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Evaluating and Prioritizing Determinants of Audit Quality: An Application of Multi-Criteria Decision-Making Models

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Abstract

Audit quality plays a pivotal role in enhancing financial transparency and in gaining stakeholder trust. This study identifies and ranks the criteria that influence audit quality. This study adopts an exploratory descriptive methodology with a statistical population consisting of 145 certified auditors working in top-tier quality control firms and auditors with over eight years of professional experience. Stratified random sampling was employed, and 105 individuals were selected using Cochran's formula. For the data analysis, the Fuzzy SWARA method was used to weigh the criteria, and the COCOSO method was applied to evaluate and rank auditors. The findings reveal that organizational size (0.55), partner competence and expertise (0.33), and organizational specialization (0.241) have the most significant impact on audit quality. Auditor A8 was the top choice in the final ranking. The results of this study can assist regulatory bodies and audit firms in improving their evaluation processes and enhancing their audit standards.

Keywords: Audit quality, Fuzzy SWARA method, COCOSO method, Auditor evaluation, Audit criteria.

1 | Introduction

Audit quality is crucial for enhancing financial transparency and building trust among stakeholders in financial markets. High audit quality improves the credibility of financial reporting, which is essential for stakeholders' decision-making processes. It ensures that financial statements are accurate and reliable, thereby fostering confidence in the integrity of the financial system [1], [2]. The occurrence of large-scale financial scandals such as Enron, World Com, and Parmalat has significantly impacted the perception of financial statement reliability and the role of auditors. These scandals have underscored the critical need for robust auditing

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practices and effective corporate governance to prevent financial misstatements and fraud [3]. The perception of auditors as primary culprits in "audit failures" stems from various systemic issues within the auditing profession and corporate governance.

Audit failures often occur when Certified Public Accountants (CPAs) fail to identify significant misstatements, which can result from chaotic pricing, inadequate preparation, and insufficient supervision of auditors [4]. Public perception of auditor independence and audit quality has significantly influenced legislative measures aimed at enhancing transparency and oversight, particularly following financial crises. The Sarbanes-Oxley Act of 2002 exemplifies such regulatory responses, mandating stricter internal controls and promoting auditor independence to restore confidence in financial reporting [5].

In Iran, financial scandals such as the banking fraud of 2011 have drawn the attention of scholars and policymakers to the issue of audit quality. Some researchers have attributed this event to regulatory deficiencies and the ineffectiveness of audit processes, characterizing it as an "audit failure" [6]. In response to these challenges, regulatory bodies and legislators have implemented modifications in their agendas. For instance, the Sarbanes-Oxley Act (2002) was enacted in the United States to introduce reforms in the financial reporting system, and in the United Kingdom, corporate governance reforms were also implemented [7]. In recent years, both the U.S. Auditing Profession Advisory Committee and the U.K.

Financial reporting council have focused on identifying key indicators of audit quality and establishing new requirements to enhance the reliability of audit services [8]. Audit quality is significantly influenced by various factors, including auditor independence, professional experience, financial expertise, and supervisory mechanisms. Research indicates that while auditor independence is traditionally viewed as crucial, its direct impact on audit quality may not be as strong as expected, particularly in certain contexts where other factors play a more significant role [5], [9].

Researchers have proposed various methods for evaluating audit quality to date. Some studies have utilized output-based criteria, such as the number of legal claims against audit firms [10]. Audit quality is influenced by various intrinsic characteristics of audit firms, including size, experience, and management structure. Research indicates that larger audit firms often possess more resources, which can enhance audit quality; however, their independence may be compromised due to client pressures and long tenures with clients [5]. However, many of these methods cannot comprehensively assess audit quality due to their reliance on limited criteria.

In this study, by employing Multi-Criteria Decision-Making (MCDM) methods, an attempt is made to identify and rank the factors influencing audit quality. MCDM methods enable the simultaneous consideration of various criteria in evaluating audit quality and provide a precise prioritization of these factors. The results of this research can assist regulatory bodies, audit firms, and other stakeholders in improving audit processes and enhancing public trust in financial reports [11].

