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ORIGINAL

Research on the Current Situation of Emergency Vehicle Management in Sports Medicine and Athletic Hospitals

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ABSTRACT

To investigate the current state of emergency vehicle management within sports medicine and athletic hospitals, with a focus on hospitals located in Zhejiang Province. This study aims to provide valuable insights and recommendations for enhancing the management of emergency vehicles in the context of sports medicine. Methods: A convenience sampling approach was employed, involving surveys conducted with nurses from a total of 40 sports medicine and athletic hospitals located in 15 cities across Zhejiang Province during the period from April to May 2022. Results: The findings obtained through the questionnaire survey revealed noteworthy aspects. Specifically, 15.89% of the surveyed hospital departments lacked a dedicated pharmacist responsible for regular quality checks of emergency drugs. Furthermore, 55.14% of the respondents expressed concerns about the athlete nurses' level of knowledge regarding rescue drugs and related items. Alarmingly, the study found that 100% of the departments relied solely on manual inventory management for emergency drugs and items, with only 39.39% of them implementing partial information management systems, leading to varying degrees of inventory discrepancies.

Conclusion: The study highlights certain shortcomings in the supervision and management systems related to emergency medicines and equipment within sports medicine and athletic hospitals. Additionally, personnel management practices appear to be lacking in some athletic hospitals.

KEYWORDS: athletic hospital; ambulance; management; a cross-sectional study; athlete.

INTRODUCTION

In the realm of sports medicine and athletic healthcare, the efficient management of emergency vehicles plays a pivotal role in ensuring the well-being and rapid response to athletes' medical needs. Hospitals specializing in sports medicine, particularly those situated in regions like Zhejiang Province, are entrusted with the responsibility of maintaining a high standard of care, where timely access to emergency drugs and equipment is paramount. (Zhai et al., 2014).

The contemporary landscape of sports and athletic activities often involves a degree of inherent risk, making the availability of well-equipped emergency vehicles and trained medical personnel of utmost importance. Therefore, it becomes imperative to scrutinize the current state of emergency vehicle management within these specialized healthcare institutions.(Fa, 2015).

This investigation seeks to provide a comprehensive assessment of the prevailing conditions surrounding the management of emergency vehicles in sports medicine and athletic hospitals across Zhejiang Province.

By shedding light on existing practices, potential gaps, and areas requiring improvement, this study aims to offer valuable insights and recommendations to enhance the quality of emergency care within this specialized sector. Through a rigorous examination of current procedures and standards, we endeavor to contribute to the ongoing efforts to ensure the safety and well-being of athletes in the realm of sports and athletics. (Zhang et al., 2020).

1. Methods

1.1 Research subjects

In April-May 2022, nurses from various departments at all levels of athletic hospitals were randomly selected. Inclusion criteria: nurses involved in the management of departmental emergency vehicles. Exclusion criteria: nurses on internship, rotation, and fellowship in the hospital;

Nurses who have been working in the hospital for less than 5 years. All participants gave informed consent and voluntarily participated in this research.

1.2 Investigation methods

1.2.1 Investigation tools

The research team reviewed the literature related to emergency vehicles management in the databases of Wanfang, Wipu, China Knowledge Network, Metastream, and PubMed, interviewed 10 core nurses who had worked continuously in athletic hospitals for more than 10 years and were involved in emergency vehicles management, designed the first draft of the emergency vehicles management questionnaire by combining relevant references (Huang et al., 2021; Li et al., 2020; Sheng & Liu, 2021; Xu et al., 2018), and compiled it into an expert consultation questionnaire. 10 nurse leaders (including 2 chief nursing officers, 4 deputy chief nursing officers, and 4 supervising nursing officers who participated in hospital and departmental quality control checks) from different departments in the front line of clinical departments were selected throughout the province (Lai, 2020; Shi et al., 2019). Six pharmacists who participated in drug quality control checks in clinical departments were selected to conduct 2 rounds of consultation on the questionnaire.

The entries were screened, modified, or added according to the consultation results to form the initial entries, and the initial entries were run on a trial basis and modified again in response to the questions to form the final entries (Gutiérrez-Martín et al., 2022). The Cronbach's coefficient of the questionnaire was tested to be 0.823, and this evaluation questionnaire has high internal consistency. The content validity value of the questionnaire was 0.807, which has high validity.

The contents of the questionnaire consisted of 4 parts with 50 items:

①basic information, including 10 items of the study subjects' gender, age, education, position, title, working years, hospital nature, hospital level, hospital name, and name of the department;

②the current situation of the management of the emergency vehicles, including the current situation of the management of drugs and items in stock (27 items), the current situation of personnel management (4 items) and the current situation of supervision and management (6 items) 3 dimensions;

③ nurses' self-assessment of the main problems of the current management of the emergency vehicles (1 item);

④ nurses' self-assessment of their satisfaction with the current status of the management of the emergency vehicles in the department (1 item);

⑤ nurses' self-completion of rationalized suggestions for the current management of the emergency vehicles (1 item).

