Research on Safety Hazards and Emergency Management System of Campus Sports Facilities

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Abstract:*With the in-depth implementation of the national fitness strategy and the concept of quality-oriented education, campus sports activities have become increasingly frequent, making sports facilities one of the most frequently used areas in public campus spaces. However, in some universities, issues such as aging equipment, poor management, and weak safety awareness persist, resulting in significant potential safety hazards. Once an accident occurs, it not only endangers students' personal safety but also poses risks to campus management and public opinion. Therefore, establishing a scientific and systematic emergency management system and enhancing the safety assurance capacity of campus sports facilities have become critical aspects of the modernization of higher education governance.Based on a review of the basic types of campus sports facilities and common safety issues, this paper systematically elaborates on the current operation of existing management mechanisms. Drawing on emergency management theory, it proposes a practical framework for constructing an emergency management system from the perspectives of organizational structure, contingency planning, and safety training. The goal is to provide theoretical support and strategic guidance for the practical management of sports facility safety in higher education institutions.*

Keywords: *campus sports facilities; safety hazards; emergency management system; safety inspection; risk prevention and control; university governance*

Introduction

Campus sports facilities serve not only as essential platforms for physical education in universities but also as key venues for students to engage in extracurricular exercise and promote their physical and mental development. Under the “Healthy China 2030” strategy, the construction and utilization of sports facilities have continued to improve. However, due to high usage frequency, incomplete management systems, and outdated maintenance mechanisms, safety incidents involving campus sports facilities still occur from time to time. In severe cases, such incidents may lead to casualties and threaten campus safety and stability.

Although notable progress has been made in the construction of campus sports facilities in China, significant shortcomings remain in safety management and emergency response. These are reflected in issues such as unclear management responsibilities, superficial safety inspections, and a lack of scientific emergency response procedures—all of which hinder the improvement of risk governance in universities.

In response, developing a comprehensive, efficient, and standardized emergency management system has become a key solution to addressing the safety challenges of campus sports facilities. This study, starting from the current status of campus sports facilities and integrating both risk prevention and emergency response perspectives, seeks to construct a management mechanism that is both practical and forward-looking. The aim is to provide a referable model for university departments, thereby advancing the modernization of governance systems and governance capacity in higher education institutions.

1. Current Status and Potential Safety Issues of Campus Sports Facilities

1.1 Overview of Facility Types and Layouts

Campus sports facilities serve as essential platforms for physical education and student extracurricular exercise. These facilities are characterized by their diversity in type, centralized layout, and high frequency of use. At present, campus sports facilities mainly include outdoor fixed installations,

indoor multifunctional venues, movable auxiliary equipment, and new intelligent sports systems. Outdoor facilities typically cover standard athletic tracks, basketball courts, football fields, and volleyball courts. These facilities are generally open spaces, located either in central campus areas or on the periphery, and possess strong public attributes. Indoor facilities—such as gymnasiums, fitness rooms, gymnastics halls, and badminton courts—offer comprehensive functions and are suitable for year-round, all-day use. Some universities have also introduced intelligent reservation and zoned management systems to improve resource utilization efficiency.

Movable and auxiliary equipment encompasses a wide variety of items, including gymnastics apparatus, ball game aids, and training tools. These are frequently used but more difficult to manage. Additionally, with the advancement of "smart campus" initiatives, an increasing number of universities are deploying innovative equipment such as intelligent fitness terminals, motion data collectors, and virtual training platforms. While these technologies enhance instructional interactivity and workout efficiency, they also impose higher demands on spatial planning, safety supervision, and operational maintenance[1].

Despite generally adequate provision of facility types across universities, overall spatial layout issues remain. Common problems include uneven distribution, functional overlap, and poor connectivity between facilities, all of which call for optimization of campus planning and facility renewal mechanisms.

1.2 Existing Safety Issues

Although the number and variety of campus sports facilities are generally sufficient, potential safety risks have become increasingly prominent due to frequent use. These risks span multiple dimensions, including facility infrastructure, environmental conditions, and management practices.

First, structural aging, damaged surfaces, and loose equipment are widespread issues that can impair functionality or directly lead to accidents. Second, many facilities lack adaptability to extreme weather conditions. Slippery tracks in rainy or snowy weather, rusted equipment, and frequent electrical short circuits significantly increase safety risks. Nighttime use presents additional challenges, including poor lighting, surveillance blind spots, and unclear pathway signage, which may result in accidents outside of regular teaching hours.

