

Original Article

Medical care delivery at the Beijing 2008 Olympic Games

Jin-jun Zhang, Li-dong Wang, Zhi Chen, Jun Ma, Jian-ping Dai

Beijing Emergency Medical Center, Beijing 100031, China (Zhang JJ, Wang LD, Chen Z); Medical Services Department of Beijing Organizing Committee for the Games of the XXIX Olympiad, Beijing 102008, China (Ma J, Dai JP)

Corresponding Author: Jin-jun Zhang, Email: zhangjj-120@hotmail.com

BACKGROUND: Beijing successfully hosted the 2008 Olympic Games, and the services including medical services were widely appreciated by both participants and visitors. We retrospectively analyzed the quality of the medical services provided to athletes, spectators, VIPs, and the workforce during the Beijing 2008 Olympic Games. The information thus gathered would be useful for planning strategies for managing mass gatherings.

METHODS: Medical encounter forms filled during the Beijing 2008 Olympic Games were retrospectively reviewed. Descriptive statistics was used to characterize the data by accreditation and diagnostic categories.

RESULTS: A total of 22 892 medical encounters were documented during the Beijing 2008 Olympic Games. Among them, 10 549 (46.08%) involved the workforce, 3 365 (14.70%) athletes, 3 019 (13.19%) spectators, 585 (2.56%) members of the media, 1 065 (4.65%) VIPs, and 4 309 (18.82%) others. Of the 22 892 cases, physical injury accounted for 27.90% (6 386), respiratory disease 18.21% (4 169), and heat-related illnesses 2.68% (615).

CONCLUSIONS: Preparations of the medical service for the Beijing 2008 Olympic Games were made for 7 years, and the service provided has been praised worldwide. This study provides valuable information that may be useful for planning medical services for upcoming Olympic Games, including the London 2012 Olympic Games and other mass gatherings.

KEY WORDS: Sports medicine; Athletic injuries; Mass gatherings; Emergency medical services; Medical care team

World J Emerg Med 2011;2(4):267-271
DOI: 10.5847/wjem.j.1920-8642.2011.04.004

INTRODUCTION

The modern Olympic Games have been conducted only once every 4 years since 1896, unlike the other major international events. Today the Olympic Games are the world's largest and most influential global sporting events.^[1-6] The 29th Olympic Games were held in Beijing, Shanghai, Hong Kong, Tianjin, Qingdao, Qinhuangdao, and Shenyang, China, in August 8th to 24th, 2008, with 37 competition venues, 86 training venues, and 22 non-competition venues. There were 302 events for 28 sports that involved 16 500 athletes from 204 countries, 100 000 volunteers, 5 million spectators,

and 2 800 VIPs (very important person). The purpose of this article is to retrospectively analyze the medical care provided to spectators, athletes, officials, and the workforce during the Beijing 2008 Olympic Games. In addition, we also discuss the organization, operation, and management of medical services during the Beijing 2008 Olympic Games.

METHODS

Organization of medical services

Medical care at the Beijing 2008 Olympic Games

was supplied by the medical services department of the Beijing Organizing Committee for the Games of the XXIX Olympiad (BOCOG) that was established on December 13, 2001, under the leadership of the Beijing Municipal Government and IOC. The BOCOG had 24 departments and 4 000 staff members by 2008; the medical services department was under the games services department and was responsible for the medical care and health planning for all the venues and activities associated with the Beijing 2008 Olympic Games. All the medical managers of venues were selected from the dedicated Olympic hospitals by the medical services department of the BOCOG; these managers organized the medical services team and were responsible for the medical care in the venue. The medical manager was also responsible for the venue manager. There were 50 medical teams that consisted of 127 medical managers and vice medical managers and 5 350 medical volunteers serviced at 226 medical stations in all the venues and the polyclinic during the Beijing 2008 Olympic Games. Medical services during the Beijing 2008 Olympic Games were free in the venues and polyclinic, including emergency medical services (EMS); treatment in the hospital required payment.

