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AI-Enabled Integration of Sports and Medicine for Spinal Health Management in College Students

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Abstract: ***This study focuses on the mechanism of integrating sports and medicine empowered by artificial intelligence (AI) technology for the spinal health management of college students. With increasing academic pressure, poor lifestyle habits, and lack of exercise, spinal health issues among college students have become increasingly prominent, and traditional management models are unable to meet the demands for personalized and precise care. This paper analyzes the current status and influencing factors of spinal health problems among college students, explores the application advantages of AI technology and the integration of sports and medicine in spinal health management, constructs a framework for the AI-empowered integration mechanism, and proposes specific implementation pathways and strategies to address challenges. The research finds that AI technology has advantages in data collection and analysis, intelligent diagnosis and prediction, and the formulation of personalized rehabilitation plans. The integration of sports and medicine can combine medical and sports resources to achieve a combination of prevention and treatment, enhancing the comprehensiveness and sustainability of health management. Through AI-empowered integration, medical and sports resources can be precisely matched, and real-time monitoring of students' rehabilitation training and dynamic adjustment of health management plans can be realized. The paper proposes countermeasures such as strengthening data security management, promoting technological standardization, increasing talent cultivation, and deepening institutional and mechanism reforms. This study provides theoretical support and practical references for improving the spinal health management level of college students and promotes the in-depth development of the integration of sports and medicine in the field of college health management.***

Keywords: Artificial Intelligence (AI); College Students; Spinal Health Management; Integration of Sports and Medicine.

1. INTRODUCTION

College students, as the future pillars of the nation, are under close scrutiny regarding their physical health. In recent years, due to academic stress, poor lifestyle habits, and lack of exercise, spinal health issues among college students have become increasingly prominent. Spinal health not only affects physical posture and physiological function but can also have negative impacts on psychological well-being. Traditional spinal health management models have certain limitations and are unable to meet the personalized and precise needs of college students. With the rapid development of artificial intelligence (AI) technology, integrating AI with the concept of integrating sports and medicine to build an innovative spinal health management mechanism for college students holds significant theoretical and practical importance.

2. CURRENT STATUS OF SPINAL HEALTH ISSUES AMONG COLLEGE STUDENTS

2.1 Incidence and Trends

According to a survey report released in 2024 by the Spinal Scoliosis Prevention and Control Committee of the Chinese Medical Association, more than 5 million adolescents in China currently suffer from scoliosis, with approximately 300,000 new cases added each year, resulting in an incidence rate of around 3%. Scoliosis has become the third most significant health threat to adolescents, following obesity and myopia [1]. Surveys targeting college students have also revealed a concerning situation. The primary causes include the prolonged sedentary lifestyle of college students, who often maintain poor postures such as bending their heads and leaning forward while studying or entertaining themselves. Activities like constantly looking down at mobile phones, writing while lying on a desk, and sitting for extended periods playing computer games place excessive pressure on the spine, disrupting its normal physiological curvature and ultimately leading to scoliosis. Additionally, insufficient

physical education courses in some universities and the lack of adequate exercise among students lead to weak muscles surrounding the spine, which are unable to effectively support and protect it.

2.2 Influencing Factors

Poor lifestyle habits among college students have numerous negative impacts on spinal health. According to a report from MyCOS Institute, the average daily cumulative mobile phone usage among college students is 5.2 hours. The 2024 China Resident Sleep Health White Paper indicates that 56% of college students use their mobile phones for more than 8 hours a day, while a survey by China Youth Media shows that only 14.05% of respondents use their mobile phones for 3 hours or less per day [2]. Prolonged mobile phone use keeps the spine in an excessively flexed or bent position for extended periods, increasing pressure and easily causing spinal deformities and pain.

The heavy academic workload in universities also has a significant impact on spinal health. Some students, especially those in science and engineering majors who need to spend long hours drawing or programming, and those in humanities who need to read and write extensively, often maintain the same sitting posture for extended periods without adequate rest or movement, which greatly affects spinal health.