In terms of management, some universities face oversight gaps or unclear administrative processes. Specific problems include mismatches between facility availability and maintenance schedules, frequent violations of usage rules by students, and inadequate assignment of safety responsibilities. Moreover, the use of emerging intelligent equipment has introduced new technical safety concerns, such as system malfunctions, electrical anomalies, and data privacy breaches. These issues challenge the capabilities of traditional safety assurance frameworks.

Overall, safety problems associated with campus sports facilities are complex, multifaceted, and often unpredictable in their consequences[2].

1.3 Root Causes of Safety Issues

Safety hazards in campus sports facilities are not isolated incidents but the result of long-term accumulation of multiple factors.

At the facility level, many universities focus heavily on construction during the initial phase while neglecting long-term operation and maintenance. The lack of a full life-cycle risk monitoring and maintenance mechanism makes it difficult to identify and resolve equipment aging issues promptly.
At the institutional level, responsibilities among sports departments, logistics units, and campus safety offices are often poorly defined, with limited coordination mechanisms in place. This results in weak enforcement of safety accountability and a higher likelihood of risks being overlooked.

In terms of personnel, facility management often relies on part-time or administrative support staff, with a shortage of professional safety and emergency response personnel. This staffing structure falls short of meeting the demands for standardized and professional management.

Regarding user education, existing safety training systems are underdeveloped. Students lack awareness of proper usage protocols, and teachers often fail to provide adequate risk reminders during instruction, contributing to frequent misuse and rule violations.
Finally, insufficient budget allocation for facility maintenance in some universities prevents the adoption of advanced detection and monitoring technologies, leaving risk control at a reactive rather than proactive

stage.

In summary, the safety risks associated with campus sports facilities stem from both technical factors—such as aging and equipment failure—and systemic issues, including institutional shortcomings and implementation gaps. A comprehensive response that addresses root causes, optimizes institutional mechanisms, and enhances management capacity is essential to resolving the current safety challenges.

2. Practical Operation of Campus Sports Facilities Management

2.1 Implementation of Safety Inspection and Maintenance

The safety of sports facilities largely depends on the systematic execution of routine inspections and regular maintenance. Currently, most universities have established safety inspection mechanisms led by either the logistics or sports departments. These mechanisms generally cover fixed installations, movable equipment, and electrical systems, and are guided by weekly, monthly, or quarterly inspection schedules. However, during actual implementation, several issues persist, including non-standardized inspection procedures, poorly maintained records, and outdated hazard detection methods. Some universities still rely on paper-based logs or single-point inspections and lack an integrated digital management platform, making it difficult to dynamically update and track safety hazards. As a result, the problem-resolution cycle is often prolonged, and feedback mechanisms remain ineffective[3].

In terms of maintenance execution, except for a small number of universities that prioritize both construction and upkeep, most institutions still face insufficient financial investment in facility maintenance. Outdoor venues, exposed to constant weathering, often suffer from cracked tracks, rusted equipment, and reduced surface friction—all of which remain unrepaired for extended periods. Indoor equipment, due to complex structures and high usage frequency, is more prone to issues such as joint looseness and imbalance in elasticity. Without the involvement of professional maintenance personnel, these facilities frequently operate under compromised conditions. Moreover, many universities lack systems for assessing equipment lifespan and issuing preemptive warnings. As a result, facilities that are near or beyond their service life continue to be used, increasing the risk of accidents.

In summary, the effectiveness of current safety inspection and maintenance work is limited by outdated institutional frameworks, a shortage of qualified personnel, and inadequate resource support. It is therefore essential to enhance safety assurance capacity through improvements in policy systems, the adoption of intelligent tools, and clearly defined accountability mechanisms.

2.2 Enforcement of Usage Regulations and Operational Procedures

The standardized use of sports facilities is a fundamental measure for preventing accidents and ensuring safety. Although universities have generally issued regulations covering facility opening hours, user eligibility, reservation procedures, staffing, and emergency protocols, there remains a significant gap between policy and practice. On one hand, student activities during non-class hours are difficult to monitor, and behaviors such as improper attire, unauthorized climbing on equipment, and relocating apparatus without permission are common. On the other hand, there is a severe lack of operational guidance and safety warnings prior to facility use. In particular, complex or intelligent equipment often lacks illustrated manuals or mandatory instructional videos, which leads to improper or unsafe operation by students working without professional supervision.

