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Retraction

Retracted: Artificial Intelligence and Big Data-Based Injury Risk Assessment System for Sports Training

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1].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] Y. Zhang, "Artificial Intelligence and Big Data-Based Injury Risk Assessment System for Sports Training," *Mobile Information Systems*, vol. 2022, Article ID 7125462, 7 pages, 2022.

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Research Article

Artificial Intelligence and Big Data-Based Injury Risk Assessment System for Sports Training

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Sports training is an important part of daily life, and various injuries are prone to occur during the training process. If they are not dealt promptly, they are bound to affect daily life. Although our nationals are becoming more and more aware of participating in physical exercise, they are performing numerous sports activities at the time of unexpected events, and sports injuries are becoming more and more frequent. To realize the evaluation and automatic prediction of sports training injury risk factors, a sports training injury risk evaluation algorithm using big data analysis is proposed. Establish a training injury risk analysis model, analyze the relevant parameters of training injury risk assessment through statistical and quantitative analyses, extract the entropy characteristics of training injury risk big data, optimize the decision-making and assessment process of injury risk through stable result assessment and fuzzy decision-making, and establish an expert system analysis model of sports training injury risk assessment. The hierarchical analysis method is applied to evaluate the training injury risk, and the adaptive fuzzy control is optimized to realize the optimal design of training injury risk assessment. Results show that this method has good adaptive characteristics and high certainty.

1. Introduction

Although our national standard of living has been improving in recent years, physical fitness is not ideal. Physical training is an important part of daily life. Sports can improve people's physical fitness, sports quality, and physical quality and can strengthen people's internal organs, muscles, bones, cardiopulmonary function, and the proportion of blood components to aspects conducive to people's health, which is conducive to people's longevity. Moreover, sports can make us feel more close to nature, close to our own origin, and enrich social communication. Sports embody the spirit of freedom and openness, making it a good recipe for people to live in harmony and help purify people's body and mind. Through sports training, we can effectively improve the sport's ability of everyone [1]. In the organization of sports training, it is necessary to carry out sports training injury risk assessment and decision making, construct a decision model for sports training injury risk, adopt the fuzzy degree feature analysis method, and carry out sports training injury risk prediction, and the related research on sports training injury risk assessment and decision-making methods has received great attention [2].

Preparation activities are crucial for any sport. Inadequate warm-up, deep muscle temperature, muscle flexibility, and joint flexibility are enough to cause muscle and ligament strains and joint injuries during exercise, while adequate warm-up can increase the explosive force generated by subsequent muscle contractions [3]. In [4], they found after a survey of student sports participants that the frequency of sports injuries due to improper preparation activities was 88, which was 21.41% of the total number of injuries reported by 132 people.

Relaxation exercise is carried out at the end of each training to relieve the stress of exercise and promote the recovery of body functions from exercise [5]. Muscles are in a tight state after exercise, and if not timely relaxed, it will not only lead to muscle soreness but with time, it will also make the muscles lose elasticity, and movement coordination will be greatly reduced; hence, appropriate postpractice relaxation is needed to relieve exercise fatigue and to meet psychological pressure requirements [6].

The whole process of sports requires different sports partners to run through the whole consciousness, and the cooperation between partners is particularly important [7]. Men play the role of "leader" in sports, while women, as "followers," need to correctly capture the body language of their male partner in time to complete the action under his guidance [8]. If the partners are not coordinated, the inconsistent curvature and extension of the movements will deplete the strength of both partners and increase the risk of sports injury [9].

This risk factor refers to the existence of an old sports injury in the athlete's body, but the athlete does not pay enough attention or insists on participating in training with the injury due to psychological factors that lead to aggravation or new sports injuries. Taking China's outstanding Latin dance players as an example, [10] investigated 48 study subjects and found that 60.45% of the players continued training after the occurrence of sports injuries with only simple treatment and 23.1596 players still trained normally [11]. Exercise fatigue is the inability of the physiological processes of the body to sustain [12]. As the level of sports competition continues to improve, the players have heavy competition tasks and high exercise intensity. The fatigue caused by the overload will cause muscle pain and activity problems, which will seriously affect the training and daily life of sports players [13].