Insufficient physical exercise is another important factor affecting spinal health. Research shows that less than 50% of college students actively participate in sports activities, and the proportion of students who meet the World Health Organization's standard of at least three 30-minute effective physical exercises per week is between 30% and 50% [3]. Lack of exercise leads to weak muscles surrounding the spine, which cannot provide sufficient support and protection, further increasing the burden on the spine.

2.3 Impact on Physical and Mental Health of College Students

Spinal health issues can cause physical pain and abnormal posture, affecting normal development and motor function. Severe scoliosis may compress vital organs such as the heart and lungs, affecting cardiopulmonary function and even leading to breathing difficulties and digestive disorders. Physical discomfort and changes in appearance can easily lead to psychological problems such as low self-esteem and anxiety among college students, affecting their mental health and social activities. Some students with scoliosis may reduce social activities due to fear of others' strange looks, and may even develop tendencies towards depression [4] .

3. APPLICATION ADVANTAGES OF AI TECHNOLOGY AND THE INTEGRATION OF SPORTS AND MEDICINE IN SPINAL HEALTH MANAGEMENT

3.1 Application of AI Technology in Spinal Health Management

Artificial Intelligence (AI) technology plays a significant role in the monitoring and intervention of spinal health among college students, covering processes such as data collection and analysis, intelligent diagnosis and prediction, and the formulation of personalized rehabilitation plans. In terms of data collection and analysis, wearable devices and smart sensors are used to gather daily life data from college students, such as steps taken, sitting duration, sleeping posture, as well as spinal physiological parameters, including spinal curvature and muscle electromyography signals. These data are then deeply analyzed using big data analytics and machine learning algorithms to accurately assess spinal health and promptly identify potential risks. In the intelligent diagnosis and prediction phase, AI medical imaging recognition technology analyzes X-rays, CT scans, MRI images, and other medical images to quickly and accurately diagnose spinal diseases. By learning from large amounts of case data, it can also predict the progression of diseases, facilitating early intervention. In terms of personalized rehabilitation plans, AI can develop tailored rehabilitation training programs and treatment plans based on the specific conditions of each student. It can simulate the impact of different rehabilitation training methods on spinal health and provide the most suitable recommendations. For example, for students with mild scoliosis, AI can recommend personalized corrective exercise programs, including the type of exercise, intensity, and frequency, and monitor the training effects in real-time through smart devices to adjust the plans as needed.

3.2 Role of the Integration of Sports and Medicine in Spinal Health Management

The integration of sports and medicine plays a crucial role in spinal health management among college students, primarily reflected in the integration of medical and sports resources, the combination of prevention and treatment, and the enhancement of the comprehensiveness and sustainability of health management. The integration of sports and medicine breaks down the boundaries between the medical and sports fields, combining professional medical diagnosis and treatment techniques with scientific sports exercises and rehabilitation training. Medical institutions provide accurate disease diagnosis and necessary medical interventions for college students, while sports institutions and professionals develop scientific exercise rehabilitation plans based on the students' physical conditions to jointly promote the recovery and improvement of spinal function. Emphasizing prevention first, the integration of sports and medicine raises awareness of spinal health among college students through the dissemination of spinal health knowledge and the promotion of scientific exercise methods, thereby preventing the occurrence of diseases. For students who are already ill, this integrated model ensures seamless integration of treatment and rehabilitation, improving treatment outcomes and reducing recurrence rates. The integration of sports and medicine provides comprehensive, full-cycle health management services for college students, ranging from health assessment and disease prevention to diagnosis, treatment, and rehabilitation care. By establishing long-term health records and tracking mechanisms, it continuously monitors spinal health and adjusts management strategies in a timely manner to ensure the sustainability of management effectiveness [5].