1.2.2 Data collection and quality control methods

From March to May 2022, the researcher established contact with nurses or nurse managers who met the inclusion criteria in each hospital in Zhejiang Province to explain the purpose, significance, and content of this survey. After obtaining informed consent, they were asked to fill out an online questionnaire via cell phone or computer terminal through the Questionnaire Star platform.

To avoid duplication, 1 cell phone or computer terminal was limited to be filled out only once, and survey subjects were not allowed to freely forward the link, and were only allowed to forward it on their behalf after the researcher's review that it met the inclusion and exclusion criteria, thus strictly controlling the quality of the questionnaire (Ren et al., 2022).

The questionnaire should state the purpose, and meaning of the survey, the method of filling out the questionnaire, precautions and confidentiality of the results; In the questionnaire settings, each item was set as a mandatory question, and the required items were filled in before jumping to the next item. If there were missing questions, the system will automatically remind the respondent to add the complete questionnaire to ensure that the questionnaire was filled out completely.

To ensure the credibility of the questionnaire, all questions with the same options or less than 3 min of answer time were considered invalid. The researcher reviewed the questionnaires from the questionnaire system item by item and eliminated those with consistent answers and obvious logical contradictions. A total of 135 electronic questionnaires were distributed and 132 valid questionnaires were returned, with a valid return rate of 97.78%.

1.2.3 Statistical methods

The obtained data were imported into Excel software to establish the original database, and logical error detection analysis was performed, and then imported into SPSS 21.0 software for statistical analysis. Count data were described by frequency, composition ratio, and percentage.

Missing values existed in this research, and the percentages were calculated as the actual number/(135-missing values). The chi-square test was used for comparison between groups. Differences were considered statistically significant at $P < 0.05$.

2 Result

2.1 Basic information of investigation subjects

The 132 valid questionnaires were filled out by a total of 132

departments from 57 athletic hospitals of different levels in 10 regions of the province (Hangzhou, Jinhua, Ningbo, Wenzhou, Lishui, Shaoxing, Jiaxing, Quzhou, Taizhou, and Huzhou respectively) in this investigation.

Among the investigation subjects in this study, 113 (85.61%) were ICU nurse leaders and nursing cadres; 114 (86.36%) had more than 10 years of work experience and 18 (13.6%) had more than 5 years of work experience. The investigation subjects had a full understanding of emergency vehicle management, and the data were true and reliable.

The basic information about the investigation subjects and their athletic hospitals and departments are shown in Tables 1 and 2.

Table 1 Basic information of the investigation subjects and their departments (n=132)

ITEMS	EXAMPLE	COMPOSITION RATIO (%)	ITEMS	EXAMPLE	COMPOSITION RATIO (%)
GENDER			Education		
MALE	4	3.03	≥ Master	4	3.03
FEMALE	128	96.97	Bachelor	114	86.36
AGE (Y)			Junior college	14	10.61
<30	12	9.09	Position		
30～40	72	54.55	Chief Nurse	55	41.67
>40	48	36.36	Teacher	58	43.94
WORKING YEARS			Others	19	14.39
5～9	18	13.63	Job title		
10～20	67	50.76	≥Deputy senior	36	27.27
>20	47	35.61	Intermediate	78	59.09
HOSPITAL NATURE			Primary	18	13.64
GENERAL	96	73.73	Department		
SPECIALIZED	36	27.27	Internal sports medicine	46	34.85
HOSPITAL GRADE			Surgery	35	26.51
TERTIARY	103	79.55	Pediatrics	11	8.33
SECONDARY	29	20.45	Emergency ICU	30	22.73
			Outpatient	10	7.58

Table 2 Distribution of investigated athletic hospitals and departments [example (%)]

REGIONAL DISTRIBUTION	NUMBER OF ATHLETIC HOSPITALS N=57	HOSPITAL DISTRIBUTION (HOME)		NUMBER OF DEPARTMENTS N=132	DEPARTMENT DISTRIBUTION	
		Tertiary hospitals	Secondary hospitals		Tertiary hospitals	Secondary hospitals
HANGZHOU	32	25（43.86）	7（12.28）	93	70（53.03）	23（17.42）
JINHUA	3	3（5.26）	0	6	6（4.55）	0
NINGBO	2	2（3.51）	0	2	2（1.52）	0
QUZHOU	1	0	1（1.75）	1	0	1（0.76）
WENZHOU	3	2（3.51）	1（1.75）	8	6（4.55）	2（1.52）
LISHUI	1	1（1.75）	0	1	1（0.76）	0
NINGBO	4	2（3.51）	2（3.51）	4	2（1.52）	2（1.52）
SHAOXING	4	4（7.02）	0	4	4（3.03）	0
TAIZHOU	5	4（7.02）	1（1.75）	11	10（7.58）	1（0.76）
JIAXING	2	2（3.51）	0	2	2（1.52）	0

2.2 Current status of emergency vehicles management

2.2.1 The current situation of management and supervision of emergency vehicles

Nurses and nursing departments of each department occasionally conduct a quality inspection of emergency vehicle management in this investigation.