Forty-eight athlete medical stations and 82 spectator-care stations operated at the 37 competition venues. Athletes received medical care during the competitions at the athlete medical stations, which were located near the competition site and were staffed by at least 1 doctor, 1 nurse, and 2 medical-student volunteers. Athletes also could seek care at the polyclinic.

Polyclinic

The polyclinic located within the residential zone of the Beijing Olympic village was approximately 4 400 m² in area and offered a comprehensive range of health care services and interpreter service at no charge to the accredited persons with access to the residential zone of the Olympic village. The clinic was operated from July 20 to August 27, 2008. The services included emergency services supported by ambulance, internal medicine, general surgery, physiotherapy, dental care, optometry, medical imaging, etc.

Emergency medical service

In all, 221 ambulances were employed during the Beijing 2008 Olympic Games serviced at all of the venues. All ambulances were equipped with first-aid equipment such as an electrocardiogram monitor,

defibrillator, ventilator, phlegm sucker, cardiopulmonary resuscitator, glucose meter, spine board, and medicine for oral and intravenous administration. Each ambulance was staffed by a doctor, a nurse, a driver, and two medical-student volunteers. The staff members were responsible for transporting the patient from the venue to the polyclinic or the dedicated Olympic hospital under the supervision of the medical manager of the venue.

Dedicated Olympic hospitals

There were 32 dedicated Olympic hospitals in Beijing and 6 other co-host cities during the Beijing 2008 Olympic Games. Anyone requiring hospitalization was taken to the most clinically appropriate Olympic hospital. The dedicated Olympic hospital for athletes was the China-Japan friendship hospital, for Olympic families was Peking union medical college hospital, and for accredited media was Beijing An Zhen Hospital.

Data collection and analysis

Medical evaluations and treatments of patients were recorded on the medical encounter forms; this form was designed and validated by the Medical Commission of the IOC. Data for this study were collected by a retrospective chart review of medical encounter forms completed when medical care was provided at the venues. Providers of medical care selected a primary diagnosis category for each patient from a predetermined list on the medical encounter forms. Data on numbers of patients from each primary diagnosis category were presented by using standard descriptive statistics.

RESULTS

During the Beijing 2008 Olympic Games, there were 16 500 athletes, 21 600 members of the media, 100 000 workforce members (BOCOG staff and volunteers), 2 800 VIPs, and 5 million spectators.

There were 22 892 total medical encounters in the medical stations of venues or in the polyclinic of the Olympic village from the opening to the closing of the Olympic village (July 21 through August 27, 2008). Patients treated included spectators, athletes, media personnel, workforce members, and others.

The 22 892 medical encounters occurred in the following locations: 8 811 (38.49%) at the polyclinic, 7 993 (34.92%) at competition venues, 384 (1.67%) at training venues, and 5 704 (24.91%) at non-competition venues (Table 1).

Table 1. Medical encounters by venue

Venues	Number of cases	Percentage (%)
Polyclinic	8 811	38.49
Competition venues	7 993	34.92
Training venues	384	1.67
Non-competition venues	5 704	24.91
Total	22 892	100

Table 2. Medical encounters by accreditation

Accreditation category	Number of cases	Percentage (%)
Athletes	3 365	14.70
Media	585	2.56
Spectators	3 019	13.19
Workforce	10 549	46.08
VIPs	1 065	4.65
Others	4 309	18.82
Total	22 892	100

Accreditation status of the individuals treated in the 22 892 medical encounters was as follows: 10 549 (46.08%) of the workforce, 3 365 (14.70%) athletes, 3 019 (13.19%) spectators, 585 (2.56%) of the media, 1 065 (4.65%) VIPs, and 4 309 (18.82%) others including international service providers, senior officials, technical officials, private coaches, organizers guests, broadcasters, technical support staff, and so on (Table 2).

