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Retraction

Retracted: A Model of Urban Economic Resilience Development with Multisource Data Fusion

Mathematical Problems in Engineering

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] J. Xia, "A Model of Urban Economic Resilience Development with Multisource Data Fusion," *Mathematical Problems in Engineering*, vol. 2022, Article ID 6490194, 7 pages, 2022.

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Research Article

A Model of Urban Economic Resilience Development with Multisource Data Fusion

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Taking a city as an example, a city physical examination index system is built around 8 aspects, including ecological livability, health and comfort, safety and resilience, and convenient transportation. Using the normalization method and hierarchical analysis method, we calculate and evaluate the natural background and operation of the city. The overall urban living environment is good, the ecological livability and neatness and orderliness of the city are high, the construction of convenient transportation and safety resilience needs to be strengthened, and there is still room for improvement in terms of style characteristics, health and comfort, innovation and vitality, diversity and tolerance, etc. The population density, the number of good air quality days, and the mortality rate of 10,000 vehicles in the urban center of the city are the highest. According to the results of the multisource urban health check, the city needs to take the problems and needs as the guide to accurately manage the "urban diseases" in the future and strive to improve the satisfaction, happiness, and sense of belonging of urban residents.

1. Introduction

Since the reform and opening up, China's urbanization has entered an accelerated period, and many cities adopted a crude economic development model in the early stage of urbanization, making urban development at the expense of the ecological environment, which has seriously affected the urban living environment and residents' life satisfaction. As China's urbanization rate continues to increase, people pay more attention to the high quality of urban life and put forward new requirements for high-quality urban development, thus transforming urban construction to the stage of improving the quality and efficiency of the stock [1–3].

Therefore, it has become the common desire of government departments and urban residents to improve the quality of urban living environment and residents' satisfaction with their lives [4].

At present, China's major urban diseases are especially prominent in large cities with large populations and have become a difficult problem for the development of high-quality habitat. Population, resources, ecology, transportation, housing prices, security, and other "urban diseases" are the problems that must be faced and solved in the current urban development. "Urban diseases" have not only occurred in large cities but also gradually spread to second- and third-tier cities, and their manifestations tend to diversify. The establishment of a scientific, comprehensive, highly applicable, and operable urban health check index system can provide effective support for comparative analysis and accurate assessment of urban development positioning [5]. With the advent of the era of big data, massive, dynamic, and multisource big data can identify and evaluate the operation status of urban elements in a timely and efficient manner, which brings significant opportunities for urban construction and sustainable development [6].

As an urban complex system, the urban agglomeration of population and industries has exposed cities to acute impacts such as natural disasters and chronic pressure caused by human interference. At the same time, a more systematic urban resilience assessment framework based on the integration of resilience theory and multidisciplinary theories can provide a theoretical basis for the deployment and implementation of sustainable development strategies and planning policies for the Suzhou urban agglomeration [7].

Scholars' research on urban resilience has been involved earlier and is mainly divided into the following aspects: urban resilience and climate change: research involves addressing climate change and urban adaptation [8], the link between tourism and urban ecological resilience [9], and structural and nonstructural integration measures to enhance community resilience in flood-prone areas [10]. Urban resilience and urban planning and construction: based on the perspective of urban planning and construction, the city constrained by the natural environment is integrated with nature to design urban planning such as water-appropriate and mountain-appropriate buildings, green buildings, and flood adaptation models to improve the development resilience of that city [11, 12]. Urban resilience governance model: based on the semistructured interview method to explore the interactions between key elements of urban resilience, the development of an adaptive governance framework and a polycentric decentralized governance approach is effective for urban resilience governance [13, 14]. Social dynamics mechanism of urban resilience: for example, Cuadrado-Roura and Maroto [15] analyzed the impact of factors such as urban economic development and unemployment growth rate on urban resilience based on the perspective of urban resilience and proposed the resilience capacity index (RCI) [16]. Urban resilience and landscape ecology: Giannakis and Bruggerman [17] explored the development sustainability of residential garden cities in the United States from the perspective of sociospatial differentiation. The research on urban resilience based on the perspective of smart cities is unique, and most of the existing studies explore ways to improve urban resilience from the perspective of "smart cities" [18].