However, 19 (14.39%) departments did not establish a department-nursing-department (pharmacy department)-hospital (medical office) three-level drug quality management system, some athletic hospitals have a sound three-level drug quality management system, but the implementation is not in place, 35 (26.52%) departments no pharmacist for drug quality verification.

The passage indicates that there are variations in the establishment, implementation, and staffing related to drug quality management systems in different departments and hospitals. Some have not established the system, while others may have it in place but face challenges with implementation or lack key personnel, such as pharmacists, for drug quality verification.

Table 3 Status of emergency vehicles supervision and management (n=132)

ITEMS	EXAMPLE	PERCENTAGE（%）	ITEMS	EXAMPLE	PERCENTAGE（%）
THREE-LEVEL QUALITY MANAGEMENT SYSTEM			Emergency vehicle management system		
NO	19	14.39	Yes	132	100.00
YES	113	85.61	Pharmacist verification time spent (min/time)		
PHARMACISTS VERIFY DRUG QUALITY			10-19	91	68.94
NO	35	26.52	20-30	28	21.21
ONCE A MONTH	73	55.30	＞30	13	9.85
ONCE A QUARTER	24	18.18	Departmental quality control checks		
NURSING DEPARTMENT QUALITY CONTROL INSPECTION			1 time a month	123	93.18
ONCE A MONTH	9	6.82	1 time two month	1	0.76
ONCE A QUARTER	117	88.64	Once a quarter	8	6.06
ONCE EVERY 6 MONTHS	6	4.55			

2.2.2 Current status of personnel management

All departments have dedicated management of emergency vehicles and regular training of knowledge related to emergency vehicles in this research. However, only 114 departments (86.36%) had regular training on the knowledge of resuscitation vehicle management. Conduct a needs assessment to identify specific areas of resuscitation vehicle management that require additional training. This could include protocols for handling critical situations, the use of specialized equipment, or communication procedures during emergencies. Develop and enhance training programs specifically focused on resuscitation vehicle management. Ensure that these programs are comprehensive, up-to-date, and aligned with industry best practices. The current status of personnel management is shown in Table 4.

Table 4 Current status of personnel management (n=132)

ITEMS	EXAMPLE	PERCENTAGE(%)	ITEMS	EXAMPLE	PERCENTAGE(%)
EMERGENCY VEHICLE-RELATED KNOWLEDGE TRAINING			Training content		
YES	132	100.00	Use of drugs and items in the emergency vehicle	132	100.00
FREQUENCY OF TRAINING			Laws and regulations, safety management knowledge	117	88.64
ONCE A QUARTER	51	38.64	Emergency vehicle management knowledge	114	86.36
2 TIMES A YEAR	18	13.64	Specialized management		
ONCE A YEAR	63	47.73	Yes	132	100.00

2.2.3 Management Status of emergency vehicles drugs and items

There are 95 departments (71.97%) where the configuration of the emergency vehicles and the whole hospital were unified; there were 37 departments (28.03%) where the configuration and the whole hospital were not unified, of which 34 (25.76%). Departments are configured according to the characteristics of the department based on the unification of the whole hospital; all departments of the emergency vehicles were managed by a human inventory of drugs and items. Each department runs out of items and medications in the emergency vehicles.

The top 3 reasons for the depletion were expired drugs and items, fuzzy labels or broken outer packaging, and errors in taking or using the drugs and items during emergency treatment. Implement a regular schedule for inventory checks in all emergency vehicles. This should include checking expiration dates, the condition of packaging, and the overall quantity of drugs and items. Ensure that all drugs and items are properly labeled with clear and accurate information. Fuzzy labels and broken outer packaging can lead to errors and contribute to the depletion of supplies.

Provide comprehensive training to personnel responsible for managing the inventory in emergency vehicles. The current status of the management of drugs and items in emergency vehicles is shown in Table 5.