The numbers of individuals who received treatment were as follows: 3 365 (20.39%) of the 16 500 athletes, 585 (2.71%) of the 21 600 media workers, 10 549 (10.55%) of the 100 000 workforce and volunteers, 1 065 of the VIPs (38.3%), and 3 019 (0.06%) of the 5 million spectators.

The 22 892 medical encounters were divided according to diagnosis into the following categories: 6 386 (27.90%) for injury, 4 169 (18.21%) respiratory disease, 2 351 (10.27%) ear, nose, and throat (ENT) disease, 1 888 (8.25%) dental disease, 1 460 (6.38%) skin disease, 1 305 (5.70%) eye disease, 1 167 (5.10%) diarrhea, and 615 (2.68%) heat-related illness (Table 3).

Of the 3 365 athletes treated, 2 090 (62.11%) had injury, 658 (19.55%) dental disease, 135 (4.01%) eye disease, 118 (3.50%) ENT disease, 100 (2.97%) skin disease, 88 (2.62%) had respiratory disease, 55 (1.63%) digestive disease, and 9 (0.26%) heat-related illnesses.

Of the 6 386 injury cases, 2 090 (32.73%) were athletes, 1 733 (27.14%) were workforce members, 735 (11.51%) were spectators, 375 (5.87%) were VIPs, 127 (1.99%) were media personnel, and 1 326 (20.76%) were others.

Table 3. Medical encounters by diagnostic category

Diagnostic category	Number of cases	Percentage (%)
Injury	6 386	27.90
Heat related		
Heat stroke	367	1.60
Others	248	1.08
Digestive		
Diarrhea	1 167	5.10
Others	1 640	7.16
Respiratory	4 169	18.21
Cardiovascular	631	2.76
Dental	1 888	8.25
Eye	1 305	5.70
ENT	2 351	10.27
Skin	1 460	6.38
Genitourinary	380	1.66
Nervous-sensory	863	3.76
Psychiatry	37	0.16
Total	22 892	100

Moreover, 802 patients were transferred by ambulance, including 273 (34.04%) workforce members, 267 (33.29%) spectators, 102 (12.72%) athletes, 30 (3.74%) VIPs, and 109 (13.59%) others. Of the 802 patients, 313 (39.03%) suffered from injury, 175 (21.82%) from digestive disease, 59 (7.36%) from cardiovascular disease, and 52 (6.48%) from respiratory disease.

Of the injured patients, 4 855 were treated as outpatients and 127 as inpatients at the dedicated Olympic hospitals. The 4 855 outpatients comprised 128 VIPs, 135 athletes, 232 media workers, 934 non-registered foreigners, and 3 426 spectators and others. Of the 127 inpatients, 95 were registered patients, including 5 athletes (1 each of acute pancreatitis, acute appendicitis, acute gastroenteritis, acute renal failure, and acute subdural hematoma), and 32 were non-registered patients.

DISCUSSION

As the world's largest and most influential global sporting events and mass gatherings, the Olympic Games have developed their own stringent standards and operating procedures.^[7-12] All activities for the Olympic Games, including medical services, must be in accordance with the IOC's or organizer's requirements, standards, and international practice.^[13,14]

Planning for medical services in the Olympic village began in 1991.^[15] According to this study, the polyclinic, which served 8 811 patients (38.49%), was the largest

medical treatment facility ever in the Olympic history and was located within the residential zone of the Beijing Olympic village. The polyclinic played an important role in medical service during the Olympic Games. There also were medical services provided in 37 competition venues ($n=7\ 993$; 34.92%), with an average of 216 cases per venue. Next was the non-competition venues ($n=5\ 704$; 24.91%). The training venue ($n=384$; 1.67%) had the least number of cases, with an average of only 4.5 cases per venue during the Olympic Games; however, we supplied medical volunteers in equal quantity and quality in the training venue as in the competition venue. For efficiency, the number of medical volunteers and ambulances in training venues can be reduced.