There is a relative lack of in-depth analysis of the dynamic simulation of urban resilience and future development trends. In terms of research methods, the traditional mathematical and physical characteristics analysis is mainly used, and the indicator evaluation method and the GIS spatial analysis method are mostly used [19]. The comprehensive use of multiple methods and tools is rarely seen. In terms of research scales, most of them are provincial and municipal domains, and it is still necessary to carry out urban resilience research in medium and macroscale perspectives because of the interrelated and nested effects in different spatial scales. Based on the above analysis, the urban resilience theory is used as a guide to construct an urban resilience evaluation index system, and a dynamic simulation study on the urban resilience of Suzhou urban agglomeration is conducted by combining multiple methods and tools such as the BP artificial neural network model, GIS spatial analysis, and entropy-TOPSIS evaluation model. The study aims to enrich regional urban resilience research and provide scientific reference for the comprehensive revitalization of old industrial bases in Northeast China.

2. Related Work

At present, domestic and foreign scholars have conducted many studies on urban habitat evaluation, mainly focusing on the urban physical examination assessment index system, data methods, and scales. In terms of the index system, Smart et al. [20] constructed evaluation systems including sustainable city, green city, and livable city, but they mostly focus on a certain area of urban development such as safety, livability, and vitality, lacking comprehensive and targeted evaluation of urban elements. In terms of data methods, remote sensing data are used for natural resource background feature identification, [21] and urban operation physical signs monitoring is conducted through a social open big data collection. At the same time, Li and Gan [2] combined some statistical data to carry out comprehensive analysis and information mining, and used qualitative and quantitative methods such as expert scoring method, principal component analysis, entropy weighting method, and hierarchical analysis method to set and evaluate index weight calculation, and the application of emerging data and methods in urban physical examination is still being gradually explored. In terms of scale research, He et al. [3] covers the evaluation of urban physical examination habitat environment in different scale areas from provinces, urban clusters, cities, streets, and communities, and there is also a lack of uniform caliber of assessment standards in different scales.

3. Overview of the Study Area, Data Sources, and Research Methods

3.1. Study Area Overview. The vulnerability of the Suzhou urban agglomeration is becoming increasingly evident, with slow urban development, and the study area is shown in Figure 1. The vulnerability can be manifested in the following aspects: economic development continues to be sluggish; the economic growth rate of Suzhou urban agglomeration decreased from 8.14% to 3.38% from 2013 to 2018, and the economic growth rate of Changchun in the first 3 quarters of 2019 was even 0; population loss is serious; the total household population of Suzhou urban agglomeration decreased by 282,000 per year from 2013 to 2018, and most of them are young people and high-level talents. The total household population of Suzhou city cluster decreased by 282,000 on average per year from 2013 to 2018, and it is mainly young people and high-level talents [4]. Ecological environment deterioration. Environmental problems are caused by resource development. For example, the deep sunken area of the mining area in Liaoyuan City is 19 km^2, accounting for 51.3% of the built-up area, and the degradation, sanding, and salinization of the grassland in Daqing oilfield area has reached 85%. The quality of life of residents is low. According to the report, Yuan et al. [4] compared with the middle reaches of Yangtze River urban agglomeration, the consumption vitality index of Suzhou urban agglomeration is 12.09 percentage points lower than it, which is 42.76. In this context, it is important to carry out the study of urban resilience of Suzhou urban agglomeration to reduce urban vulnerability and promote the sustainable development of urban agglomeration with practical guidance.

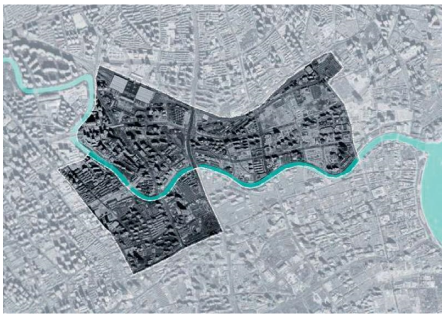

Figure 1: Overview map of the study area.