Table 5(a) Current status of drugs and items management in emergency vehicles (n=132)

ITEMS	EXAMPLE	PERCENTAGE(%)	ITEMS	EXAMPLE	PERCENTAGE (%)
EMERGENCY VEHICLES CONFIGURATION AND HOSPITAL-WIDE UNIFORMITY			Emergency vehicle configuration content (multiple choice)		
YES	95	71.97	Emergency sports medicine	132	100.00
NO	37	28.03	Infusion supplies	132	100.00
INFORMATION SHARING			Chest press template	132	100.00
NO	132	100.00	Injectables	132	98.41
CONFIGURE THE PLANAR HISTOGRAM			Respiratory products	132	98.41
YES	129	97.73	All kinds of liquids	128	96.97
NO	3	2.27	Blood pressure monitor and stethoscope	125	94.70
PLACEMENT IS CONSISTENT WITH THE PLANAR HISTOGRAM			Terminal Blocks	115	87.12
YES	124	93.94	Pupil Pen	107	81.06
NO	2	1.52	Others	21	15.91
SEQUESTRATION MANAGEMENT			Types of emergency sports medicines		
YES	122	92.06	5-10 kinds	16	12.12
NO	10	7.94	11-15 kinds	67	50.76
TOOLS USED FOR SEQUESTRATION			16-20 kinds	31	23.48
PAPER SEAL	40	30.30	21-25 kinds	7	5.32
PLASTIC MATERIAL SEAL	3	2.27	> 25 kinds	11	8.33
DISPOSABLE CODE LATCH	79	57.94	Total number of emergency sports medicines		
RECOMMENDED DOSES OF EMERGENCY DRUGS FOR CHILDREN			< 50 sticks	23	17.42
YES	43	32.58	50-60 sticks	60	46.21
NO	89	67.42	61-70 sticks	13	9.85
DRUGS AND ITEMS WARNING SIGNS			71-90 sticks	21	15.16

Table 5(b) Current status of drugs and items management in emergency vehicles (n=132)

EXPIRATION DATE	122	92.42	>100 sticks	15	11.36
HIGH ALERT	122	92.42	Total check verification method		
SEEMINGLY	78	59.09	Double verification	129	97.73
SOUND LIKE	78	59.09	Single verification	3	2.27
FOLLOW THE FIRST-IN-FIRST-OUT PRINCIPLE			Total inspection frequency		
YES	127	96.21	Once a week	13	9.85
NO	5	3.79	Once a month	119	90.15
INVENTORY METHOD			General check inventory registration method		
MANUAL COUNTING	132	100.00	Handwritten records	131	99.24
FREQUENCY OF INVENTORY REGISTRATION			Computer system generation	1	0.76
ONCE PER CLASS	132	100.00	Inventory registration time consumption (min/time)		
MATERIAL DEPLETION IN EMERGENCY VEHICLES			＜5	95	71.97
YES	132	100.00	5-9	25	18.94
CAUSES OF DEPLETION (MULTIPLE CHOICE)			10-19	12	9.09
EXPIRED DRUGS AND ITEMS	115	87.12	Total checking time (min/time)		
BLURRED LABELS OR BROKEN OUTER PACKAGING	56	42.42	15-19	16	12.12
GRABBING OR USING THE WRONG ONE DURING RESUSCITATION	25	18.94	20-24	59	44.70
FRAGILE GLASS MATERIAL	17	12.88	25-30	43	32.58
INHERENT QUALITY PROBLEMS	7	5.30	＞30	14	10.61
OTHERS	2	1.52	Frequency of error events		
THE WAY OF CLAIMING DEPLETED MATERIALS			1-2 times/quarter	16	12.12
HANDWRITTEN DRUG CLAIM FORMS OR COMPUTERIZED ENTRY OF ITEMS FOR CLAIMING	55	41.67	1-2 times/year No	51 65	38.64 49.24
ALL HANDWRITTEN DRUG CLAIM FORMS	51	38.63	Error event type (multiple choice)		

Table 5(c) Current status of drugs and items management in emergency vehicles (n=132)

ALL COMPUTERIZED ENTRY OF ITEMS FOR CLAIMING	26	19.70	Wrong number of placements	32	24.24
FREQUENCY OF EXPIRATION OF DRUGS AND PRODUCTS			Pickup error	20	15.15
NO	17	12.88	Wrong type of placement	11	8.33
1-2 TIMES/YEAR	99	75.00	Doctor's order information error	10	7.58
EMERGENCY VEHICLES USE REGISTRATION METHOD (MULTIPLE CHOICE)			Others	3	2.27
EMERGENCY DRUGS ARE RECORDED IN THE EMERGENCY VEHICLES DRUG USE REGISTER	100	75.76	Missing or insufficient emergency supplies No	87	65.91
EMERGENCY ITEMS ARE RECORDED IN THE EMERGENCY VEHICLES REGISTER	94	71.21	Shortage of pharmaceutical items	45	34.09
NO	4	3.03	Missing drug and items	32	24.24

2.2.4 Comparison of the current status of emergency vehicles management in different levels of athletic hospitals

The data were collated and analyzed, and some of the data with large differences were extracted, and the chi-square test was used to compare the current status of management in secondary and tertiary athletic hospitals. See Table 6.