The majority of patients treated on venue were from workforce members ($n=10\ 549$; 46.08%), indicating that the workforce had the highest medical utilization. Because of the long duration to set up and run the Olympic village, from June to August, the workforce daily worked an average of 12 hours or more; thus, medical service for the workforce is an important consideration when planning medical coverage for mass gatherings. Athletes ($n=3\ 365$; 14.70%) were the third most common visitors, followed by spectators ($n=3\ 019$; 13.19%); but care of athletes and spectators is the most primary objective of medical care in the Olympics.

The highest proportion of patients who required medical treatment in the category of accreditation status were VIPs at 38.3% (1 065 of 2 800), followed by athletes at 20.39% (3 365 of 16 500), workforce members at 10.55% (10 549 of 100 000), and spectators at 0.06% (3 019 of 5 million). Thus VIPs and athletes are the principal clients of medical service in the Olympics.

Injury was most common ($n=6\ 386$; 27.90%), and respiratory disease predominant in five diagnoses in medical services. Even in summer, the heat-related illnesses were infrequent ($n=615$; 2.68%). These findings may be related to measures taken to prevent heatstroke. The most common accreditation status in regard to injuries was athletes ($n=2\ 090$; 32.73%); this finding was the same as the finding in other Olympic Games.^[3,11,15]

EMS plays an essential role in protecting people's lives and ensuring the success of major social events.^[16,17] There were 802 patients who required ambulance service from venues to the polyclinic or the dedicated Olympic hospitals during the Beijing 2008 Olympic Games. Of the 802 patients, 273 (34.04%) were workforce members, 267 (33.29%) were spectators, and 102 (12.72%) were athletes. These results indicate that members of the workforce and spectators were the main users of

emergency medical services.

All the hospitals, especially the dedicated Olympic hospitals, were alerted during the Beijing 2008 Olympic Games period, including periods of arrival and departure of the participating delegations and teams. There were 95 registered patients who were hospitalized and treated at the dedicated Olympic hospitals; 5 athletes were hospitalized in the China-Japan Friendship Hospital, and a total of 32 patients were treated in the dedicated Olympic hospitals. The need for so many dedicated Olympic hospitals should be studied, but one hospital must be located near the main stadium (preferably within 5 km).

The data for this study were collected from the medical encounter system in the medical service department of the BOCOG, so the results should be accurate and credible. However, there might have been many people who did not seek medical services on site in venues, thus the reported total cases may be lower than the true number. Many national teams traveled with their own medical staffs; therefore, many athletes had access to their own medical staff and may not have services from the athlete medical station or polyclinic. Thus the true number of cases of medical services for athletes may not be fully represented by this study. These weaknesses exist in other similar studies.^[3,10] In addition, doping control is not part of the general medical service, so these data cannot be included.

Hosting the Olympic Games has not only accelerated the improvement of medical care delivery in Beijing but also helped accumulate some experience in hosting mass gatherings. First, the strong leadership and support of the BOCOG and Beijing municipal government provided a fundamental basis for success. The high-quality medical team also contributed to the success of the event, and all medical managers and volunteers were recruited from the dedicated hospitals according to proximity. The carefully planned training and exercises were also essential to the successful medical care operations. However, there were some weaknesses. Although we took into account the level of foreign language skills and conducted foreign language training for volunteers, language proficiency was still the most important issue. The number of the dedicated hospitals should be reduced, but classified management according to the accreditation is an innovation. The medical stations and volunteers in the training venue should be reduced as they often had nothing to do during the games.

Finally, we would like to quote the words of Ljungqvist, chairman of the IOC Medical Commission,

who has been an IOC member since 1987: "The medical services are the best I have ever experienced in my Olympic life. The 29th Olympics will be well remembered among the public health community".^[18]

ACKNOWLEDGEMENTS

We acknowledge the valuable contributions and dedicated service from the following members of the medical service department of the Beijing Organizing Committee for the Games of the XXIX Olympiad: Zhen XZ, Wang R, Yan Y, Yu Q, Li YL, Wang Y, and Zhai JG. We also appreciate the enthusiasm and leadership of Dr. Patrick Schamasch, director of the International Olympic Committee Medical Commission.