3.2. Data Source. The 11 prefecture-level cities of Suzhou city cluster are selected as the spatial study area, and 2010, the first year of the 12th Five-Year Plan, is chosen as the starting year, while the target year is 2018, the later year of the 13th Five-Year Plan.

3.3. Research Methodology. The TOPSIS evaluation model based on entropy weights is used to measure the urban resilience of Suzhou urban agglomeration. The specific steps are as follows: firstly, the entropy value method is used to determine the index weights, then the TOPSIS evaluation model is used to rank the decision targets, and finally, the urban resilience evaluation value of Suzhou city cluster is calculated [1].

A three-layer BP neural network prediction model is used to simulate the urban resilience measure values for 2020–2030 in MATLABR2018b environment [3], with 31 urban resilience evaluation indicators as the input layer and the target layer as the final output layer. It is first trained using the input-output sample set to achieve the given input-output mapping relationship, and finally, the urban resilience data of Suzhou urban agglomeration from 2010 to 2018 are input for the prediction of urban resilience in 2020–2030.

The influencing factors of the evolution of the spatial pattern of the Suzhou urban agglomeration are detected and analyzed using a geodetector model, which is as follows [3]:

$$q(Y|h) = 1 - \left[\sum_{h=1}^{L} \frac{\left(N_h \sigma_h^2\right)}{\left(N\sigma^2\right)}\right], \tag{1}$$

where $h = 1, 2, \ldots, L$ is the indicator classification (using K-means clustering), Y is the urban resilience measure, N_h is the number of urban resilience evaluation indicators, N is the number of evaluation units, σ_h^2 and σ^2 are the variance of the indicator layer h and the area-wide Y value, respectively. q values range from [0, 1], and the larger the value, the stronger the explanatory power of the urban resilience spatial variance of the Suzhou urban agglomeration. The higher value of q indicates the stronger explanatory power of the spatial variance of urban resilience in Suzhou city cluster.

Based on the ArcGIS platform, we analyzed the urban resilience measures of Suzhou city cluster from 2020 to 2030 by projecting the orthogonal surface of the urban resilience measures from 2020 to 2030, and each vertical bar in the trend analysis map represents the height and location of an urban resilience measure. Each vertical bar in the trend analysis graph represents the height and position of a city resilience measure. These urban resilience measures are projected onto an east-west and a north-south orthogonal plane, and a best-fit line is drawn through the projection points to simulate the trend of urban resilience in a specific direction and to reveal the future spatial development pattern of urban resilience.

4. Simulation Analysis of Urban Resilience Dynamics in Suzhou City Cluster

The BP neural network model is used to predict the trend of urban resilience in Suzhou city cluster from 2020 to 2030 (Figure 2).

The prediction results show that, in general, the urban resilience of Suzhou urban agglomeration develops slowly and the degree of resilience decreases gradually, and is dominated by the first level of resilience and the second level of resilience, and the proportion of cities with higher resilience level is smaller. Among them, the urban areas have a lower resilience level and the change trend is more stable, and the first level of resilience is dominant.

5. Case Study

5.1. Evaluation Analysis of Typical Indicators. The representative indicators calculated by fusing multiple sources of data were selected for analysis, and the evaluation process and results of the physical examination were elaborated in terms of data and methods, using 3 typical indicators at different scales for communities, streets, and municipal districts as examples.

Based on the data of buildings within the built-up areas of municipal districts, the building development intensity of 80 streets within the study area was calculated as the evaluation unit. The results show that the areas with high building development intensity are distributed in the streets of Furong District, Kaifu District, and Tianxin District, while the building development intensity of all the streets in Wangcheng District is at a low level. In general, the level of building development intensity in Suzhou is not high, and in terms of spatial distribution, it is mainly concentrated in the streets in the central part of the city, and the degree of intensive land use in the peripheral streets of the built-up area still needs to be improved (Figure 3).