Table 6 (a) Comparison of the current status of departmental emergency vehicles management in different levels of athletic hospitals [example (%)]

ITEMS	**TERTIARY HOSPITAL (N=103)**	**SECONDARY HOSPITAL (N=29)**	X^2	*P*
THREE-LEVELS OF QUALITY MANAGEMENT SYSTEM			58.996	<0.001[a]
YES	101（98.06）	12（41.38）		
NO	2（1.94）	17（58.62）		
FREQUENCY OF QUALITY CONTROL INSPECTIONS BY THE NURSING DEPARTMENT			1.773	0.412

Table 6(b) Comparison of the current status of departmental emergency vehicles management in different levels of athletic hospitals [example (%)]

ITEMS	TERTIARY HOSPITAL (N=103)	SECONDARY HOSPITAL (N=29)	X^2	*P*
ONCE A MONTH	7（6.80）	2（6.90）		
ONCE A QUARTER	90（87.38）	27（93.10）		
ONCE EVERY SIX MONTHS	6（5.82）	0		
PHARMACIST VERIFICATION			57.157	<0.001[a]
NO	12（11.65）	23（79.31）		
ONCE A WEEK	72（69.90）	1（3.45）		
ONCE A QUARTER	19（18.45）	5（17.24）		
FREQUENCY OF TRAINING			38.561	<0.001[a]
ONCE A WEEK	14（13.59）	0		
ONCE A QUARTER	52（50.49）	0		
2 TIMES A YEAR	11（10.68）	12（41.38）		
ONCE A YEAR	26（25.24）	17（58.62）		
RECOMMENDED DOSES OF EMERGENCY DRUGS FOR CHILDREN			0.040	0.841
YES	34（33.01）	9（31.03）		
NO	69（66.99）	20（68.97）		
DRUGS AND ITEMS WARNING SIGNS				
HIGH ALERT	122（92.42）	25（86.21）	2.052	0.225
EXPIRATION DATE	115（87.12）	25（86.21）	2.052	0.225
SEEMINGLY	78（59.09）	8（27.59）	16.972	<0.001[a]
SOUND LIKE	78（59.09）	8（27.59）	16.972	<0.001[a]
SPORTS MEDICINE CONFIGURATION TYPES			39.929	<0.001[a]
5-10 KINDS	3（2.91）	13（44.82）		
11-15 KINDS	57（55.34）	10（34.48）		
16-20 KINDS	25（24.27）	6（20.69）		
21-25 KINDS	7（6.80）	0		
> 25 KINDS	11（10.68）	0		
TOTAL NUMBER OF EMERGENCY DRUG CONFIGURATIONS			26.659	<0.001[a]
< 50 STICKS	9（8.74）	14（48.28）		
50-60 STICKS	51（49.51）	9（31.03）		
61-70 STICKS	11（10.68）	2（6.90）		

Table 6(c) Comparison of the current status of departmental emergency vehicles management in different levels of athletic hospitals [example (%)]

ITEMS	TERTIARY HOSPITAL (N=103)	SECONDARY HOSPITAL (N=29)	X^2	*P*
71-90 STICKS	17（16.50）	4（13.79）		
> 100 STICKS	15（14.56）	0		
TOTAL CHECKING TIME (MIN/TIME)			9.847	0.020[a]
15-19	9（8.74）	7（24.14）		
20-24	43（41.75）	16（55.17）		
25-30	39（37.86）	4（13.79）		
＞30	12（11.65）	2（6.90）		
THE WAY OF CLAIMING MATERIALS FOR DEPLETION			36.018	<0.001[a]
HANDWRITTEN DRUG CLAIM FORMS OR COMPUTERIZED ENTRY OF ITEMS FOR CLAIMING	51（49.51）	4（13.79）		
ALL COMPUTERIZED ENTRY OF ITEMS FOR CLAIMING	26（25.24）	0		
ALL HANDWRITTEN DRUG CLAIM FORMS	26（25.24）	25（86.21）		

[a] *means P < 0.05.*

2.3 The problems with the management of emergency vehicles and suggestions for improvement were shown in Table 7.

Table 7(a) Problems in the management of emergency vehicles and suggestions for improvement (n=132)

ITEMS	EXAMPLE	PERCENTAGE (%)
PROBLEMS		
LACK OF INFORMATION MANAGEMENT	92	69.70
LACK OF NURSES' KNOWLEDGE OF DRUG ITEMS IN EMERGENCY VEHICLES	79	59.85
THE NURSE IS NOT FAMILIAR WITH THE PLACEMENT OF DRUGS AND ITEMS IN THE EMERGENCY VEHICLES	73	55.30
LONG TIME CONSUMING AND HEAVY WORKLOAD FOR INVENTORY	72	54.55
IMPROVEMENT SUGGESTIONS		

Table 7(b) Problems in the management of emergency vehicles and suggestions for improvement (n=132)

ITEMS	EXAMPLE	PERCENTAGE (%)
ENHANCE INFORMATION MANAGEMENT TO IMPROVE EFFICIENCY	99	75.00
STRENGTHEN THE TRAINING OF KNOWLEDGE RELATED TO EMERGENCY VEHICLES	78	59.09
REDUCE LOSSES	69	52.27

2.4 Survey results of nurses' satisfaction with emergency vehicles management

Nurses were very satisfied with the management of emergency vehicles in 30 departments (22.73%); 68 (51.52%) departments were basically satisfied; 19 (14.39%) departments were dissatisfied; 15 (11.36%) departments were very dissatisfied.