2 | Literature Review

2.1 | Theoretical Foundations

Audit quality is crucial for ensuring financial transparency and enhancing investors' trust. High audit quality positively affects the reliability of financial reporting, which is essential for maintaining investor confidence and market stability. Research indicates that effective audit practices reduce information asymmetry and promote transparency, thereby fostering trust among stakeholders including investors and regulators [12], [13] .The concept of audit quality in the scientific literature is divided into two broad dimensions: the auditor's technical competence and independence. DeAngelo [14] defines audit quality based on two factors: the auditor's ability to detect material misstatements and errors in financial statements, and their motivation to report these issues. This definition serves as the foundational framework for many subsequent studies in this field [15]. From the perspective of international regulatory bodies, audit quality is influenced by factors such as the size of the audit firm, auditor's experience and expertise, audit fees, company's governance structure,

and characteristics of the audit committee. Some studies have shown that audit quality can be improved by implementing stricter standards and more effective oversight of the auditing profession [16]. However, other studies have highlighted that the financial dependence of audit firms on their clients and the lack of complete auditor independence pose significant challenges to enhancing audit quality [17].

2.2 | Models and Frameworks for Evaluating Audit Quality

Various studies have proposed diverse models to measure and improve audit quality. Francis [7] introduced six analytical levels for examining audit quality, which include audit inputs, audit processes, the structure of audit firms, the audit market, the regulatory environment, and economic outcomes. This framework emphasizes that audit quality depends not only on the auditor's performance but also on their interactions with the business environment and external oversight.In Iran, Khalatbari Limaki et al. [18] proposed a model based on the supply and demand of audit services, in which auditor characteristics (such as experience, independence, and expertise) are identified as drivers of audit quality. On the other hand, demand-side factors such as shareholders' need for transparent information, regulatory oversight, and corporate governance characteristics also influence audit quality.

3 | Research Background

Numerous studies in Iran have examined the factors influencing audit quality. For example, Asnad et al. [19] demonstrate that auditors' social connections have a positive impact on audit quality. Bayazidi et al. [20] investigated the effect of auditors' Intelligence Quotient (IQ) on audit quality and concluded that auditors with higher IQs make better decisions during the audit process. Anvarkhatibi et al. [21] used the TOPSIS method to rank the criteria affecting audit quality and found that auditors' industry expertise, number of certified accountants employed, and quality control ratings are among the most significant factors influencing audit quality.

Lotfi et al. [22] examined auditors' confirmation bias and its impact on audit quality, showing that this bias can reduce audit quality, although certain client and auditor characteristics can mitigate this effect.

International studies have reported similar findings. Li et al. [23] found that remote auditing under appropriate management conditions can enhance the quality and efficiency of audits.

Xiao et al. [7] emphasized that increased auditor effort increases the likelihood of audit adjustments and improves the quality of financial reports.

Kitiwong and Sarapaivanich [24] concluded that audit quality plays a significant role in improving firm performance, with this effect being more pronounced in highly competitive markets.

Sarhan et al. [25] showed that corporate governance quality in North African countries directly impacts audit quality and board independence contributes to improving audit report quality.

4 | Methodology

This research is exploratory in terms of its objective, as it gathers criteria and indicators for evaluating audit quality from the existing literature, enabling decision making regarding weighting strategies and prioritization of these indicators. Additionally, it is descriptive-analytical in terms of its methodology, as it not only describes the criteria for evaluating audit quality, but also facilitates data analysis and the extraction of results.

The statistical population of this study consists of certified auditors with specific characteristics selected based on two main criteria:

I. According to the iranian association of CPAs, certified auditors are employed in firms with a top-tier (Grade A) quality control rating.

II. Certified auditors with a minimum of 8 years of professional experience.

Based on these criteria, the population size was determined as 145 individuals. The sample size was calculated using Cochran's formula, resulting in a final sample size of 105 participants. Stratified random sampling with proportional allocation was used as the sampling method.

Data were collected using a survey approach with a questionnaire as the primary tool. In the initial phase, factors influencing audit quality are identified through a review of library resources, including domestic and international articles, and categorized into three groups: 1) organizational factors, 2) individual factors, and 3) professional performance. Subsequently, a questionnaire was designed based on these findings and distributed to the statistical population. To assess the validity of the questionnaire, feedback was obtained from university professors and auditing experts, and the necessary revisions were made. Additionally, Cronbach's alpha was used to evaluate the reliability of the questionnaire, yielding a value of 0.82, indicating high reliability of the measurement tool.