The assessment of sports training injury risk is using the big data analysis of sports training injury risk, the constraint parameter analysis of sports training injury risk assessment by the statistical quantitative analysis method, the extraction of entropy feature quantity of big data of sports training injury risk, the extraction of similarity information of sports training injury risk feature distribution set, the adaptive sports training injury risk assessment, and the adaptive sports training injury risk assessment by the quantile regression analysis method [14]. Sports training injury risk assessment through the quantile regression analysis method is used to achieve risk assessment, but the traditional method for sports training injury risk assessment has poor adaptiveness and low feature discrimination ability; in this regard, this paper proposes a sports training injury risk assessment algorithm based on hierarchical gray correlation analysis [15]. A big data analysis model of sports training injury risk is established, combined with a fuzzy degree feature extraction method for sports training injury risk assessment, and finally, simulation test analysis is conducted to draw valid conclusions.

2. Related Work

In order to make the sources of sports injury risk more comprehensive and more effective, it is necessary to make a reasonable classification of the sources of sports injury risk, as shown in Figure 1. There are two aspects. The risk of people mainly includes action-behavior risk and self-management risk; the risk of sports venues includes safety management risk and medical supervision risk; the risk of venue equipment mainly includes activity venue risk and sports equipment risk; the risk of external environment mainly includes natural environment risk and manmade environment risk.

Common sports injuries are as follows: skin and soft tissue injuries: the cuticle and tissue fluid of the skin exude, but local inflammation is weak, and capillaries do not bleed when they are not damaged. It is important to prevent and treat skin infections. For small abrasions, the wound can be cleaned with saline or cold water, disinfected with 70% alcohol cotton balls, and wrapped with purple salve. If the wound has foreign material such as cinder blocks or fine sand, it is rinsed with saline or cold boiling water and disinfected with hydrogen peroxide and alcohol cotton balls. The wound is then covered with a strip of petroleum jelly and wrapped with a sterile dressing. Compared with abrasions, cuts bleed more and are more difficult to debride, and it has the risk of easy infection. First of all, attention should be paid to bleeding, mainly to stop bleeding with pressure, and if necessary, bandages can be used to stop bleeding. If the wound is deep, debridement is difficult, and it is important to know at which point the injured person should be taken to a doctor and vaccinated against tetanus. It is worth mentioning that open wounds of the head are often difficult to stop bleeding because of the rich blood flow to the scalp and the high tension of the scalp, which should be treated promptly and correctly and sent to the hospital decisively for treatment.

A muscle strain is a minor muscle injury caused by rapid muscle contraction or excessive pressure during exercise that results in a partial or complete tear of the muscle. After a muscle strain, you may feel pain, swelling, pressure, and muscle stiffness. The mild muscle strains can be localized pain, swellin and pressure, but severe cases can lead to muscle tears, swelling, subcutaneous congestion, and muscle contraction. Treatment for such injuries should be immediate with cold compresses, pressure packs, and elevated elevation of the injured limb. When pain is severe, oral sedative and analgesic medications may be administered and can be used within 24 hours or less.

The analysis of the steps to prevent the risk of injury in sports is shown in Figure 2.

3. Methodology

According to the above, the hierarchical analysis model is constructed as shown in Figure 3.

In the model, the highest risk factor is used as the target; severity and incidence as the criterion; and four types of risk factors, namely, sports instruction, partner cooperation, personal factors, and sports combination as the alternative. Next, a comparison matrix is constructed and solved, and finally, the highest risk category is determined logically, and those risk exposures with higher incidence and more severe consequences are identified and focused on.

The ratio scaling method is shown in Table 1.

The fourth-order matrix A formed is as follows (A_{ij} is the ratio of importance between risks ij, $A_{ji} = 1/A_{ij}$) [10].