3.3 Synergistic Advantages of AI-empowered Integration of Sports and Medicine

AI-empowered integration of sports and medicine demonstrates unique advantages in spinal health management among college students, mainly in terms of precise matching and efficient collaboration, real-time monitoring and dynamic adjustment, and knowledge sharing and innovation. On the one hand, AI technology matches medical experts with sports rehabilitation experts based on the spinal health data of college students, forming interdisciplinary professional teams to achieve efficient collaboration between medical and sports resources. It recommends appropriate medical teams and rehabilitation coaches according to the students' conditions and physical status, enhancing the professionalism and relevance of health management. On the other hand, through the real-time monitoring function of AI-enabled smart devices, the integrated team can track the students' physical responses and progress during rehabilitation training in real-time and dynamically adjust treatment plans and training programs. For example, smart wristbands can monitor indicators such as heart rate and exercise intensity, and the system can promptly alert coaches and students to adjust their exercise methods and intensity when abnormalities are detected. Driven by AI technology, knowledge sharing and exchange between the medical and sports fields are promoted. Big data analysis and algorithmic mining uncover potential knowledge patterns in spinal health management, providing a basis for the formulation of scientific and effective health management strategies [6].

4. CONSTRUCTION OF THE SPORTS-MEDICINE INTEGRATION MECHANISM FOR AI-EMPOWERED SPINAL HEALTH MANAGEMENT AMONG COLLEGE STUDENTS

4.1 Goal Setting

In the realm of spinal health management, short-term, medium-term, and long-term goals have been established. In the short term, the aim is to enhance college students' awareness of spinal health, improve poor lifestyle habits, and reduce the incidence of spinal diseases by leveraging AI technology and the integration of sports and medicine. Within one academic year, it is expected that the awareness rate of spinal health knowledge will increase to 30%-50%, and the correction rate of poor sitting posture will reach 30%-40%. The medium-term goal is to achieve precise monitoring and early diagnosis of spinal health among college students, provide personalized treatment and rehabilitation plans for those with spinal diseases, effectively alleviate symptoms, and improve spinal function. Over a period of two to three years, the early diagnosis rate of spinal diseases is planned to be raised to 60%-70%, with a rehabilitation effectiveness rate of 65%-75%. In the long term, the objective is to establish a comprehensive spinal health management system for college students, cultivate their self-management awareness and capabilities, promote their overall well-being, and create a sustainable health management model that lays a solid foundation for their lifelong health.

4.2 Participating Entities and Their Responsibilities

In the spinal health management of college students, various participating entities undertake different

responsibilities. Universities are responsible for organizing and conducting spinal health management activities, formulating relevant policies and regulations, integrating on-campus resources to establish sports-medicine integration service centers, equipping necessary AI devices and professional personnel, carrying out publicity and education activities, organizing regular physical examinations and screenings, establishing health records, and communicating and coordinating with partner organizations. Medical institutions are tasked with diagnosing and treating spinal diseases, providing medical technical support and guidance, dispatching doctors to participate in health assessments and diagnoses, formulating treatment plans, promptly treating severe diseases, and conducting medical knowledge training. Sports institutions provide professional sports rehabilitation services, develop exercise rehabilitation plans, dispatch coaches to guide rehabilitation training and exercise, conduct technical research and innovation, and offer exercise methods and technical support. Technology companies are responsible for developing and providing AI-related products and services, such as smart devices, software, and medical imaging systems, collaborating with all parties to apply AI technology in health management practice, and optimizing technological products to enhance intelligence levels. College students themselves need to actively participate in health management activities, establish correct health concepts, proactively learn health knowledge, develop good lifestyle and exercise habits, cooperate with health assessments, diagnoses, and rehabilitation training, regularly provide feedback on their health status, and improve their self-health management capabilities.

4.3 Operational Process

The operational process of spinal health management for college students includes health data collection, assessment and diagnosis, personalized plan formulation, intervention implementation and monitoring, and effectiveness evaluation and feedback. In the health data collection phase, college students wear smart wearable devices to collect real-time data on movement, posture, sleep, etc. Universities regularly organize spinal health check-ups, and medical institutions collect physiological parameters and disease diagnosis data through equipment. All data are transmitted to the sports-medicine integration health management platform for integration and storage. Professional personnel from the sports-medicine integration service center use AI data analysis technology to assess spinal health status. Doctors from medical institutions combine medical examination results with AI-assisted diagnostic systems to further diagnose students suspected of having spinal diseases. Medical experts, sports rehabilitation experts, and AI systems jointly develop personalized spinal health management plans, providing corresponding recommendations and plans for students with different health conditions. During the intervention implementation and monitoring process, students follow the plans for treatment and rehabilitation training, with sports rehabilitation coaches and medical personnel providing on-site guidance and supervision. Smart devices monitor physical responses and exercise conditions in real-time and feedback to the management platform, which adjusts the plans accordingly. Regular re-assessment of college students' spinal health status is conducted, comparing data before and after intervention to evaluate the effectiveness of the plans. The results are fed back to the participating entities to provide a basis for optimizing the plans and improving the mechanism.