3 Discussion

3.1 The current situation and problems of management of emergency vehicles

Improving patient medication safety is not only one of the ten safety goals issued by the National Health Commission, but also an important element in the accreditation of graded athletic hospitals (Zhang, 2019). To ensure medical safety, the emergency vehicles in each hospital department should be in a functional state at all times, and nurses are required to be proficient to take timely and effective resuscitation measures for patients with acute and critical illnesses (Jin, 2019). Therefore, each hospital attaches great importance to the management of emergency vehicles. The results of this survey show that all departments have dedicated management and regular training on knowledge related to emergency vehicles.

All athletic hospitals have a regulatory system in place, and the nursing department and department nurses in each hospital conduct quality checks on the management of emergency vehicles from time to time. 95 (71.97%) of the departments' emergency vehicles were configured and unified with the whole hospital, 34 (25.76%) departments were configured according to the characteristics of the departments based on the hospital-wide unification, and 127 (96.21%) departments followed the principle of first-in, first-out to use the drugs and items in the emergency vehicles. 122 (92.42%) departments are managed under seal with high warning and near expiration date markings, which is consistent with the management of other athletic hospitals in the country and abroad (Li et al., 2018; Mostafa et al., 2020; Wang, 2016; Xia &

Xie, 2017).

However, this survey found that 18 (13.64%) departments had incomplete training content for knowledge related to emergency vehicles, which resulted in nurses lacking knowledge related to emergency vehicles; 19 (14.39%) departments did not have a three-tier drug quality management system, and some athletic hospitals had a sound management system but did not implement it properly. 35 (26.52%) departments did not have a pharmacist for drug quality verification, indicating imperfect organizational management; 89 (67.42%) departments were not equipped with a recommended dosage chart for pediatric resuscitation drugs, which would lead to the manual calculation of dosage during resuscitation of pediatric patients, which is prone to errors (Zhou et al., 2016); In our study, 49 (37.12%) departments had more than 16 types of emergency drugs, and even 11 (8.33%) departments had more than 25 types of drugs, and the configuration of emergency vehicles was not reasonable [5].Seventy-eight (59.09%) departments had incomplete warning labels for drug items in emergency vehicles in this survey. Since the ampoules of some resuscitation drugs have almost the same shape and size in appearance, such as epinephrine, norepinephrine, and atropine, the absence of warning labels can trigger incorrect medication administration during resuscitation (Lin et al., 2020; Marznaki et al., 2020; Yu & Liu, 2017); 67 (50.76%) of the departments surveyed had error events, which threatened the lives of patients and were prone to medical disputes and hospital economic losses, posing a great challenge to the effective management of emergency vehicles. With the continuous development of information technology, hospital management is gradually moving toward fine informationization. In recent years, some domestic athletic hospitals have gradually improved the management of emergency vehicles using the management advantages of information technology and implemented barcode management of emergency vehicles, which has produced positive management benefits (Liu & Sheng, 2021; Liu et al., 2021; Ying et al., 2018).

However, our investigation found that most athletic hospitals lack information management, and all departments carry out manual inventory, general inspection, and handwritten registration; 106 (80.30%) of the drugs consumed by the departments were applied for through the handwritten application form, 51 (38.63%) of the items in the departments were applied for through the handwritten application form, and the rest were manually entered into the computing.

Manual operation was time-consuming and laborious, with 12 (9.09%) departments taking >10 min/time to count; 82 (77.28%) departments took 20-30 min/time for total checking, and 14 (10.61%) departments took >30 min/time for total checking. The manual operation repeatedly touches the drugs and items, which is easy to make the markings blurred and the outer packaging is

broken, and it is easy to cause errors (Zhang, 2020). This is similar to the second-ranked reason for the loss in this survey, which is the blurred labeling of drugs and items (Pitts, 2022).

As seen in Table 6, the current status of management of emergency vehicles in different levels of athletic hospitals differed significantly. In terms of the current status of supervision and management, the two statistically significant items of the tertiary quality management system, as well as pharmacist verification, indicate that the supervision and management of secondary athletic hospitals lag behind tertiary hospitals. In the current situation of personnel management, the frequency of personnel training in secondary hospitals is significantly less than that in tertiary athletic hospitals, and the management of athletic hospitals should be strengthened.

