coefficient is calculated, and the study's conclusion is then reached. The ranking is determined by the proximity coefficient value that is nearest to FPIS and has the highest value. The main element causing floods in Kedah is rainfall. The closest coefficient among the other variables, as determined by Fuzzy TOPSIS, is the proximity coefficient of rainfall. It demonstrates that the study was successful in rating different flood variables.

Additionally, Azizi et al. (2015) studied the essential criteria and sub-criteria for choosing the best supplier in the automotive industry. The recognised criteria were accountability, adaptability, competence, cost-cutting, and speed, with 18 sub-criteria based on four suppliers—factories A, B, C, and D. In the automotive industry, Factory A has the best supplier, according to the research, while Factory D has the worst. Therefore, it may be stated that they can persuade their employees to be innovative, come up with fresh ideas, and persuade the weaker organizations in their supplier chain to imitate the more nimble and powerful businesses.

METHODOLOGY

Data Collection

To learn more about the causes of mental illness and social stress in students, questionnaires were supplied to the psychology officers at UiTM Tapah, UiTM Segamat, and UiTM Machang, who act as the decision-makers (DM1, DM2, DM3). The questionnaire was developed with the goal of prioritizing the importance of each aspect based on the family background (C1), mode of study (C2), physical health (C3), and educational level (C4). Social life (A1), academic life (A2), and financial situation (A3) are the study's alternatives. They were all asked to rate the study's criteria and alternate options. There are five categories: "very affected" (VA), "affected"(A), "neutral"(N), "less affected"(LA), and "not affected" (NA). Using the linguistic factors for each criterion mentioned in Table 1, the decision-makers assessed how well the alternatives scored for each criterion.

Linguistic Variable

Ordered Fuzzy numbers are used to represent the decision makers' data because they are excellent at handling ambiguous and incompetent knowledge. In many cases, approximated measures or quantities are employed rather than exact ones. To convert language concepts into Fuzzy numbers, some conversion scales have been used. According to Sodhi & T. (2012), the criteria and options are rated on a scale of 1 to 9. Table 1 shows a summary of the Fuzzy ratings for the linguistic variable.

Table 1: Linguistic variables and Fuzzy ratings for issues impacting students' social stress and mental health

Fuzzy number	Alternative assessment
(1,1,3)	Not Affected (NA)
(1,3,5)	Less Affected (LA)
(3,5,7)	Neutral (N)
(5,7,9)	Affected (AF)

(7,9,9)	Very Affected (VA)

(Source: Sodhi & Prabhakar, 2012)

Fuzzy Set Theory Concept

The models are expressed as either a set of fuzzy linguistic rules developed from expert operators' experience or as a set of fuzzy implications that characterize the process's input-output connection locally. The presence of three parameters (a, m, b) demonstrates that the membership function of the triangle curve is a combination of two linear functions. A fuzzy number is referred to as a triangular fuzzy number (TFN) since its membership function is triangular, as seen in Figure 1.
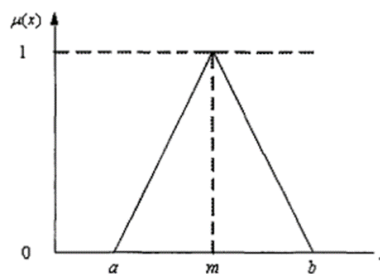

Figure 1: Membership function of Triangular Fuzzy Number (TFN)

This fuzzy number is usually applied in research and practice. The triangular fuzzy number is defined as *m, a,* and *b,* where *m, a,* and *b* stand for mode, left endpoint, and right endpoint, respectively.

$$\mu_A(x) = \begin{cases} \frac{x-a}{m-a}, & a \leq x \leq m. \\ \frac{b-x}{b-m}, & m \leq x \leq b. \\ 0, & x < a \ or \ x > b. \end{cases}$$

Fuzzy TOPSIS in Determining the Factors Affecting Mental Illness and Sosial Stress Among Students