4.4 Technical Support

In terms of technical support, medical imaging recognition technology, smart wearable device technology, and health management platform technology collectively support spinal health management for college students. Medical imaging recognition technology uses AI to quickly and accurately analyze spinal X-rays, CT scans, MRI images, and other medical images, automatically identifying spinal morphology, structure, and lesion locations to assist doctors in diagnosis, improving diagnostic efficiency and accuracy, and reducing human error. Smart wearable device technology continues to evolve, enhancing device monitoring precision and comfort, with real-time data collection, transmission, analysis, and reminder functions. These devices monitor students' movement, posture, heart rate, sleep, and other multidimensional data and issue warnings when necessary to guide students in adjusting their behavior habits. An integrated sports-medicine integration health management platform is constructed to achieve centralized management, sharing, and interaction of health data. The platform features user management, data storage and analysis, plan formulation and push, real-time monitoring, and feedback functions, providing convenient and efficient health management services for universities, medical institutions, sports institutions, and college students.

5. IMPLEMENTATION PATHWAYS FOR AI-EMPOWERED SPORTS-MEDICINE INTEGRATION MECHANISM IN SPINAL HEALTH MANAGEMENT AMONG COLLEGE STUDENTS

5.1 Strengthening Collaboration between Universities and Various Parties

To enhance spinal health management among college students, universities need to establish close cooperative relationships with medical institutions, sports organizations, and technology companies. A university sports-medicine integration alliance for spinal health management should be formed to share resources, exchange experiences, and collaborate on innovation. Joint research projects on AI technology applications should be conducted to explore new health management models, such as developing spinal health monitoring systems and rehabilitation training software, and transforming research outcomes into practical applications. Talent cultivation cooperation should also be carried out to train interdisciplinary professionals who are proficient in both medicine and sports and possess AI skills. This can be achieved through relevant courses, practical teaching, and base construction, providing a solid talent pool for spinal health management. Collaborative efforts from all parties will collectively drive the development of spinal health management among college students.

5.2 Improving Infrastructure Construction

To improve the infrastructure for spinal health management among college students, universities should strengthen the construction of sports-medicine integration service centers and health management informatization. On the one hand, increased investment in sports-medicine integration service centers is necessary, equipping them with advanced AI devices, medical diagnostic equipment, and sports rehabilitation tools, and setting up functional areas such as health assessment zones to provide one-stop spinal health management services for students. On the other hand, the informatization of university health management should be enhanced by perfecting the sports-medicine integration health management platform. This platform should be integrated with the university's academic affairs system and student management system to access basic student information and data. Meanwhile, data sharing with medical and sports institutions' systems should be implemented to improve the efficiency of collaborative health management.

5.3 Conducting Publicity, Education, and Training

To raise awareness of spinal health among college students and enhance the service capabilities of relevant staff, publicity, education, and training activities should be carried out. For students, spinal health knowledge should be disseminated through health lectures, promotional materials, and online courses. The content should cover the anatomy of the spine, causes and prevention of spinal diseases, correct sitting postures, and appropriate exercise methods, thereby increasing their attention to spinal health. For staff members of the university sports-medicine integration service center, physical education teachers, counselors, and others, training should be provided on the application of AI technology, diagnosis and treatment of spinal diseases, sports rehabilitation training, and health management concepts. This will enable them to skillfully utilize the sports-medicine integration mechanism and provide high-quality health management services to students.