5.2. Coverage Rate of Community Convenience Service Facilities. Figure 4 shows that there are 259 communities in the evaluation area, among which 85 communities are fully covered by 6 types of convenient service facilities, accounting for 32.82%; 74 communities are covered by 5 types of facilities, accounting for 28.57%; 41 communities are covered by 4 types of facilities, accounting for 15.83%; 59 communities are covered by 3 types of facilities or less, accounting for 22.78%. Among them, 15 communities (5.79%) are not covered by any convenient service facilities.

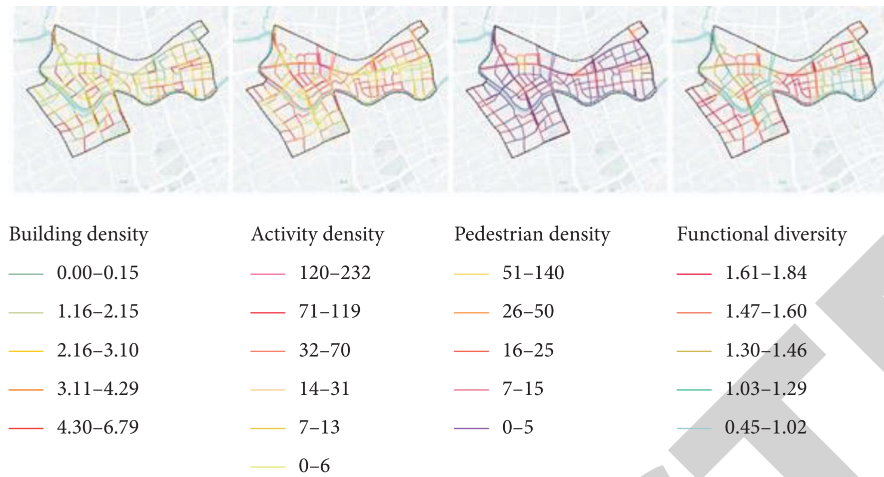

Figure 2: Evolution of the urban resilience level of Suzhou city cluster in 2020–2030.

Figure 3: Distribution of street building development intensity.

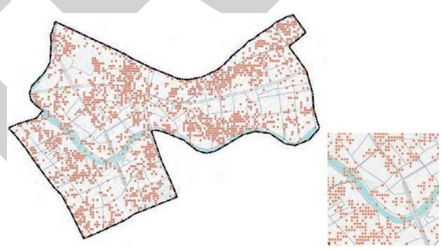

Figure 4: Distribution of the number of types of community convenience service facility coverage.

More than 77% of the communities with convenient service facilities of category 4 or above are areas with a high level of community services [22].

The communities with low coverage are mainly located at the edge of built-up areas far from the city center.

In terms of the coverage of convenient service facilities (Figure 4), the coverage of commercial, medical, and educational facilities is high, reaching 89.19%, 79.92%, and 78.76%, respectively. The coverage rates of elderly and cultural and sports facilities are lower, only 43.24% and 63.71%, and there are obvious differences in the coverage rates of various types of convenient facilities. This indicates that there is still much room for improvement in the integrity and sharing of public service facilities in Suzhou; especially, with the arrival of an aging population, the coverage of community elderly service facilities should be strengthened.

5.3. Rent-to-Income Ratio. The rental price matching the income of the mobile population has become an important indicator to portray the housing problem of the population, and the rent-to-income ratio reflects the operation of the residential rental market and also affects the quality of life of the mobile population [16]. The rental price data of Internet neighborhoods are collected through Chain Home, and after cleaning and de-duplication, the rent per unit area of residential units can be obtained from the rental rent and rental area information of the neighborhoods, and the rent-to-income ratio is obtained by dividing it with the per capita urban disposable income data counted by each district and county (Figure 5).