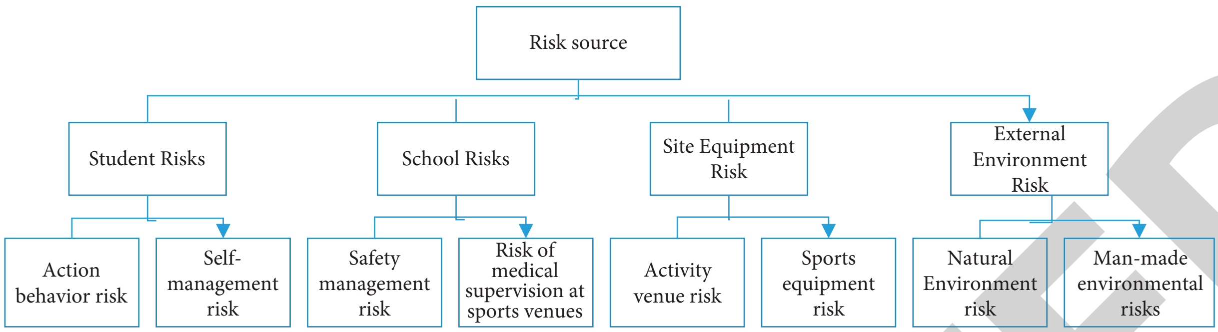

FIGURE 1: Sports training risk factors classification chart.

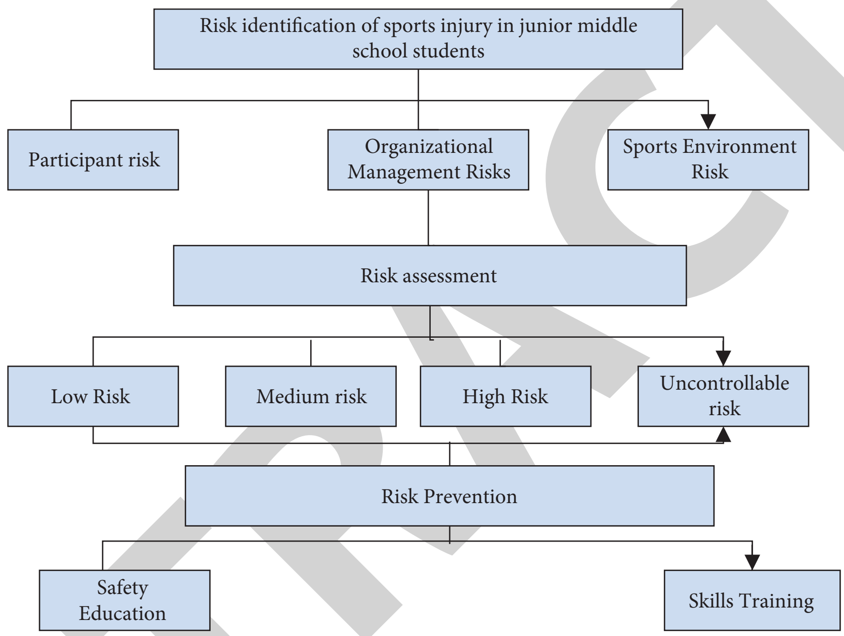

FIGURE 2: Risk prevention chart for sports injuries.

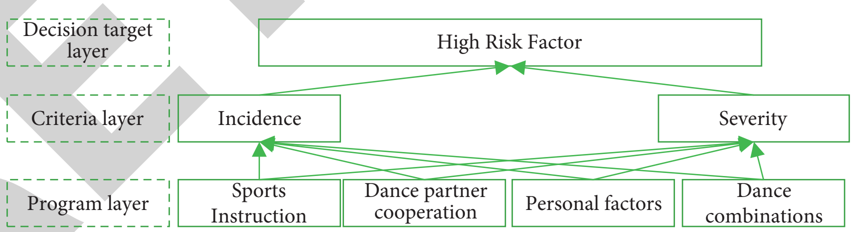

FIGURE 3: A hierarchical decision model for high-risk factors.

$$A = \begin{bmatrix} 1.00 & 4.00 & 7.00 & 9.00 \\ 0.25 & 1.00 & 4.00 & 6.00 \\ 0.14 & 0.25 & 1.00 & 3.00 \\ 0.11 & 0.16 & 0.33 & 1.00 \end{bmatrix}. \quad (1)$$

To achieve the sports training injury risk assessment model, the big data fusion scheduling method is used for big data information sampling of sports training injury risk assessment, combined with the statistical information mining method for sports training injury risk assessment,

TABLE 1: 1–9 ratio scale method.