5.4 Establishing Incentive and Guarantee Mechanisms

To promote spinal health management among college students, incentive and guarantee mechanisms need to be established. Universities should set up special reward funds to recognize students who actively participate in spinal health management, have good habits, and show improved health conditions. At the same time, teachers, staff members, and partner organizations that perform outstandingly in sports-medicine integration work should also be commended to motivate all parties' participation. The university student medical insurance system should be perfected to cover the costs related to spinal diseases, alleviating students' financial burden. Additionally, service quality supervision should be strengthened, and an evaluation system should be established to ensure the safety and effectiveness of health management services.

6. CHALLENGES AND COUNTERMEASURES FOR AI-EMPOWERED SPORTS-MEDICINE INTEGRATION MECHANISM IN SPINAL HEALTH MANAGEMENT AMONG COLLEGE STUDENTS

6.1 Challenges

In the spinal health management of college students, the application of AI technology and the integration of sports and medicine face numerous challenges. Data security and privacy protection are particularly prominent issues.

The collection and storage of large amounts of health data increase the risk of data breaches, which could harm students' rights and trigger a crisis of trust. The application of AI technology in this field lacks unified standards and norms, and compatibility issues among devices and software from different manufacturers affect the collaboration and data sharing in the integration of sports and medicine. There is a shortage of interdisciplinary talents who are proficient in both AI and medicine and sports, which makes it difficult to meet the developmental demands and restricts the in-depth application and innovation of AI technology. Traditional concepts and systemic differences between the medical and sports fields create barriers to their integration, necessitating further coordination in management models, service philosophies, and the distribution of benefits.

6.2 Countermeasures

To address the challenges in spinal health management among college students, the following countermeasures should be adopted:

Enhancing Data Security Management: Establish strict regulations and policies, and employ technical measures such as encryption, access control, and data backup. Clearly define data usage permissions to prevent unauthorized commercial use of the data.

Promoting Standardization of AI Technology: Foster collaboration among governments, industry associations, and research institutions to develop unified AI technology standards. Standardize device interfaces, data formats, and algorithm models to facilitate interconnectivity and data sharing.

Strengthening Interdisciplinary Talent Cultivation: Increase efforts in cross-disciplinary talent training in universities and vocational colleges. Optimize the curriculum by introducing interdisciplinary courses and conducting on-the-job training and academic exchanges to improve the quality of professionals in the field.

Deepening Systemic and Mechanistic Reforms: Enhance government coordination to break down systemic barriers. Improve policies and management systems for the integration of sports and medicine, clarify responsibilities and rights, and encourage collaboration through policy and financial support to jointly advance spinal health management.

REFERENCES

[1] Qiao, Y. (2025). Stand Tall—Youth Troubled by Scoliosis. *Everybody's Health*, (05), 10-13. doi:10.20252/j.cnki.rrjk.2025.05.004.
[2] He, K. (2024-03-19). *The 2024 China Sleep Health White Paper*: Over Half of Chinese People Have Insomnia Issues, Huawei Health Provides Scientific Sleep Solutions [EB/OL]. (2024-10-29). https://news.sina.com.cn/sx/2024-03-19/detail-inanvyns9312643.shtml
[3] Li, M., & Deng, X. (2018). The Impact of Urban Family Lifestyle Changes on Adolescent Sports Behavior. *Scientific Consulting (Science & Management)*, (14), 12-13.
[4] Wu, J., & Yuan, J. (2025). Research Progress on the Etiology, Screening Methods, and Intervention Measures of Adolescent Scoliosis. *Chinese Journal of Chronic Disease Prevention and Control*, 33(03), 236-240. doi:10.16386/j.cjpccd.niss.1004-6194.20240729.0565.
[5] Tang, X., Li, D., Zhang, Z., Yu, Y., & Xu, T. (2024). Service Paths of "Integration of Sports and Medicine" in Universities in the Context of Smart Sports. *Journal of Xiangnan University*, 45(05), 76-82.
[6] Wang, G., Lin, L., & Qiao, F. (2022). Research on the Integrated Development of Sports and Medical Care Promoted by Artificial Intelligence under the Background of Healthy China. *China Sport Science and Technology*, 58(10), 109-113. doi:10.16470/j.csst.2021083.

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