The collected data were analyzed using MCDM methods. These methods enable the ranking and comparison of audit-quality indicators. Furthermore, statistical software was used for more precise data analysis, enhancing the accuracy and inferential capability of the findings.

4.1 | Fuzzy SWARA Method

The fuzzy SWARA method operates similarly to the SWARA method, meaning it can be used to calculate the weights of criteria, and the weights in this method are also fuzzy.

The relative weights of the criteria wj are calculated using *Eq. (1)*.

$$W_j^{\sim} = \frac{q_j^{\sim}}{\sum_{k=1}^{n} q_k^{\sim}} \quad , W_j^{\sim} = \left(W_{jl}^{\sim}, W_{jm}^{\sim}, W_{ju}^{\sim}\right). \tag{1}$$

WJI: Represents the lower bound of triangular fuzzy numbers.

WJI: Represents the midpoint of triangular fuzzy numbers.

WJI: Represents the upper bound of triangular fuzzy numbers.

4.2 | COCOSO Method

The first step in all MCDM methods is the formation of a decision matrix, which is presented in the following equation.

$$x_{ij} = \begin{bmatrix} x_{11} & x_{12} & x_{1n} \\ x_{21} & x_{22} & x_{2n} \\ x_{m1} & x_{m2} & x_{mn} \end{bmatrix}.$$

$$i = 1,2 \ldots . . m, \qquad j = 1,2, \ldots . n. \tag{2}$$

The second step is the normalization of the decision matrix, where *Eq. (3)* is used for positive criteria and *Eq. (4)* is used for negative criteria. In the following equations, Max x_{ij} and Min x_{ij} represent the maximum and minimum values of each criterion column, respectively. Based on this normalization, all elements are scaled between 0 and 1.

$$r_{ij} = \frac{x_{ij} - \mathrm{Min}x_{ij}}{\max x_{ij} - \mathrm{Min}x_{ij}}, \quad \text{Benefit-type criteria.} \tag{3}$$

$$r_{ij} = \frac{\mathrm{Max}x_{ij} - x_{ij}}{\max x_{ij} - \mathrm{Min}x_{ij}}, \quad \text{For cost} - \text{type criteria.} \tag{4}$$

In the third step Calculation of Weighted Sum and Weighted Product Values Based on *Eqs. (5)* and *(6)*, the weighted sum (S) and weighted product (P) values for each alternative are calculated. In the following equations, (p) represents the weights of the criteria.

$$S_i = \sum_{j=1}^{n} (W_j r_{ij}). \quad (5)$$

$$P_i = \sum_{i=1}^{n} (r_{ij})^{wj}. \quad (6)$$

In the fourth step, the evaluation scores of the alternatives are determined based on three strategies. In this section, the scores of the alternatives are calculated using *Eqs. (7)-(9)*. *Eq. (7)* represents the arithmetic mean of the scores, while *Eq. (8)* expresses the relative scores compared to the best alternatives. *Eq. (9)* represents a compromise between the two scores. In this *Eq. (8)* is determined by the decision-maker. However, when 0.5, it offers significant flexibility.

$$k_{i\alpha} = \frac{s_i + p_i}{\sum_{i=1}^{m} (s_i + p_i)}. \quad (7)$$

$$k_{ib} = \frac{S_i}{MinS_i} + \frac{P_i}{MinP_i}. \quad (8)$$

$$k_{ic} = \frac{\lambda s_i + (1-\lambda) p_i}{\lambda Mins_i + (1-\lambda) \max p_i}, \quad 0 \le \lambda \le 1. \quad (9)$$

In this section, the final score is calculated based on *Eq. (10)*. This equation essentially represents the sum of the geometric mean and the arithmetic mean of the three strategies from the previous step. The higher the score (k) of an alternative, the greater its superiority.

$$k_i = (k_{i\alpha} k_{ib} k_{ic})^{\frac{1}{3}} + \frac{1}{3}(k_{ia} + k_{ib} + k_{ic}). \quad (10)$$

5 | Results and Findings

Collected data, as raw resources, require processing and analysis to extract meaningful results. In this section, the results from fieldwork are examined using MCDM techniques in a fuzzy environment to determine the final weights of the factors influencing audit quality.