According to the analysis of the rental data of 2,545 districts under the jurisdiction of the city, the rent-to-income ratio of each district and county ranged from 0.0057 to 0.0066. Among them, Wangcheng District had the lowest

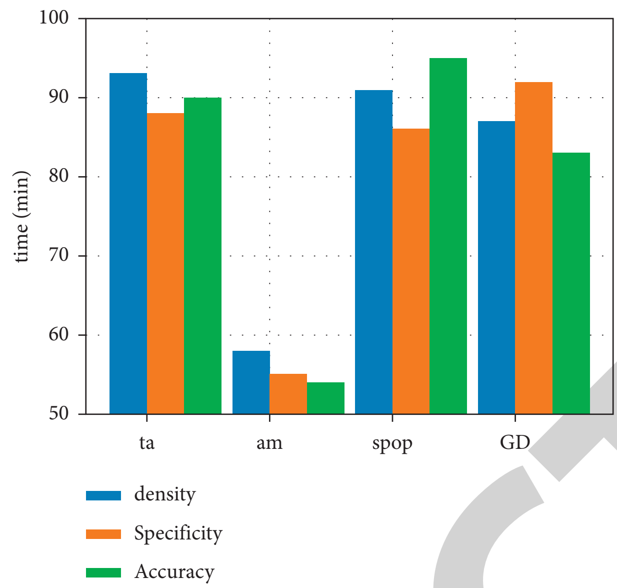

Figure 5: Municipal district rent-to-income ratio.