During instructional activities, some teachers, influenced by time constraints or curriculum design, fail to adequately address equipment safety, neglecting to provide proper demonstrations or risk reminders. This further increases the likelihood of accidents. In addition, the absence of an effective supervision mechanism is a major contributor to enforcement failures. Due to limited human resources, many universities are unable to assign dedicated personnel to monitor venues during non-teaching hours, resulting in a disconnect between policy and practice[4].

Although some universities have introduced smart technologies such as access control systems, usage data monitoring, and facial recognition to enhance management efficiency, overall implementation remains limited and integration with traditional workflows is insufficient. Consequently, improving regulatory enforcement requires multiple approaches: enhancing publicity and training on operational procedures, advancing the intelligence level of supervision technologies, and developing comprehensive reward and penalty systems for rule violations.

2.3 Design and Operation of Emergency Response Procedures

Emergency response capabilities reflect the maturity of campus sports facility management systems. While most universities have developed contingency plans that cover physical education, extracurricular exercise, and large-scale events, these plans often lack specificity. Many of them follow general templates for "public emergencies" and fail to account for the unique characteristics of different facility types, spatial layouts, and user compositions, making them inadequate for real-world rapid response.

Furthermore, in practice, emergency procedures face issues such as delayed activation, slow information flow, and poor coordination. For example, in frontline venues, several key questions affect response effectiveness: Do on-duty staff understand the proper reporting process? Can medical assistance be dispatched immediately? Are evacuation procedures clear and actionable?

From an operational standpoint, many universities lack routine emergency drills and scenario-based simulations, leading to slow reactions and poor cooperation during actual incidents. In cases such as student fainting, bone fractures, or falling equipment in gymnasiums, it is common to observe bystanders hesitating or communication breakdowns, which severely compromise rescue efficiency. Post-incident processes also remain underdeveloped. There is often no standardized system for incident documentation, cause analysis, or policy review. Accident investigations may become perfunctory, with little to no trend analysis or policy revision based on data, thus failing to achieve a closed-loop management process.

To address these issues, it is critical to build a responsive, well-coordinated, and risk-controllable emergency management model for campus sports facilities. This can be achieved by optimizing organizational structures, dynamically updating procedures, supporting operations with digital platforms, and institutionalizing regular drills. Together, these measures will ensure scientific forecasting, swift response, and effective control in emergency situations[5].

3. Construction Plan for the Emergency Management System of Campus Sports Facilities

3.1 Organizational Structure of the Emergency Management System

An efficient emergency management system requires a well-structured organizational framework. To systematically address potential emergencies in the operation of campus sports facilities, a multi-level emergency management system should be established. This system should be led by a university-level decision-making body, supported by relevant functional departments, and executed by frontline venue personnel, thereby ensuring smooth information flow, timely response, and effective handling. At the macro level, the system may rely on the university's safety committee or establish a dedicated "Campus Sports Safety Task Force" responsible for top-level planning and command coordination. Under this task force, an office should be set up to handle routine management affairs and coordinate various resources including those of the physical education department, equipment management office, logistics services, security office, and campus hospital.

In terms of organizational structure, a grid-based model of "vertical stratification and horizontal coordination" should be adopted. Vertically, a three-tier response system should be established at the university, school/department, and venue levels. The university level will coordinate major incidents; the school or department level will mobilize internal resources for initial response; the venue level will serve as the direct executor to ensure quick first-response capability. Horizontally, by appointing information liaisons, setting up emergency communication channels, and forming rapid response teams, effective coordination can be achieved between the sports department and other functions such as medical, security, and infrastructure services.

Furthermore, the system must define responsibility assignments, communication pathways, and specific duties. A detailed responsibilities manual should be developed, covering mechanisms for early warning information collection, incident grading and reporting, response initiation criteria, and post-incident evaluation procedures. The integration of a digital management platform can further improve organizational efficiency by enabling real-time data collection, dynamic risk tracking, automated emergency task dispatching, and closed-loop processing. This digital shift will facilitate the transformation from traditional static response to intelligent and dynamic emergency management, thereby significantly enhancing the overall capability for systematic campus sports safety management.