There are three alternatives and four criteria used in this study. The alternatives are social life, academic life, and financial position. Family background, mode of study, physical health, and education level make up the criterion. In this study, the factor is considered an alternative, and it will be ranked. Figure 2 shows all the criteria and alternatives in determining the factors affecting mental illness and social stress among students.
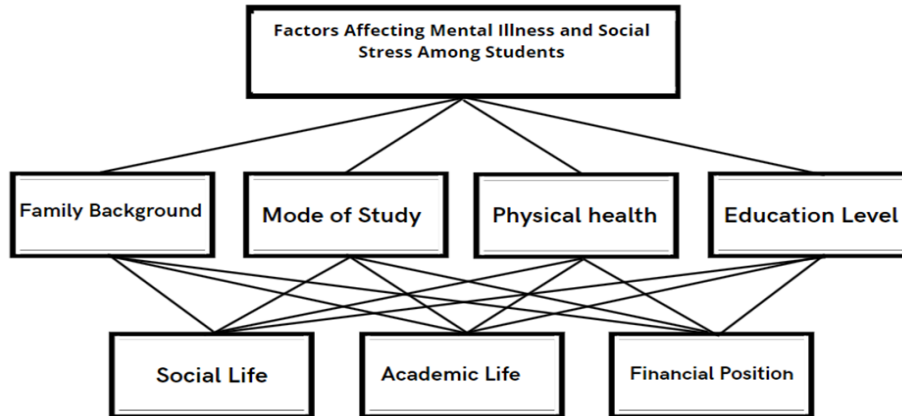
Figure 2: Alternative and criteria in determining the affecting factors of mental illness and social stress among students.

Steps in Fuzzy TOPSIS

Fuzzy TOPSIS consists of the following steps:

Step 1: In order to assign a score to each of the criteria and alternatives, it is assumed that there is a K member decision-making group. The Fuzzy rating of the kth decision-maker about alternative A_i with respect to criterion C_j is denoted as $\widetilde{x_{ij}^k} = (a_{ij}^k, b_{ij}^k, c_{ij}^k)$, while the weight of criterion C_j is denoted as $\widetilde{w_j^k} = (w_{j1}^k, w_{j2}^k, w_{j3}^k)$.

Step 2: The fuzzy aggregate ratings for alternative and the aggregate Fuzzy weight for criteria are computed by the following equations.
The aggregate Fuzzy rating $\widetilde{x_{ij}} = (a_{ij}, b_{ij}, c_{ij})$ of ith alternative with respect to j^{th} criterion is given by:

$$a_{ij} = \{a_{ij}^k\}, \quad b_{ij} = \frac{1}{k}\sum_{k=1}^{k} b_{ij}^k, \quad c_{ij} = \{c_{ij}^k\}. \tag{1}$$

The aggregate Fuzzy weight $\widetilde{w_j} = (w_{j1}, w_{j2}, w_{j3})$ for the criterion C_j is defined by:

$$w_{j1} = \{w_{j1}^k\}, \quad w_{j2} = \frac{1}{k}\sum_{k=1}^{k} w_{j2}^k, \quad w_{j3} = \{w_{j3}^k\}. \tag{2}$$

Step 3: The normalised Fuzzy decision matrix is obtained by using equations (3) and (4) where $\tilde{R} = [\widetilde{r_{ij}}]$

$$\widetilde{r_{ij}} = \left(\frac{a_{ij}}{c_j^*}, \frac{b_{ij}}{c_j^*}, \frac{c_{ij}}{c_j^*}\right), \text{ and } c_j^* = \max_i\{c_{ij}\} \text{ (benefit criteria)}. \tag{3}$$

$$\widetilde{r_{ij}} = \left(\frac{a_j^-}{c_{ij}}, \frac{a_j^-}{b_{ij}}, \frac{a_j^-}{a_{ij}}\right), \text{ and } a_j^- = \min_i\{\{a_{ij}\}\} \text{ (cost criteria)}. \tag{4}$$

While mode of study (C2) and physical health (C3) are categorized as cost criteria, family background (C1) and academic level (C4) are classified as benefit criteria. The decision was then made based on the

weighting of the variables listed in Table 1. In the event that the weight level is high, a benefit criteria will be used. If the weight level is low, the cost will be taken into account.

Step 4: The weighted normalised Fuzzy decision matrix is computed by using the following equation:

$$\tilde{V} = (\widetilde{v_{ij}}), \text{ where } \widetilde{v_{ij}} = \widetilde{r_{ij}} \times w_j. \tag{5}$$

Step 5: The Fuzzy Positive Ideal Solution (FPIS) and Fuzzy Negative Ideal Solution (FNIS) are calculated by the following equations respectively:

$$A^* = (\widetilde{v_1^*}, \widetilde{v_2^*}, \ldots, \widetilde{v_n^*}), \text{ where } \widetilde{v_j^*} = \max_i \{v_{ij3}\}. \tag{6}$$

$$A^- = (\widetilde{v_1^-}, \widetilde{v_2^-}, \ldots, \widetilde{v_n^-}), \text{ where } \widetilde{v_j^-} = \min_i \{v_{ij1}\}, \tag{7}$$

where A^* is for FPIS and A^- represents FNIS. v^+ is chosen for the greatest value in each row and v^- is for the minimum value in each row.