Relative importance	Definition
1	Equally important/advantageous
3	Slightly important/advantageous
5	Relatively important/advantageous
7	Very important/advantageous
9	Absolutely important/advantageous
2, 4, 6, 8	The median value of two adjacent judgments

dividing the level of sports training injury risk assessment $X^{(0)}$, into N levels, as $X^{(1)}, X^{(2)}, \ldots, X^{(N)}$, that is, $X^{(0)} = \cup_{i=1}^{N} X^{(i)}$, with the fuzzy feature distributed mining method for statistical analysis and optimal assessment of sports training injury risk, establishing a big data analysis model for sports training injury risk assessment and adaptive learning for sports training injury risk assessment and obtaining a statistical function for sports training injury risk assessment as [11]

$$\begin{aligned}
&\min F = R^2 + A \sum_i \xi_i \\
&st\colon \left\|\phi(x_i) - o\right\|^2 \le R^2 + \xi_i \text{and} \xi_i \ge 0, i = 1, 2, \cdots \\
&\max \sum_i \alpha_i K(x_i, x_i) - \sum_i \sum_j \alpha_i \alpha_j K(x_i, x_j) \\
&\text{s.}\, t\colon \sum_i \alpha_i = 1 \text{ and } 0 \le \alpha_i \le A, i = 1, 2, \cdots
\end{aligned} \tag{2}$$

The above equation is a big data fusion model of sports training injury risk assessment for quantitative analysis of sports training injury risk assessment, and the correlation distribution relationship of the constraint covariate set R^N, X^N of sports training injury risk assessment is established as [13]

$$\begin{aligned}
p\left(R^N = r_i\right) &= p\left(X^N = x_i \| x_i| = |r_i|, \text{angle}(x_i)\right. \\
&= \left(\text{angle}(r_i) - \varphi_g\right) \text{mod}(2\pi)\big).
\end{aligned} \tag{3}$$

We combine the autocorrelation feature matching method for sports training injury risk assessment big data sampling according to the sampling results for sports training injury risk optimization, evaluation, and decision making. The feature matching function of sports training injury risk is established, $\{x(t_0 + i\Delta t)\}, i = 0, 1, \ldots, N-1$. The optimization-seeking trajectory of machine learning is calculated as [14]

$$X = [s_1, s_2, \ldots s_K]_n = \left(x_n, x_{n-\tau}, \ldots, x_{n-(m-1)_\tau}\right). \tag{4}$$

The fuzzy parametric identification of sports training injury risk assessment is carried out by using output stability gain assessment and the fuzzy decision method is constructed as

$$\frac{dz(t)}{dt} = F(z). \tag{5}$$

Let $f(s_i) = (f(x_1), f(x_2), \ldots, f(x_n))$; construct a fuzzy subspace scheduling model for sports training injury risk evaluation as $P(n_i) = \left\{p_k | pr_{kj} = 1, k = 1, 2, \ldots, m\right\}$, and conduct correlation scheduling, automatic mining, and fuzzy degree feature analysis for sports training injury risk evaluation. The fuzzy update rule for sports training injury risk evaluation is calculated as [15]

$$\begin{aligned}
\lambda &= \frac{1}{1 + \alpha(\partial S/\partial t)^2}, \\
\widehat{k}_\mu(t+1) &= \widehat{k}_\mu(t) + Q(t+1) \times \left[\frac{\partial \widehat{F}_\mu / Mg}{\partial t} - \frac{\partial S^\lambda}{\partial t} k_\mu(t)\right], \\
Q(t+1) &= P(t+1) \frac{\partial S}{\partial t}, \\
P(t+1) &= \frac{1}{\lambda}\left[P(t) - \frac{\partial S}{\lambda + P(t)(\partial S/\partial t)^2}\right], \\
\frac{\partial S}{\partial t} &= \frac{r}{v_c} \frac{\partial \omega_w}{\partial t}.
\end{aligned} \tag{6}$$