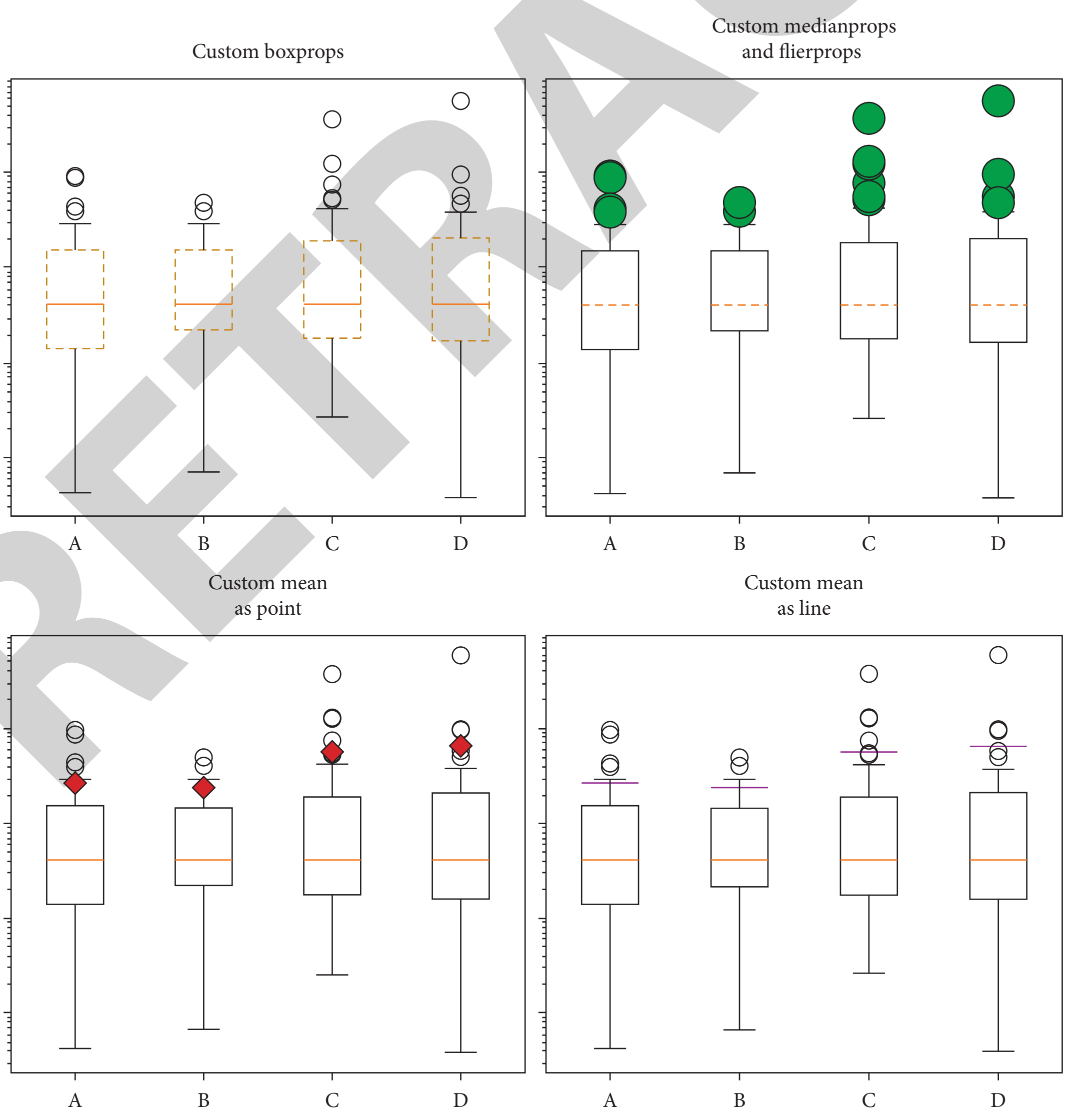

Figure 6: Municipal district thematic assessment results.

per capita urban disposable income among all districts and counties; thus, its rent-to-income ratio was the highest; Furong District had the highest average annual rent per unit area, and thus its rent-to-income was at a high level.

5.4. Analysis of Integrated Assessment Results. The comprehensive analysis of city physical examination needs to identify the characteristics and shortcomings of urban development through thematic assessment and index diagnosis, and provide a reference basis for the formulation of countermeasures and programs for fine urban governance.

First of all, from the overall perspective of the city, ecological livability scores the highest, mainly in the city center with reasonable population density, better air and water environment quality, and an overall good urban habitat environment due to the high degree of intensive use of urban resources and the gradual enhancement of ecological environmental protection and governance. The second highest score is for cleanliness and orderliness, which is mainly due to the strong capacity of domestic garbage and domestic sewage treatment and the high density of sanitation facility distribution. The lowest score is for convenient transportation, mainly because of the low speed of motor vehicles during peak hours, the large separation of resident population, and the unreasonable distribution of road network patterns. The score of safety and resilience is also low, and there are hidden dangers in major emergencies and public health safety, mainly in the coverage rate of fire stations and community health service centers.

In terms of landscape characteristics, the city's historical and cultural protection is relatively intact, and the tourism attraction and income generation capacity are gradually growing. In terms of health and comfort, community services basically meet the required standards, but community construction and management are still insufficient, and the level of community housing conditions is limited. In terms of innovation and vitality, the youth population is energetic and the business environment for innovation is gradually improving. In terms of diversified inclusion, the level of group inclusion is not high, and the protection for low-income groups and unemployed people needs to be further strengthened; housing inclusion performs well, with excellent rental capacity and high accommodation tolerance for foreign population, which is a major advantage of Suzhou in attracting talents.

Secondly, from the assessment results of the topics of each municipal district, Suzhou has the highest average value of the topic index with a score of 0.80, while Wangcheng District has the lowest value with a score of 0.47. From the regional distribution of the high and low levels of different topics (Figure 6), the highest values of ecological livability, health and comfort, neatness and orderliness, and innovation and vitality topics of the district and county transportation convenience topics are highest in Wangcheng District, and the diversity and inclusion, security and resilience, and style characteristics are high.

6. Conclusions

The ecological livability and orderliness of the city are high, the traffic convenience and safety resilience are low, and the appearance, health and comfort, innovation and vitality, and diversity and tolerance are at a medium level. The overall scores of all topics are above 0.7, and the urban habitat is generally good, but there is still room for improvement.

The use of multisource data to conduct a city check-up in Suzhou can effectively combine the advantages of static statistical data and dynamic emerging data, providing powerful data support for efficient and accurate diagnosis of urban diseases. At the same time, it constructs an index system for urban resources and environment, security and resilience, facility coverage, and innovation and vitality, and establishes evaluation criteria for horizontal and vertical comparison, which can identify the shortcomings of urban development in a more comprehensive way and provide targeted treatment for urban diseases.

Data Availability

The data underlying the results presented in the study are available within the manuscript.

Conflicts of Interest

There is no potential conflict of interest in our paper, and

Authors' Contributions

All authors have read the manuscript and approved to submit to the journal.

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