Step 6: The distance of criteria of each alternative from FPIS and FNIS is obtained as follows:

$$d(\tilde{x}, \tilde{y}) := \sqrt{\frac{1}{3}[(a_1 - a_2)^2 + (b_1 - b_2)^2 + (c_1 - c_2)^2]}. \tag{8}$$

Let

$$d_i^* = \sum_{j=1}^n d(\widetilde{v_{ij}}, \widetilde{v_j^*}), \; d_i^- = \sum_{j=1}^n d(\widetilde{v_{ij}}, \widetilde{v_j^-}), \tag{9}$$

be the distance from each alternative A_i to the FPIS and the FNIS, respectively. From equation (9), d_i^* indicates to calculate the distance of FPIS while d_i^- calculates the distance of FNIS.

Step 7: The closeness coefficient CC_i for each alternative is given by:

$$CC_i = \frac{d_i^-}{d_i^- + d_i^*}. \tag{10}$$

Step 8: Finally, the rank of the alternatives (the factors) is determined by the highest closeness coefficient where it represents the most affecting factor.

FINDINGS AND DISCUSSIONS

The interviewees' responses are compiled and analysed. Table 2 displays the respective weights of the factors considered by the decision-makers. The findings of the study of the possibilities based on each of the criteria are presented in Table 3.

Table 2: The Important Weight of Criteria.

Criteria	Decision-Maker		
	DM1	DM2	DM3
C1	VA	AF	VA
C2	N	AF	LA

C3	N	VA	AF
C4	AF	VA	AF

Table 3: The Ratings of Alternatives.

Criteria	Alternative	Decision-Maker		
		DM1	DM2	DM3
C1	**A1**	VA	AF	VA
	A2	VA	AF	N
	A3	VA	AF	VA
C2	**A1**	N	AF	N
	A2	N	AF	LA
	A3	N	AF	N
C3	**A1**	N	VA	AF
	A2	LA	VA	AF
	A3	N	AF	AF
C4	**A1**	AF	AF	AF
	A2	AF	VA	AF
	A3	AF	VA	AF

The aggregate fuzzy weights for the criteria shown in Table 4 was computed by equation (1).

Table 4: The Aggregate Fuzzy Weight Each Criteria.

Criteria	Aggregate Fuzzy weight
C1	(5.000, 8.333, 9.000)
C2	(1.000, 5.000, 9.000)
C3	(3.000, 7.000, 9.000)
C4	(5.000, 7.667, 9.000)

Table 5 displays the aggregate fuzzy rating of alternative which was obtained using equation (2).

Table 5: Aggregate Fuzzy Rating of Alternatives.

Criteria	Alternative		
	A1	**A2**	**A3**
C1	(5.000, 8.333, 9.000)	(3.000, 7.000, 9.000)	(5.000, 8.333, 9.000)
C2	(3.000, 5.667, 9.000)	(1.000, 5.000, 9.000)	(3.000, 5.667, 9.000)
C3	(3.000, 7.000, 9.000)	(1.000, 6.333, 9.000)	(3.000, 6.333, 9.000)
C4	(5.000, 7.000, 9.000)	(5.000, 7.667, 9.000)	(5.000, 7.667, 9.000)

Table 6 shows the normalized aggregate fuzzy decision matrix. Equation (3) was used to determine family background (C1) and education level (C4). On the other hand, mode of study (C2) and physical health (C3) were determined using equation (4).

Table 6: Normalized Aggregated Fuzzy Decision Matrix for Alternative.

Criteria	Alternative		
	A1	**A2**	**A3**
C1	(0.556, 0.926, 1.000)	(0.333, 0.778, 1.000)	(0.556, 0.926, 1.000)
C2	(0.111, 0.176, 0.333)	(0.111, 0.200, 1.000)	(0.111, 0.176, 0.333)
C3	(0.111, 0.143, 0.333)	(0.111, 0.158, 1.000)	(0.111, 0.158, 0.333)
C4	(0.556, 0.778, 1.000)	(0.556, 0.852, 1.000)	(0.556, 0.852, 1.000)

Weighted normalized fuzzy decision matrix is tabulated in Table 7 by using equation (5).

