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The Systematic Construction of Emergency Medical Security System in Long-Distance Walking Movement on Urban Paved Roads

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ABSTRACT

Objective To explore the scope of building emergency medical security mechanism in urban paved road environment, and to provide reference, sample data and improvement suggestions for building emergency medical security mechanism in such specific environment. Methods The data of rescue personnel deployment, rescue materials allocation, rescue force monitoring, actual rescue situation, emergency plan and relevant regulations setting, training and other aspects of the emergency medical security mechanism in March and April 2023 were collected, and the data were analyzed. Results (1) The hiking distance was 40km and the road conditions were urban paved roads. There were 1150 official trekkers and 65 people were treated medically. (2) The most common symptoms of outdoor hiking included skeletal muscle injury (19.48%), foot skin and soft tissue injury (18.17%), fever (2.61%) and diarrhea (0.61%). (3) In March, 18.36% of the core medical team members and 20.41% of the first aid volunteers who underwent systematic training took up the task of supporting hiking activities. In April, the core medical team personnel who undertook the task of supporting hiking activities accounted for 1.23% of the total number of the security team, and the first aid volunteers who underwent systematic training accounted for 37.04%. (4) According to local conditions, the multi-vehicle rescue and transport mode was adopted, which was combined with the modified commercial rescue vehicle (42.86%) with the on-board emergency medical unit (EMU) and the ordinary ambulance (28.57%). (5) More than 700 pieces of 34 kinds of medical materials and 40 sets of mobile communication equipment, which were put into use after the feasibility study of the expert group and the technical group, guaranteed the competition from the hardware level. Conclusion The construction of emergency medical support mechanism in outdoor walking sports needs to pay attention to environmental characteristics, operation mode of support team, personnel and adaptability training, equipment and deployment of medical support materials, deployment and cooperation of communication and transport capacity, reasonable support plan and other factors. Medical volunteers who have been systematically trained can undertake part of outdoor medical rescue work. Pre-activity training and regular re-training of medical volunteers can ensure the

ARTICLE DETAILS

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safety of outdoor activities.

KEYWORDS: Emergency medical treatment, Medical management, Event security, Hiking sports, Paved roads

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As one of the outdoor extreme sports, long-distance hiking (exceeding the distance of marathon) is an event with great potential risks. The emergency medical security work during the event period is very important. Establishing a good working mechanism for it can effectively reduce the interference of human factors and greatly improve the meticulousness, reliability, stability and effectiveness[1] of the security work. Common injuries during the event include knee injury, ankle injury, Achilles tendon injury, knee meniscus injury,iliotibial band friction syndrome, tibial stress syndrome, plantar fasciitis, dehydration, digestive tract bleeding, pancreatitis, hypothermia, pulmonary edema, fall and blunt force injury, hyponatremia, heat stroke, hypoglycemia, sudden cardiac death, etc. According to the characteristics of the above accidents, some studies put forward the following coping principles, and the necessity of dividing the emergency medical treatment system and the medical volunteer service system from the holistic perspective. From the perspective of early prediction and accurate rescue, the rationality of formulating the injury spectrum of cross-country racing was proposed; From the perspective of accurate rescue, the integrity [2] of equipping the injured and sick with search and rescue equipment, on-site first aid equipment and three-dimensional evacuation equipment is proposed.

There are statistics at home and abroad, in more than 50 kilometers[3-4] of outdoor hiking, for the vital signs of unstable early identification, early disposal, in order to prevent the occurrence of adverse events.For outdoor trekkers on mountain roads, fully prepare materials to deal with low temperature weather and environment

before the game, and educate participants to understand the preventive measures that can reduce the risk of hypothermia, including preparing appropriate thermal clothing, thermal blankets and adequate caloric intake[5] .

Hangzhou Leye Discovery ® is the organization of outdoor hiking events. It has organized more than 1,000 hiking events so far, and has accumulated rich experience in organizing. This study applied for the activity **data** information authorized by LeYE Exploration ®, and analyzed it in order to sum up the operation experience and provide reference for the future event protection.