3.2 Formulation and Hierarchical Management of Emergency Plans

As the core guiding document in emergency response, the scientific validity and adaptability of an emergency plan are directly related to the effectiveness of incident management. Given the diversity, openness, and high frequency of use of campus sports facilities, emergency response plans should be formulated based on the identification of risk sources and should comprehensively cover different types of facilities, usage scenarios, and accident categories. The planning system should follow a design principle that emphasizes modular structure, detailed content, and standardized procedures. It should consist of three layers: general plan, specific contingency plans, and on-site response procedures, thus ensuring complete coverage from strategic to operational levels[6].

In hierarchical management, emergency events should be classified into three response levels—Level I (particularly serious), Level II (major), and Level III (general)—based on risk severity and scope of impact. Each level should correspond to different degrees of organizational mobilization, personnel deployment, and resource allocation. For Level I events, such as large-scale facility collapses or mass injuries, the university-level emergency command center should take full control and collaborate with local emergency and medical institutions. Level II events, such as localized equipment damage causing injuries, should be led by the school or department emergency management team, which should quickly isolate the hazard and organize medical assistance. Level III events, such as minor student abrasions, may be handled directly by on-duty venue staff or supervising instructors, with timely reporting in accordance with procedures.

It is important to ensure that emergency plans remain adaptable. Plans should be regularly updated to reflect changes in facilities, personnel structure, and management requirements. Universities may conduct periodic reviews and evaluations of the plans, inviting internal and external safety experts to identify and address any shortcomings. In addition, by leveraging modern information technologies, paper-based plans can be upgraded into digital emergency systems that support one-click retrieval, intelligent push notifications, and cross-platform synchronization, thereby enhancing both responsiveness and practical utility.

3.3 Safety Training and Emergency Drill System

The implementation and effectiveness of any system ultimately rely on personnel competence and emergency preparedness. Therefore, the establishment of a systematic safety training and drill mechanism forms the foundational pillar of the campus sports facilities emergency management system. First, training content and objectives should be tailored according to the roles of different personnel. For management staff, emphasis should be placed on risk identification, emergency coordination, and policy enforcement capabilities. For teachers and frontline venue workers, the focus should be on incident assessment, on-site handling skills, and execution of evacuation commands. For the general student population, training should promote basic safety knowledge, proper equipment usage, and self-rescue and mutual-aid skills, thus enhancing awareness of becoming “first responders.”

Training methods should be diversified and context-driven. Beyond traditional lectures and knowledge competitions, immersive simulation teaching should be conducted in real venues. The incorporation of virtual simulation technology and interactive emergency systems will enhance the learning experience. Periodic "assessment-based" safety education should be integrated into physical education curricula and daily training routines, promoting the internalization of emergency knowledge into habitual behavior.

In terms of drill mechanisms, a dual-track model combining “scheduled” and “random” exercises should be established. Scheduled drills should be conducted at key time points, such as the beginning of the semester and before major holidays, with at least one full-process comprehensive drill annually to ensure familiarity with procedures and organizational coordination. Random drills should simulate unexpected scenarios and be initiated without prior notice by the management team to test emergency response speed and execution capability. After each drill, a review and discussion session should be held, evaluating performance based on response time, communication effectiveness, procedural adherence, and equipment support. A drill report and improvement plan should be generated to facilitate experience accumulation and mechanism refinement.

By integrating safety training and emergency drills into regular operations, the system can not only enhance the emergency preparedness of all campus personnel but also foster a safety culture and responsive ecosystem characterized by full participation, efficient collaboration, and rapid response in

the management of campus sports facilities.

Conclusion

The safety management of campus sports facilities encompasses a wide range of responsibilities and involves a complex chain of accountability, forming a vital part of the overall safety governance system in higher education institutions. This study reveals that current challenges in the safety management of university sports facilities include the concealed nature of potential hazards, the inadequacy of management mechanisms, and delays in emergency response. Establishing an emergency management system that is supported by institutional safeguards, underpinned by technological means, and grounded in comprehensive training can significantly enhance the effectiveness of campus safety governance. Looking ahead, universities should continue to advance the standardization and refinement of safety management policies, adopt intelligent monitoring and data analysis technologies, and achieve dynamic management throughout the entire facility usage process. Moreover, it is essential to promote interdepartmental collaboration and develop an emergency coordination platform characterized by multi-party participation and shared resources.

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