In the equation, λ represents the fuzzy distribution factor of the big data for sports training injury risk assessment, combined with the statistical feature analysis method for sports training risk assessment. The sports training injury risk assessment is obtained as

$$\sum_{s_c \in S^2} p\left\{\frac{C_k^l}{A_k^i B_k^b}\right\} p\left\{\frac{A_{k+1}^j}{A_k^i B_k^b C_k^l}\right\}. \tag{7}$$

The linear fit equation for the risk assessment of physical training injuries is

$$p_{id}^{\text{new}} = \begin{cases} p_{id} + m\left(X_{\max} - p_{id}\right), & \text{if } m > 0, \\ p_{id} + m\left(p_{id} - X_{\min}\right), & \text{if } m \le 0. \end{cases} \tag{8}$$

The similarity analysis method is used for adaptive assessment of sports training injury risk, and the fuzzy control in the process of sports training injury risk assessment can be displayed as

$$SL_{\text{i}} = \begin{cases} L_i, & \text{if } i = 1, \\ N_{ew}, & \text{otherwise.} \end{cases} \tag{9}$$

$\text{New}_i = (e_{i1}, e_{i2}, \ldots, e_{iD})$ denotes the distributed scheduling set for sports training injury risk assessment, from which the fuzzy association rule scheduling set for sports training injury risk assessment is constructed, and the segmentation test for sports training injury risk characteristics is performed [14].

$$\begin{aligned}
C_{\text{code}} &\coloneqq \left(\text{name}, A, \Psi_{\text{ckcallee}}, \Psi_{\text{ckcaller}}, X_{\text{decl}}, X_{\text{req}}, X_{gmt}\right), \\
C_{\text{data}} &\coloneqq \left(\text{name}, \Psi_{\text{ckcallee}}, \Psi_{\text{ckcaller}}, X_{\text{decl}}\right), \\
\widehat{C} &\coloneqq \left(\text{name}, \Psi_{\text{ckcallee}}, \Psi_{\text{ckcaller}}, X_{\text{decl}}, X_{\text{req}}, X_{grnt}, \{C_1, \ldots\ldots, C_i\}\right), \\
iC_{:} &= \left(\text{name}_r, C, X_{\text{grtt}}\right), \\
\widehat{C}_{:} &= \left(\text{name}_r, C, X_{gmt}, \{iC_1, \ldots\ldots, i\text{C}_i\}\right), \\
E_{:} &\coloneqq x = E_1; E_2 \left|\text{call} iC_i\right| \text{return } i\text{C}_i|, \\
&\quad \text{grant Prin} T_{gt} PF, \\
&\quad \text{checkguard} iCTgt\Psi.
\end{aligned} \tag{10}$$

Table 2: Sports training risk factors category statistics table.

No.	Risk factor category	Frequency	Cumulative percentage (%)
A-a	Student movement behavior risk	162	20.12
C-b	Sports equipment risk	148	39.69
C-a	Activity venue risk	139	55.36
A-b	Student self-management risk	125	71.03
B-a	School safety management risk	100	82.55
D-b	Manmade environment risk	75	92.36
B-b	School medical supervision risk	35	96.77
D-a	Natural environment risk	28	100

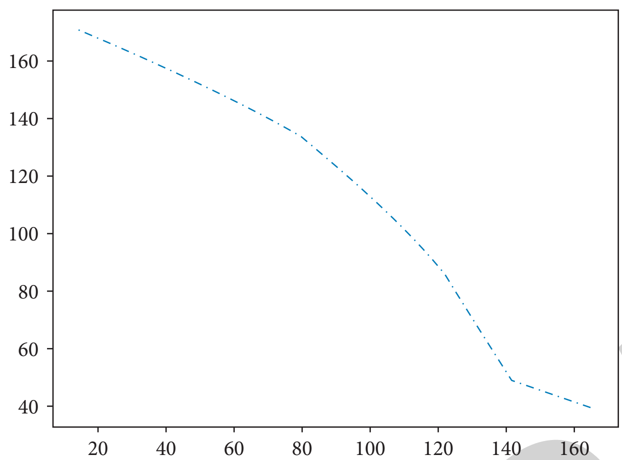

Figure 4: Pareto analysis diagram of risk factor categories for physical training on frequency.