1. DATA AND METHODS

1.1 Materials

The questionnaire data after the **two** long walking activities organized by Leye Exploration and PEACEBIRD Fashion Clothing Company in Hangzhou in March and April 2023 were selected. A total of 1150 copies were distributed and 1150 copies were recovered.

1.2 Research Methods

Before the activity, all trekkers were required to undergo physical health screening (health survey questionnaire), excluding bad living habits such as severe sleep deficiency and alcoholism, habitual dislocation, cerebral infarction, epilepsy, uncontrolled high/low blood pressure, heart disease, myocarditis within 1 year, habitual dislocation, severe cervical and lumbar spine diseases, severe night blindness, asthma and other diseases. History of major surgery within six

months, pregnant women and women within one year after delivery are excluded. Composition and configuration of medical security: The experimental group dominated by medical personnel were all composed of emergency department medical care, with 1 doctor and 1 nurse for every 50 people; The control group dominated by medical volunteers was composed of 1 emergency department doctor and volunteers, and 2 volunteers were assigned to every 50 people. Ambulances with oxygen, defibrillator and monitor were routinely equipped. Subjects: 1150 adults aged 18-60, weighing 40-100 kg; Experimental group: Select 2 groups of urban paved road outdoor hiking distance greater than 40 km, a total of 1150 participants, weight 40~100 kg, randomly divided into the control group 400 people, the experimental group 750 people; Hiking activities and intervention methods: The exercise environment temperature of the players was 15~30℃, the humidity was (55±5) %, and the exercise was completed within 9 h. During the exercise process.the control

group was given medical intervention by the doctor, while the experimental group was given medical volunteer
intervention. When the doctor or medical volunteer in the medical vehicle patrolling along the way found that the movement speed of the trekkers decreased, the physical state of the trekkers was checked in time. Further assess whether medical treatment is needed, and free supply and walking exercise during other periods. Complete more than 40 km of hiking within 9 hours. The day after the activity, the health return questionnaire (a total of 8 multiple choice questions) was conducted to collect the discomfort symptoms of the hikers. Experimental group: The medical volunteers handled the emergency situation, the doctors assessed whether there was a life-threatening situation, and the medical volunteers handled the non-life-threatening situation, the doctors did not intervene; Control group: doctors assessed and handled the accident. Experimental samples were collected and analyzed to record the safety risks of the members of the three groups and their outcomes after treatment, as well as the current discomfort symptoms of the trekkers the next day. The risks of the activities were analyzed; Analyze the risk of medical security in the case of physician medical intervention; Analyze the medical security risk under the intervention of medical volunteers; To analyze the reasonable allocation of the resources of activity guarantee.

1.3 Statistical Methods

EXCEL 2013 software was used to input the data, SPSS 13.0 was used to establish a database, and the frequency and rate were used to express the data of rescue personnel deployment, rescue materials allocation, rescue force monitoring and deployment, actual rescue situation and other data in the event

2. RESULTS

2.1 Relevant rescue guarantee situation

In March, a total of 17 people were medically treated and 1 person was medically withdrawn (including 1 person who was forced to withdraw). The main medical conditions of the person included: foot skin and soft tissue injury (16.50%), bone and muscle sports injury (15%), fever (2%), diarrhea (0.75%), etc. In April, a total of 48 people were medically treated, and 3 people were medically withdrawn (3 of them were forcibly withdrawn). Their main medical conditions included: foot skin and soft tissue injury (19.07%), bone and muscle sports injury (21.87%), fever (2.93%), diarrhea (0.53%), etc. No hypothermia was found in the two hiking activities. From the analysis of receiving medical treatment, the increase in the need for professional medical treatment was significantly higher than that of the trekking members. In the case of receiving medical treatment, the number of trekking members in April increased significantly, the corresponding medical volunteers also increased relatively, and the number of cases requiring treatment was significantly higher than that in March, as shown in Table 1.