5.1 | Research Modeling

The model presented in this study includes indicators, alternatives, and their weight vectors. Initially, through an extensive review of previous articles and research, as well as expert opinions from the industry, the indicators influencing audit quality were identified. These indicators were then weighted using the Fuzzy SWARA method. *Table 1* presents the alternatives under consideration.

Table 1. Alternatives under investigation.

Code	Row	Code	Row
F	6	A	1
G	7	B	2
H	8	C	3
L	9	D	4
K	10	E	5

5.2 | Valuation of Audit Quality

For the evaluation of audit quality, 17 key indicators have been identified and considered as the main criteria for the decision-making model. These indicators are categorized into three main groups:

I. Organizational Indicators (e.g., organizational size and governance quality).

II. Individual Indicators (e.g., auditor experience and competence).

III. Professional Indicators (e.g., independence, professional accuracy, and conflict of interest).

These indicators collectively provide a comprehensive framework for assessing audit quality, enabling a holistic evaluation of the factors that influence the effectiveness and reliability of audit processes.

Table 2. Indicators influencing audit quality evaluation.

Indicator Titles	Code
Organizational size	C1
Partner competence and expertise	C2
Organizational specialization	C3
Proper execution of audit processes	C4
Management team competence and expertise	C5
Governance quality	C6
Knowledge management	C7
Audit fees	C8
Knowledge	C9
Experience	C10
Adaptability and efficiency	C11
Independence	C12
Impartiality	C13
Professional accurac	C14
Conflict of interest	C15
Professional judgment	C16
Competence	C17

The calculations related to the SWARA method have been performed, and the corresponding results are presened in *Table 3*. In this table, the fuzzy values of the relative importance of the criteria compared to each other, i.e., sj. have been calculated.

Table 3. relative importance values of criteria.

Average of the Relative Importance of Each SJ Criterion			Code	Title
S_j^u	S_j^m	S_j^l		
0.57	0.5	1.22	C1	Organizational size
0.56	0.61	0.68	C2	Partner competence and expertise
0.3	0.36	0.44	C3	Organizational specialization
0.4	0.5	0.66	C4	Proper execution of audit processes
0.76	0.77	0.8	C5	Management team competence and expertise
0.26	0.30	0.36	C6	Governance quality
0.44	0.44	0.85	C7	Knowledge management
0.34	0.41	0.53	C8	Audit fees
0.6	0.66	0.77	C9	Knowledge
0.32	0.38	0.48	C10	Experience
0.28	0.33	0.40	C11	The power of efficiency matching
0.74	0.75	0.76	C12	Independence
0.54	0.58	0.64	C13	Impartiality
0.64	0.61	0.96	C14	Professional accuracy
0.36	0.44	0.57	C15	Conflict of interest
0.28	0.33	0.4	C16	Professional judgment
0.28	0.33	0.40	C17	Competence

After calculating the fuzzy values of the relative importance of the criteria compared to each other, in the next step, the fuzzy values of the coefficient Kj were calculated using *Eq. (4)*, and their values are presented in the table below.

Table 4. The obtained values of the index kj.

Kj			Code	Title
K_j^u	K_j^m	K_j^l		
1.57	1.5	2.22	C1	Organizational size
1.56	1.61	1.68	C2	Partner competence and expertise
1.3	1.36	1.44	C3	Organizational specialization
1.4	1.5	1.66	C4	Proper execution of audit processes
1.76	1.77	1.8	C5	Management team competence and expertise
1.26	1.3	1.36	C6	Governance quality
1.44	1.44	1.85	C7	Knowledge management
1.34	1.41	1.53	C8	Audit fees
1.6	1.66	1.77	C9	Knowledge
1.32	1.38	1.48	C10	Experience
1.28	1.33	1.40	C11	The power of efficiency matching
1.74	1.75	1.76	C12	Independence
1.54	1.58	1.64	C13	Impartiality
1.64	1.61	1.96	C14	Professional accuracy
1.36	1.44	1.57	C15	Conflict of interest
1.28	1.33	1.4	C16	Professional judgment
1.28	1.33	1.40	C17	Competence

After calculating the fuzzy values of the relative importance of the criteria compared to each other, in the next step, the fuzzy values of the coefficient Kj were calculated using the equation above. The values are presented in *Table 5*.