Since the degree of informationization of the management of emergency vehicles in hospitals at all levels is low, and they all rely on manual counting, it is obvious that the total checking time is longer in tertiary hospitals. In terms of the way of claiming the depleted materials, 86.21% of the departments in secondary athletic hospitals claimed the depleted items by handwritten claim form, while 74.75% of the departments in tertiary athletic hospitals claimed the depleted items by computer, which shows that the degree of information management in secondary athletic hospitals is lower than that in tertiary athletic hospitals.

3.2 Suggestions for improving the management of emergency vehicles

3.2.1 Standardize the personnel management of emergency vehicles

All departments in this survey had regular training on knowledge related to emergency vehicles. However, in the nurses' self-assessment of the problems of emergency vehicle management, 59.85% thought that nurses lacked knowledge of the drug items in the emergency vehicles, and 55.30% thought that nurses were not familiar with the placement of drug items in the emergency vehicles. Among the suggestions for improvement, strengthening the training of knowledge related to emergency vehicles ranked second, indicating that the training was not in place, which is consistent with the low rate of nurses' mastery of emergency drugs in clinical settings reported in the literature (Zhang & Wang, 2018). It has been noted in foreign literature that when resuscitating patients, nurses are in a high-pressure and very time-critical environment, while resuscitation teams are formed on an ad hoc basis, which increases the risk of errors. If the nurses are not proficient in the drugs and items in the emergency vehicles, it is very easy to cause errors in the emergency process. Therefore, it is necessary to continuously strengthen the training of departmental nurses on the knowledge related to emergency vehicles until they are proficient and to enhance their awareness of the safe

management of emergency drugs and items. The hospital organizes annual training on drug-related laws and regulations, and drug safety management precautions. The chief nurse organizes quarterly training on the use of drugs and items in the emergency vehicles and training on knowledge related to the management of the emergency vehicles and conducts assessments to prompt nurses to consciously comply with the management system of the emergency vehicles and strictly prohibit the private appropriation of emergency drug items, thus ensuring medical safety.

3.2.2 Improve the three-level management quality control system of emergency vehicles and implement supervision and management

Quality control management is an important part of current hospital management, which can effectively improve medical quality, and the three-level quality control management model achieves seamless closed-loop management in the form of focusing on hierarchical management, refining and grading management content layer by layer, and centralizing and decentralizing management authority, thus reducing blind spots in hospital management. At present, the three-level management quality control system is widely used in clinical quality management in all hospital departments, and the management of emergency vehicles includes the management of emergency drugs and items, so it is recommended to establish a three-level quality management system for drugs and items jointly with the pharmacy department, medical department, and nursing department [5], and to establish a three-level drug quality and safety management team of department-pharmacy department (nursing department)-medical department in drug management, and a three-level item quality and safety management team of the department-nursing department-medical department in item management, according to the development of quality and safety management system and evaluation standards of the emergency vehicles in the ward. First-level quality control by the department quality control nurse once a week to check the emergency vehicle, the chief nurse once a month to check the implementation, and regular assessment, and assessment results are linked to performance. Secondary quality control is carried out by the pharmacy department staff to check the quality of drugs in the emergency vehicles every month, and the nursing department to check the quality of items; Quality control at the third level is carried out quarterly by the quality control staff of the medical department, and the problems are fed back to each department and responsible department in time for timely rectification to ensure the quality of drugs and items in the emergency vehicles, and to ensure that medical personnel are proficient in the configuration of drugs and items in the emergency vehicles and can use them correctly promptly when rescuing. By improving the three-level quality management system of the emergency vehicles and refining every aspect of management, the nurses have rules to follow for the inspection of the emergency vehicles, which ensures the continuous and effective quality

management of drugs and items in emergency vehicles, thus improving medical safety.

3.2.3 Strengthen the management of emergency vehicles drugs and items

3.2.3.1 Reasonable configuration of emergency vehicles

Scientific emergency vehicle configuration can improve the effectiveness of emergency vehicles services, improve the convenience of users, and thus effectively improve the efficiency of work when emergency rescue. The types of drugs in the emergency vehicle of each department of the hospital are generally 9 to 15 kinds, and generally, 5-10 sticks of each drug are reserved. (Tsima et al., 2019) found through a survey of athletic hospitals in Botswana region that the availability of emergency drugs in emergency vehicles ranged from 17.6% to 20.6%. And the first reason for wastage in this survey was the expiration of drugs and items, but also 34.09% of the departments had a shortage of drugs and items, and the unreasonable type and base of emergency drugs and items will directly affect the smooth implementation of emergency rescue. Consequently, the allocation of emergency drugs and items should be unified and standardized, the nursing department should issue a questionnaire to all departments of the hospital, and each department should count the types and bases of emergency drugs and items in the emergency vehicles according to the specific conditions of the admitted diseases and patients, as well as subdivide and unify the quantities of the four essential categories of emergency drugs, fluids, items, and special items by combining the requirements of the new guidelines for CPR. In addition, the department specifies 1-3 other resuscitation drugs and special items on its own according to the different types of admitted diseases. Some of the ampoules of emergency drugs are similar in appearance and pronunciation. To prevent nurses from confusing and taking the wrong ampoule when they are busy resuscitating patients, which may lead to serious consequences or even endanger patients' lives, it is recommended that the outer box or ampoule of such drugs be marked. High-warning drugs are labeled with high warning signs. According to the expiration date using the near expiration date special signs to remind, eye-catching signs to remind nurses to pay special attention to verification in the use, to avoid errors. It has been noted in the literature that although cardiac arrest in children is rare, it can occur anywhere and at any time, and health care facilities should be prepared with personnel and supplies to give timely resuscitation to children. Therefore, it is necessary to allocate a dose conversion table for children's emergency drugs in the emergency vehicles of each department, and the medical and nursing staff, together with the pharmacy department, make a dose conversion book for children's drugs by reviewing the relevant literature and store it in a prominent and fixed place in the emergency vehicles to ensure that the required doses are used accurately when resuscitating children and to guarantee medical safety.