Table 7: Weight Normalized Fuzzy Decision Matrix.

Criteria	Alternatives		
	A1	**A2**	**A3**
C1	(2.778, 7.716, 9.000)	(1.667, 6.481, 9.000)	(2.778, 7.716, 9.000)
C2	(0.111, 0.882, 3.000)	(0.111, 1.000, 9.000)	(0.111, 0.882, 3.000)
C3	(0.333, 1.000, 3.000)	(0.333, 1.105, 9.000)	(0.333, 1.105, 3.000)
C4	(2.778, 5.963, 9.000)	(2.778, 6.531, 9.000)	(2.778, 6.531, 9.000)

In this study, equation (6) and (7) were applied to calculate the FPIS and FNIS, respectively, as shown in Table 8.

Table 8: FPIS and FNIS for Each Criterion.

Criteria	A^+	A^-
C1	(9.000, 9.000, 9.000)	(1.667,1.667,1.6667)
C2	(9.000, 9.000, 9.000)	(0.111, 0.111, 0.111)
C3	(9.000, 9.000, 9.000)	(0.333, 0.333, 0.333)

C4	(9.000, 9.000, 9.000)	(2.778, 2.778, 2.778)

The distance of alternatives from FPIS was determined by using equation (8) and equation (9). Tables 9 and Table 10 imply the result of the distance of alternatives from FPIS and FNIS.

Table 9: Distance of Alternatives from FPIS.

Criteria	Alternatives		
	(A1)	(A2)	(A3)
C1	3.668	4.477	3.668
C2	7.765	6.904	7.765
C3	7.640	6.769	7.603
C4	3.997	3.865	3.865
d_x^+	23.071	22.014	22.902

Table 10: Distance of Alternatives from FNIS.

Criteria	Alternatives		
	(A1)	(A2)	(A3)
C1	5.526	5.065	5.526
C2	1.726	5.158	1.726
C3	1.587	5.024	1.603
C4	4.036	4.195	4.195
d_x^-	12.875	19.441	13.050

Each alternative's closeness coefficient CC_x was defined and calculated according to equation (10), and the results are shown in Table 11.

Table 11: Computation of d_x^+ , d_x^- and CC_x.

Alternative	d_x^+	d_x^-	CC_x
A1	23.071	12.875	0.358
A2	22.014	19.441	0.469
A3	22.902	13.050	0.363

Table 12: Ranking of Each Alternative.

Rank	CC_x	Alternative
1	0.469	A2
2	0.363	A3
3	0.358	A1

Table 12 shows that academic life (A2), which has the highest closeness coefficient of 0.469, is the element that has the greatest overall influence on mental illness and social stress in students. Due to the family's desire for their child to work hard in school and achieve outstanding results to have a brighter future, there

is a chance that pressure from family will arise. Following up to academic life is the financial situation (A3) with a 0.363 closeness coefficient. Some students have to use their own money to pay for their daily expenses, which adds to their stress and causes them to worry about money more often. Last but not least, social life (A1) has the lowest closeness coefficient of 0.358. The likelihood of having physical and mental health problems is higher among students who prefer to study alone. Additionally, they lack self-assurance in their capacity to interact socially.

CONCLUSION AND RECOMMENDATIONS

According to the Fuzzy Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) analysis, academic life is generally the most important element that influences mental illness and social stress among students. As a driver of economic expansion and globalization, education has developed into a service-oriented economic sector under the control of private organizations. Social life, on the other hand, is the least significant factor in determining students' mental health and social stress. In light of the current COVID-19 pandemic, it is critical to look at social isolation, loneliness, and quality of life among those who are cooped up in their houses and cut off from social life. The study's findings indicate the importance of having a strong educational foundation, which includes a supportive familial background, a positive learning and social environment, as well as a stable financial status. Future studies ought to compare results for Malaysia and other developing countries as well. Finally, the surveys referred to "mental illness" as a general term for a range of mental health issues rather than naming particular types of mental illness. Though this technique has been applied to various surveys in the past, it may reduce the precision with which the survey questions may be comprehended. Not to mention, effective statistical techniques are required for high-quality research.

ACKNOWLEDGMENTS

CONFLICT OF INTEREST DISCLOSURE

The authors declared that they have no conflicts of interest to disclose.

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