Table 5. The obtained values of the index Kj.

The Initial Weight of the Criterion qj			Code	Title
q_j^u 0	q_j^m	q_j^l		
1	1	1	C1	Organizational size
0.64	0.62	0.59	C2	Partner competence and expertise
0.49	0.45	0.40	C3	Organizational specialization
0.35	0.30	0.24	C4	Proper execution of audit processes
0.20	0.17	0.13	C5	Management team competence and expertise
0.15	0.13	0.10	C6	Governance quality
0.109	0.09	0.05	C7	Knowledge management
0.08	0.064	0.03	C8	Audit fees
0.051	0.038	0.02	C9	Knowledge
0.038	0.027	0.01	C10	Experience
0.0303	0.02	0.009	C11	The power of efficiency matching
0.017	0.011	0.0054	C12	Independence
0.011	0.0075	0.003	C13	Impartiality
0.006	0.0046	0.001	C14	Professional accuracy
0.005	0.0032	0.001	C15	Conflict of interest
0.0039	0.0024	0.0007	C16	Professional judgment
0.0030	0.0018	0.000542	C17	Competence
2.20	1.95	1.63	Total	

Finally, after calculating the fuzzy values of the initial weights (qj), the final weights of the indicators were calculated using the equation mentioned above, and their values are presented in *Table 6*. The obtained weights for the indicators will be used to rank these criteria using the COCOSO method.

Table 6. The obtained values of the index qj.

WDEF	Normalized Fuzzy Weight wj			Code	Criteria
0.552558	0.454545	0.512821	0.613497	C1	Organizational size
0.336612	0.291375	0.318522	0.363733	C2	Partner competence and expertise
0.241031	0.224135	0.234207	0.251429	C3	Organizational specialization
0.15398	0.160096	0.156138	0.151463	C4	Proper execution of audit processes
0.086178	0.090964	0.087883	0.084146	C5	Management team competence and expertise
0.064849	0.072194	0.067429	0.061872	C6	Governance quality
0.042588	0.049903	0.046718	0.033384	C7	Knowledge management
0.02911	0.037241	0.032977	0.021772	C8	Audit Fees
0.017037	0.023276	0.019786	0.012278	C9	Knowledge
0.011925	0.017633	0.014269	0.008258	C10	Experience
0.008725	0.013776	0.010702	0.005871	C11	The power of efficiency matching
0.00497	0.007917	0.006115	0.003336	C12	Independence
0.003083	0.005141	0.003862	0.002026	C13	Impartiality
0.001876	0.003122	0.002399	0.00103	C14	Professional accuracy
0.001252	0.002296	0.001662	0.000655	C15	Conflict of interest
0.000918	0.001793	0.00125	0.000468	C16	Professional judgment
0.00067	0.001401	0.000937	0.000332	C17	Competence

5.3|Selecting the Best Auditor Using the COCOSO Method

In this stage, the weights of the criteria obtained from the Fuzzy SWARA method are used to select the best auditor. *Table 7* shows the scoring matrix of each alternative for selecting the best auditor along with the criteria. The first row represents the weights obtained from the Fuzzy SWARA method, and the second row indicates the type of criteria, all of which are positive and are represented by the number 1.

Table 7. Characteristics of the candidate alternatives for selection.

Weights	**0.55255838**	**0.33661157**	**0.24103083**	**0.15397994**	**0.08617827**	**0.064848841**	**0.042588**	**0.02911**
Criterion Types	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Criteria	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**
A1	1	2	6	9	8	7	9	2
A2	5	3	9	8	7	9	7	4
A3	3	6	8	7	10	8	9	6
A4	6	9	6	6	6	9	6	6
A5	9	8	5	3	7	6	5	3
A6	8	7	9	2	9	3	9	2
A7	7	9	7	4	8	5	7	4
A8	10	8	9	6	6	4	6	6
A9	9	10	10	2	3	7	5	3
A10	8	7	7	4	7	9	9	2

Finally, using the formula $K_i = (K_1 + K_2 + K_3)^{\frac{1}{3}} + \frac{1}{3}(K_1 + K_2 + K_3)$, the combination of the three different weights was calculated, and the final ranking of each alternative was determined, as shown in *Table 8*.