The information construction of the management of drugs and items in emergency vehicles should be strengthened. Nurses' self-assessment of the problems of emergency vehicles management and suggestions, the lack of information management, and strengthening the information construction of the emergency vehicles were both ranked first in this research. There were 25 departmental take or use errors, 10 departmental medical advice information errors, and even 5 departmental drug use errors in the occurrence of the investigated error events, which were analyzed mainly because the discharge of drugs and items in the emergency vehicles was not connected with medical advice, and the consistency of the discharge of drugs and items in the emergency vehicles with medical advice could not be ensured, and the use of drugs and items in the emergency vehicles was not associated with medical advice and could not be traced back to the patients who used them. The information construction of emergency vehicle management should be strengthened to reduce the deficiencies and drawbacks of manual management. Some studies have shown that using radio frequency identification technology to count high-value consumables can avoid manual contact and provide a fast and reliable electronic information data management method for detecting, tracking, and managing emergency vehicle drugs and items [38]. Design the intelligent management system for rescue vehicles based on radio frequency identification technology to achieve the following functions: ① All drugs and items are scanned by the system to quickly and automatically identify the unique identification code for incoming and outgoing inventory checks, and automatically generate daily reports, saving manual inventory and registration time consuming. ②By setting the warning range, when the drugs and items reach the alert value of near expiration date or spare quantity, the machine will alert to ensure the fixed stock quantity of various drugs and items and within the expiration date; ③ Automatic inventory and generation of addendum list after the end of rescue, and rapid generation of addendum list at the end of regular inventory to realize paperless shift handover.

Establishing a closed-loop management system for the whole process of emergency vehicles drugs and items based on IOT technology, associating the emergency vehicles information management system with the HIS system and interconnecting it with the pharmacy department, replenishing emergency drugs to departments on time according to the outgoing inventory, and realizing the real-time linkage between the actual consumption of emergency vehicles drugs and the inventory base and automatic replenishment, ensuring the immediacy of clinical use.

Pharmacy department personnel monitor the use of rescue drugs in each department through the system, eliminating the need for monthly inventory checks in each hospital department and solving the manpower problem; the release of rescue drugs is associated with the medical advice system, enabling rapid identification of error correction, improving accuracy and

timeliness, safeguarding medical safety, and effectively improving the efficiency of medical and nursing staff, thus enhancing the management of the hospital.

4 Conclusion

The investigation into the current situation of emergency vehicle management in sports medicine and athletic hospitals across Zhejiang Province has provided valuable insights into the state of emergency care within this specialized sector. The findings of this study underscore both the strengths and areas in need of improvement within the management of emergency vehicles in these healthcare institutions.

Several key takeaways emerge from this research:

1. Quality Assurance Challenges: The study revealed that a significant percentage of departments in these hospitals lack regular quality checks of drugs, highlighting a potential area of concern. Ensuring the quality and efficacy of medications and equipment in emergency vehicles is paramount for athlete safety.

2. Knowledge Gaps: A notable proportion of investigators expressed concerns about nurses' knowledge of rescue drugs and items. Bridging this knowledge gap is crucial to enhance the preparedness of healthcare providers in responding to sports-related emergencies.

3. Information Management: The study found that while all departments conducted manual inventory management of rescue drugs and items, only a fraction implemented information management systems. This discrepancy raises questions about data accuracy and accessibility, which are vital in time-sensitive emergency situations.

In conclusion, there is room for improvement in the supervision and management of sports medicines and emergency items within hospitals specializing in sports medicine in Zhejiang Province. Standardizing procedures, enhancing personnel training, and implementing robust information management systems are essential steps in ensuring the safety and well-being of athletes and individuals involved in sports and athletic activities.

The findings of this research serve as a foundation for further enhancements in emergency vehicle management, ultimately contributing to the quality of care and response in the sports medicine field.

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