Table 1: Comparison of the cases receiving medical treatment

Items	March Field	April Matches	Growth rate(%)
Trekkers	400	750	87.5
Medical Disposal (physician)	17 (4.25%)	48 (6.4%)	183
Mandatory medical withdrawal	1 (0.25%)	3 (0.4%)	200
Skin damage	66 (16.50%)	143 (19.07%)	116.67
Muscle damage	60 (15%)	164 (21.87%)	173.33
fever.	8 (2%)	22 (2.93%)	175
diarrhea.	3 (0.75%)	4 (0.53%)	33.33

Criteria for mandatory withdrawal: 1. confusion and inability to answer questions accurately; 2. Limb movement disorder affecting the walking movement; 3. Skin oxygen measured by pulse oximeter is less than 90%.

2.2 Composition of the rescue team

2.2.1 Medical team physicians in March: including director/deputy chief physician (22.22%), attending/resident physician (55.55%), supervisor nurse (11.11%), nurse (11.11%). Medical team physicians in April: including director/deputy chief physician (100%). Medical volunteers in March: Medical volunteers in April: medical volunteers who have participated in medical training for more than 2 times (60%) and more than 1 time (40%); medical volunteers who have participated in medical training for more than 2 times (70%) and more than 1 time (30%).

From the analysis of medical resource allocation, it is necessary to strengthen the training of medical volunteers. Multiple medical knowledge training and repeated practice can ensure that medical volunteers can deal with common sports injuries, and can identify critical situations and call medical support in time. Combined with the activity analysis of 3 months, common sports injuries are mainly skin injuries and muscle injuries. Sufficiently skilled medical volunteers can be competent in the treatment of skin injuries, as shown in Table 2.

Table 2: Analysis of medical resource allocation

Items	March Field	April Matches	Growth rate(%)
Medical team physicians	9(18.36%)	1 (1.23%)	88.89
Medical volunteers	10 (20.41 percent)	30 (37.04%)	200
Training 1 session	4 (40%)	9 (30%)	125
Training twice	6 (60%)	21 (70%)	250

2.2.2 Pre-event training for medical team and medical volunteers

The deputy chief physician of the Department of Emergency and Critical Care Medicine of Grade III Hospital will organize and take charge of the teaching, including BLS course and field advanced first aid course. Two lectures and practical operations on the treatment of common outdoor sports injuries were organized within one month before the event. After the event was over in 3 months, medical volunteers were timely organized to conduct a review, analyze and summarize the medical accidents that occurred during the event, further practice the treatment of skin injuries and muscle injuries in a targeted manner, and conduct operational assessment on medical volunteers after training. Only after passing the assessment can they serve as medical volunteers.

2.3 Relief Supplies

2.3.1 Emergency Rescue vehicles 5 support vehicles were deployed for the hike: Including 3 commercial vehicles (42.86%) as emergency rescue vehicles, including emergency medical unit (EMU) and security fixed network, which can ensure

the safe placement of on-board first aid kit, automatic external defibrillator and other rescue plans. 2 general ambulances (28.57%) and 2 supply and material reserve vehicles (28.57%).

2.3.2 Medical supplies to be prepared in the medical supplies race schedule include: 3 automatic external defibrillators (placed in the emergency rescue vehicle), 2 manual defibrillators (placed in the ambulance), 2 portable ventilators (placed in the ambulance), 2 ECG monitors (placed in the ambulance), 2 pulse oximeters (placed in the emergency rescue vehicle), 7 electronic sphygmomanometer (placed in the emergency rescue vehicle and supply point), 7 ear temperature guns (placed in the emergency rescue vehicle and supply point)), 2 oxygen cylinders (placed in ambulances), another 1000 ice packs (placed in rescue vehicles and supply points), 50 first-aid blankets (placed in rescue vehicles and supply points), about 34 kinds of drugs and medical

consumables, a total of more than 700 pieces (placed in rescue vehicles and supply points).

2.3.3 Communication and positioning equipment The main equipment for communication and positioning in the hiking activity: 4 handsets for the rescue team and 22 handsets for the trekking team. In addition, the rescue team also has 7 mobile stations and 7 standby mobile stations.