Table 8. Final calculated weights for each alternative.

Alternatives	Ka	Ranking	Kb	Ranking	Kc	Ranking	K	K	Final Weight
A1	0.09	10.00	2.00	10.00	0.76	10.00	1.46	1.46	10
A2	0.11	1.00	3.34	8.00	0.98	1.00	2.19	2.19	5
A3	0.11	3.00	3.26	9.00	0.92	3.00	2.11	2.11	7
A4	0.09	8.00	3.44	6.00	0.82	8.00	2.09	2.09	8
A5	0.10	7.00	3.38	7.00	0.84	7.00	2.08	2.08	9
A6	0.09	9.00	3.60	5.00	0.80	9.00	2.14	2.14	6
A7	0.11	2.00	3.73	3.00	0.94	2.00	2.32	2.32	3
A8	0.11	4.00	4.31	1.00	0.92	4.00	2.52	2.52	1
A9	0.10	6.00	4.13	2.00	0.88	6.00	2.42	2.42	2
A10	0.10	5.00	3.69	4.00	0.89	5.00	2.26	2.26	4

The data analysis reveals that auditor independence (C12) and management team competence (C5) have the most significant impact on audit quality. This finding indicates that auditors with strong management and high independence generally provide better audit quality. Furthermore, among the evaluated options, Auditor A8 was identified as the best choice. This result demonstrates that the auditor possesses characteristics such as independence, experience, and effective implementation of audit processes, which have contributed to achieving a higher score. The findings of this research show that auditors' individual and professional attributes directly influence audit quality. Key indicators such as management team competence, auditor independence, and professional accuracy are of great importance in this study. The results of this research can be valuable for regulatory bodies, companies, and policymakers to develop new standards for ranking auditors. These insights may enhance the overall quality of auditing practices and ensure greater accountability and transparency in financial reporting.

6 | Conclusion

This study identifies and ranks the criteria for evaluating audit quality. To achieve this, data collected from certified auditors working in top-tier firms and auditors with over 8 years of experience were analyzed using the Fuzzy SWARA method, and the indicators influencing audit quality were weighted. Subsequently, the COCOSO method is employed to evaluate and rank auditors. The results revealed that the criteria for evaluating audit quality can be categorized into three main groups: 1) organizational factors (e.g., organizational size, partner competence, organizational specialization, governance quality, 2) individual Factors (e.g., knowledge, experience, adaptability, efficiency, etc.), 3) professional performance (e.g., independence, professional accuracy, conflict of interest, professional judgment, etc.), and 4) the weighting of the criteria indicates that organizational size, partner competence and expertise, and organizational specialization are the most significant indicators of audit quality. The other criteria were ranked with varying levels of priority.

The findings of this study are consistent with those of previous studies. Studies such as Asnad et al. [19], Omidvar and Ranjbar [26], Bayazidi et al. [20] have also demonstrated that auditors' organizational factors and professional characteristics significantly impact audit quality. Additionally, the results are consistent with international findings such as those of Li et al. [23] and Xiao et al. [7], which emphasize the role of corporate governance, auditor independence, and specialized knowledge in improving audit quality. This study highlights the substantial influence of organizational and professional factors on audit quality, with organizational size, partner competence, and auditor expertise among the most critical evaluation criteria. The findings of this research can assist companies, regulatory bodies, and audit firms in making better decisions based on key indicators of audit quality, ultimately contributing to enhanced transparency and reliability in financial reporting.

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Author Contribution

Seyed Fakhreddin Fakhrhosseini conceptualized the study, designed the methodology, and supervised the research process. Abdolhossein Alipour contributed to data collection, statistical analysis, and manuscript writing. Rasoul Naserhojjati Rudsari assisted in data interpretation and literature review. All authors reviewed and approved the final version of the manuscript.

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Data Availability

The data used in this study were collected from certified auditors and quality control firms. The datasets supporting the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest related to this research.

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