Funding: None.

Ethical approval: Not needed.

Conflicts of interest: The authors have no financial or other conflicts of interest regarding this article.

Contributors: Zhang JJ drafted the manuscript. Wang LD helped to draft the manuscript. Chen Z and Ma J performed the statistical analysis. Dai JP participated in its design. All authors read and approved the final manuscript.

REFERENCES

- Leggat PA, Seelan ST. Preparedness of general practitioners in Australia for the Sydney 2000 Olympic and Paralympic Games. *J Travel Med* 2002; 9: 322-325.
- Brennan RJ, Keim ME, Sharp TW, Wetterhall SF, Williams RJ, Baker EL, et al. Medical and public health services at the 1996 Atlanta Olympic Games: an overview. *Med J Aust* 1997; 167: 595-598.
- Wetterhall SF, Coulombier DM, Herndon JM, Zaza S, Cantwell JD. Medical care delivery at the 1996 Olympic Games. Centers for Disease Control and Prevention Olympics Surveillance Unit. *JAMA* 1998; 279: 1463-1468.
- Cantwell JD, Fontanarosa PB. An Olympic medical legacy. *JAMA* 1996; 276: 248-249.
- Milne C, Shaw M, Steinweg J. Medical issues relating to the Sydney Olympic Games. *Sports Med* 1999; 28: 287-298.
- Speech by Jacques Rogge at the closing ceremony. <http://en.beijing2008.cn/ceremonies/headlines/n214584113.shtml>. 2008.
- International Olympic Committee. Medical service: technical manual on medical services. IOC, http://www.olympic.org/>uk/index_uk.asp. 2005.
- Enock KE, Jacobs J. The Olympic and Paralympic Games 2012: literature review of the logistical planning and operational challenges for public health. *Public Health* 2008; 122: 1229-1238.
- Thackway SV, Delpech VC, Jorm LR, McAnulty JM, Visotina M. Monitoring acute diseases during the Sydney 2000 Olympic and Paralympic Games. *Med J Aust* 2000; 173: 318-321.
- Grissom CK, Finnoff JT, Murdock DC, Culberson JT. Nordic venue medical services during the 2002 Winter Olympics. *J Emerg Med* 2006; 30: 203-210.
- Moreno Millan E, Bonilla F, Alonso JM, Casado F. Medical care at the VIIth International Amateur Athletics Federation World Championships in Athletics 'Sevilla '99'. *Eur J Emerg Med* 2004; 11: 39-43.
- Hanley DF. Medical care of the US Olympic Team. *JAMA* 1976; 236: 147-148.
- Arbon P. Planning medical coverage for mass gatherings in Australia: what we currently know. *J Emerg Nurs* 2005; 31: 346-350.
- Milsten AM, Maguire BJ, Bissell RA, Seaman KG. Mass-gathering medical care: a review of the literature. *Prehosp Disaster Med* 2002; 17: 151-162.
- Woodfin BA, Eaton SB, Askew JL. Medical care at the 1996 Olympic Village. *J Med Assoc Ga* 1997; 86: 15-17.
- Hadjichristodoulou C, Mouchtouri V, Soteriades ES, Vaitis V, Kolonia V, Vasiliogiannacopoulos AP, et al. Mass gathering preparedness: the experience of the Athens 2004 Olympic and Para-Olympic Games. *J Environ Health* 2005; 67: 52-57.
- Levett J. A new opportunity for public health development: Athens 2004. *Prehosp Disaster Med* 2004; 19: 130-132.
- People's daily online. Medical services impress visitors. <http://english.people.com.cn/90001/90776/6485595.html>. 2008.

Received May 13, 2011

Accepted after revision September 16, 2011