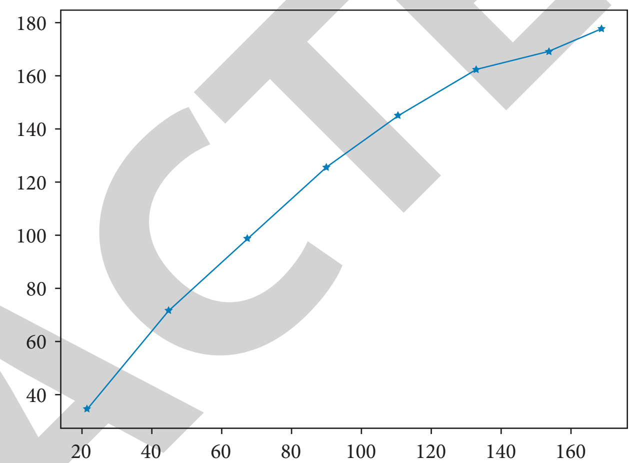

Figure 5: Pareto analysis diagram of risk factor categories for physical training on percentage.

For large sports training injury risk assessment and adaptive control,

$$M_v = w_1 \sum_{i=1}^{m\times n} (H_i - S_i) + M_h w_2 \sum_{i=1}^{m\times n} (S_i - V_i) + w_3 \sum_{i=1}^{m\times n} (V_i - H_i). \tag{11}$$

The association rule distribution function for sports training injury risk assessment is M_h, and the joint association rule mining method is used to obtain a finite dataset of association dimensional distribution for sports training injury risk assessment [15].

$$X = \{x_1, x_2, \ldots, x_n\} \subset R^2. \tag{12}$$

The sports training injury risk assessment contains n samples, and the expert system analysis model of sports training injury risk assessment is established, and the control sample function is obtained as $x_i, i = 1, 2, \ldots, n$.The feature quantity of sports training injury risk assessment is obtained by combining the hierarchical gray-scale correlation analysis method p_q with the quantitative relationship of sports training injury risk assessment and is displayed as

$$h(t) = \sum_i a_i(t) e^{j\theta_i(t)} \delta(t - iT_S). \tag{13}$$

The sports training injury risk prediction function is obtained, as shown in the following equation, to sum up the analysis, achieve the optimization of sports training injury risk, and to improve sports training injury risk control.

$$\text{Minimize} \frac{1}{2}\|w\|^2 + C \sum_{i=1}^{n} (\xi_i + \xi_i^*)$$
$$\text{Subject to}\, y_i - (w' \Phi(x_i) + b) \le \varepsilon - \xi_i^*$$
$$(w' \Phi(x_i) + b) - y_i \le \varepsilon - \xi_i^* \xi_i, \xi_i^* \ge 0, i = 1, 2, \ldots, n; C > 0. \tag{14}$$

4. Experiments

Pareto analysis was applied to assess the overall risk factors of sports training, and the results of the overall risk assessment of sports training were obtained, as shown in Table 2.

Pareto analysis of the categories of risk factors for people's physical training is plotted according to Table 2, as shown in Figures 4 and 5.

First, the quantitative assessment of risk in terms of movement behavior was performed using the list ranking method and based on the formula for calculating the amount of risk, which resulted in the mean score of likelihood and mean score of severity, and the amount of risk for each risk factor is shown in Table 3.

First, the quantitative assessment of risks in self-management was performed using the list ranking method and

Table 3: Assessment results of action-behavior risk factors ($n = 192$).

No.	Risk factors	Likelihood mean score	Severity mean score	Amount of risk	Risk amount ranking
A-b-1	Inappropriate attire during after-school physical exercise	4.35	2.16	8.89	3
A-b-2	Carrying sharp objects or fragile objects	3.45	3.55	12.05	3
A-b-3	Poor mental state due to problems such as lack of sleep or improper diet	3.26	2.45	7.87	5
A-b-4	Having an illness or physiological problems	2.89	3.22	9.15	4
A-b-5	Poor self-protection ability	4.28	3.85	15.59	2
A-b-6	Loss of valuables or clothes due to lack of care	3.85	1.75	6.68	6

Table 4: Assessment results of self-management risk factors ($n = 192$).