2.4 Management of supply points The management, maintenance, transfer, use and replenishment of medical supplies are an important part of the management of supply points. The station is equipped with medical area and rehabilitation area to meet different functional needs, equipped with electronic

sphygmomanometer, ear warming gun, ice pack, first aid blanket, drugs and medical consumables. The corresponding medical and medical volunteers are responsible for the disposal of medical needs, drug use registration, and timely coordination of the general dispatch of supplementary drugs.

2.5 Emergency Response Plan

In this competition, a unified emergency medical support command and operation team was used, so that the rescue support plan system could be well implemented and reflected. The rules and plans involved in the first aid guarantee of the event include: (1) On the road: "Assessment Form of the trekkers", "Road Medical Distribution and Work Responsibilities"; (2) Stations: Assessment Form of Trekkers, Medical Distribution and Job Duties of stations, Unified Medical Document Record Plan, Compulsory Withdrawal Standard, and General Medical Rules of the Event.

3. DISCUSSION

In view of the increasing demand for outdoor hiking, we advocate a safe medical security method to ensure the safety of outdoor hiking. Combined with the experience of two safe hikes, we have done relevant work in the configuration of conventional rescue forces and materials supplies before and after hiking, so as to create greater value for better protecting the healthy completion of the race. The physical health screening (health survey questionnaire) of trekkers before the event plays a key role in preventing medical accidents during the event. Before the event, the physical condition of the participants is systematically assessed to exclude chronic cardiovascular and cerebrovascular diseases, organic diseases of bone and joint, history of acute myocarditis within 1 month, and other trekkers including pregnant women and major operations within 6 months. Avoid the aggravation of basic diseases caused by long-distance hiking. Drawing on the pre-race screening in marathon, the

question-and-answer questionnaire designed by us can quickly screen out the team members suitable for long-distance hiking.

After systematic medical training and re-training, medical volunteers can undertake medical security services for outdoor paved roads, but professional doctors with senior experience are required to make the final decision and systematically evaluate whether the trekkers need to be forced to withdraw from the race. Each mobile emergency unit is equipped with medical personnel or medical volunteers, and senior doctors are deployed in the restructured commercial rescue vehicle, which can timely deal with emergencies in the hiking team and evaluate whether the trekkers need to be forced to withdraw from the race. Through multiple training and repeated practice, medical volunteers can deal with common sports injuries in the process of hiking, and can timely determine whether to seek medical support, which can effectively alleviate the relative shortage of medical resources under the current shortage of medical resources, and also provide effective medical security for outdoor sports. Through the practice before the activity, medical volunteers can master the use of the allocated relief materials. In the two activities, medical volunteers can skillfully use monitoring instruments such as thermometer and blood pressure monitor, and can skillfully use bandages and gauze to deal with common sports injuries.

After hiking, arrange a group of 2 medical volunteers, male and female, to enter the room of the trekkers to check the physical condition of the trekkers, and deal with the physical injury during the hiking process. The difficult event is further assessed by the senior doctor whether it needs to be sent to a medical institution for further treatment. According to the feedback results of the two hiking activities, there was no significant difference between the treatment of the medical volunteers and the treatment of the medical volunteers. Effective training can make the medical volunteers competent for the treatment of common sports injuries. Based on the construction of a reasonable system, we advocate

strengthening the training and practical practice of medical volunteers, who can be competent for the disposal of common outdoor sports injuries, and give corresponding intervention to trekkers in a safe medical security way, so as to reduce the related health injuries of trekkers and ensure the safety of outdoor trekking. To provide a reliable practical basis for the construction of outdoor trekking protection.

Conflict of interest: The author declares that there is no conflict of interest

Author contribution: Dong Jing: Responsible for project design and article writing; Yang Zheng: Responsible for project design and article revision; Ruan Jialong: responsible for the planning and organization of activities; Chen Jianing,and Song Xiaohong: responsible for data collection, statistics and data analysis before and after the hike.

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