No.	Risk factors	Likelihood mean score	Severity mean score	Amount of risk	Risk amount ranking
A-a-1	No preparation activities or relaxation activities	4.45	2.75	11.97	3
A-a-2	The technical movements are not standardized, the movements are casual and lazy	2.92	2.49	6.98	6
A-a-3	Too violent technical movements	3.55	3.36	11.35	5
A-a-4	Technical movements are not fully mastered, engaged in difficult movements	3.36	3.85	12.25	1
A-a-5	Violent conflicts caused by collisions between peers	4.28	3.88	15.36	2

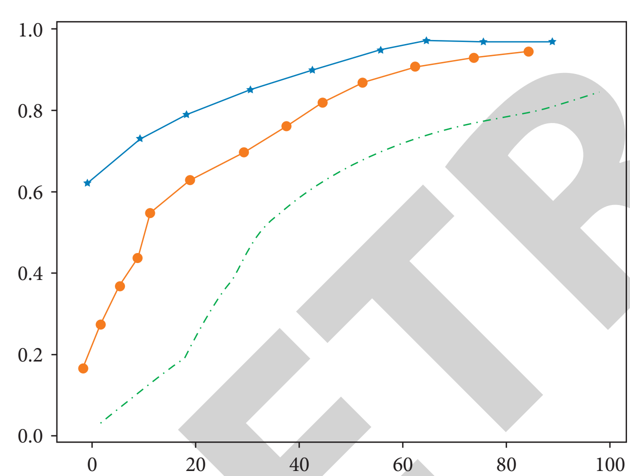

Figure 6: Comparison of the accuracy of sports training injury risk assessment.

based on the formula for calculating the amount of risk, which led to the mean scores of likelihood and severity for each risk factor, and the mean score of the amount of risk is shown in Table 4.

To verify the effectiveness of this method in sports training injury risk, this paper uses statistical analysis software to simulate and analyze the training injury risk. The statistical sample length of sports training injury risk is 1024 and the risk assessment coefficient is 0.25. The uncertainty degree of risk characteristic distribution is determined according to the abovementioned parameters. Based on this, the sports training injury risk assessment is carried out, and the information on injury risk distribution in sports training is obtained. The analysis of that the training injury risk assessment method is effective in the accuracy assessment obtained by statistical analysis, test, and comparison (Figure 6).

5. Conclusion

To carry out sports training injury risk prediction and improve the optimal decision-making ability of sports training injury risk assessment, this paper proposes a sports training injury risk assessment algorithm based on hierarchical gray correlation analysis to establish the analysis model of sports training injury risk big data, to analyze the constraint parameters of sports training injury risk assessment by using the method of statistical quantitative analysis, to extract the entropy feature quantity of sports training injury risk big data, to make the optimal decision and evaluation of sports training injury risk assessment by using the method of output stability gain assessment and fuzzy decision making, and to establish the expert system analysis model of sports training injury risk assessment. The method of hierarchical gray correlation analysis is used for adaptive optimization and fuzzy control of sports training injury risk assessment and to realize the optimal design of sports training injury risk assessment. The analysis shows that the adaptiveness of the risk assessment of sports training injury using this method is good, the confidence level is high, and the risk prediction and assessment ability also has improved.

To predict the training injury risk and improve the optimal decision-making ability of sports training injury risk assessment, a training injury risk assessment method using gray correlation analysis is proposed. Establish the big data analysis model of training injury risk, analyze the relevant parameters of training injury risk assessment by the statistical quantitative analysis method, extract the entropy characteristics of training injury risk big data by the stable result evaluation method and make a fuzzy decision, optimize the decision-making and evaluation process of training injury risk, and establish a special system analysis model for training injury risk evaluation. The gray correlation analysis method is applied to evaluate the sports training injury risk, and the adaptive fuzzy control is optimized to realize the optimal design of sports training injury risk evaluation. It is found that this method adapts well to the injury risk assessment in sports training, has high reliability, and improves the ability of risk prediction and assessment.

Data Availability

No data were used to support this study.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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