Medical Care Delivery at the 1996 Olympic Games

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Context.—Mass gatherings like the 1996 Olympic Games require medical services for large populations assembled under unusual circumstances.

Objective.—To examine delivery of medical services and to provide data for planning future events.

Design.—Observational cohort study, with review of medical records at Olympics medical facilities.

Setting.—One large multipurpose clinic and 128 medical aid stations operating at Olympics-sponsored sites in the vicinity of Atlanta, Ga.

Participants.—A total of 10 715 patients, including 1804 athletes, 890 officials, 480 Olympic dignitaries, 3280 volunteers, 3482 spectators, and 779 others who received medical care from a physician at an Olympic medical station.

Main Outcome Measures.—Number of injuries and cases of heat-related illness among participant categories, medical use rates among participants with official Games credentials, and use rates per 10 000 persons attending athletic competitions.

Results.—Injuries, accounting for 35% of all medical visits, were more common among athletes (51.9% of their visits, $P < .001$) than among other groups. Injuries accounted for 31.4% of all other groups combined. Spectators and volunteers accounted for most (88.9%, $P < .001$) of the 1059 visits for heat-related illness. The rates for number of medical encounters treated by a physician were highest for athletes (16.2 per 100 persons, $P < .001$) and lowest for volunteers (2.6 per 100). Overall physician treatment rate was 4.2 per 10 000 in attendance (range, 1.6-30.1 per 10 000). A total of 432 patients were transferred to hospitals.

Conclusions.—Organizers used these data during the Games to monitor the health of participants and to redirect medical and other resources to areas of increased need. These data should be useful for planning medical services for future mass gatherings.

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MASS GATHERINGS require the provision of medical services for large populations who have assembled under unusual circumstances. Mass gatherings, including scheduled events in sports facilities, air shows, rock concerts, outdoor celebrations, and visits by dignitaries, vary in their complexity and demand for medical services.[1-5] The 1996 Centennial Olympic Games was a mass gathering that posed unique challenges for ensuring the public health and medical safety needs of its participants.[6] During the 17 days of the Olympics, an estimated 5 million people (including visitors and residents of metropolitan Atlanta) from 197 different countries gathered in a confined area under subtropical environmental conditions.[7] The duration, size, and location of the gathering, likelihood of hot weather, and concerns about terrorism influenced the planning of medical services for participants.[8-11] The official organizer, the Atlanta Committee for the Olympic Games (ACOG), was responsible for providing medical services at all Olympic residential, training, and competition sites. The Centers for Disease Control and Prevention (CDC) developed a health surveillance system that monitored daily the health and safety of Olympics participants. In this article we examine medical care delivery during the 1996 Olympics and provide data that should be useful for planning future Summer Olympics and other mass gatherings.

METHODS

Participants

We categorized persons on the basis of accreditation status, the system of classification used by ACOG in issuing identification passes. Because of concerns about security, all persons who were working or otherwise participating in the Olympics (other than spectators) were required to wear identification badges.

See also pp 1469 and 1485.

Athletes were persons engaged in competition; officials included team officials (eg, coaches and trainers), referees, and judges; the Olympic family comprised members (and their dependents) of the International Olympic Committee and the National Olympic Committees and other dignitaries; volunteers included full-time and part-time staff of ACOG; and spectators were persons without accreditation.

Medical Care Organization

Medical care for the 1996 Olympics was coordinated by the Medical Services Department of ACOG. There were 3346 volunteers who provided medical care.[12] Volunteers included 664 physicians, 474 nurses, 246 paramedics, 242 emergency medical technicians, 411 American Red Cross first responders, 796 trainers, 128 physical therapists and massage therapists, 80 dentists, 20 podiatrists, and 335

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administrators. Medical services were responsible for providing first aid and emergency care for all athletes, spectators, staff, and volunteers who sought care at any Olympic site. All persons were required to provide written consent before receiving medical care. Sites included the polyclinic (located in the Olympic Village), 24 competition venues (eg, the Olympic Stadium) and 11 noncompetition venues (eg, Centennial Olympic Park and the main press center).

Beginning July 6, the polyclinic, a 2250-m^2 facility located in the Student Health Center of Georgia Institute of Technology, Atlanta, provided medical care for athletes and the Olympic family residing in the Olympic Village. The polyclinic was open 24 hours a day, provided primary care and emergency medical care, and was equipped with an emergency assessment area, an observation unit, and 8 examination rooms. Other clinical services with capacity for minor surgical procedures were available in orthopedics, otolaryngology, ophthalmology, gynecology, psychiatry, and oral health. Support services included radiography (with teleradiography capacity), diagnostic ultrasound, mobile magnetic resonance imaging (MRI), pharmacy, and clinical laboratory. Although the polyclinic was available to all athletes, teams from some countries had their own physicians and other medical personnel. These medical teams were provided separate space within their residential areas.

At each of the sites of athletic competition, medical care was organized into sports medicine stations and spectator care stations. Athletes received care during competition at sports medicine stations, which were located near the competition site and were staffed by at least 1 physician, 1 nurse, and 1 trainer. Athletes also could seek care (eg, massage therapy and athletic trainers) at a sports medicine station located in the Olympic Village.

Eighty-four spectator care stations operated at the 24 competition venues. Each venue supported 1 to 3 stations. At the Olympic Stadium, the largest venue, there were 8 spectator care stations. At these stations, physicians and other medical personnel provided care for spectators, staff, and volunteers. Each care station, which opened 2 hours before each day's competition began, was equipped to respond to cardiac arrests and to provide care for minor and less urgent medical problems. In addition to the spectator care stations, mobile aid teams (comprising 1 emergency medical technician and 1 paramedic) at each Olympic site circulated among spectators within the venue and provided minor aid (eg, dispensed aspirin or sunscreen). There was 1 mobile aid team for each 20 000 spectators.

Spectators and others requiring nonemergency care beyond that available at the venue were referred to an outpatient clinic or designated referral hospital. For emergencies, the patient was transported by ambulance to the closest hospital. Emergency medical services and transportation plans were developed to provide service at each venue. At least 1 ambulance was assigned for every 20 000 spectators expected. As soon as an ambulance crew began to provide care for a patient, a replacement ambulance was dispatched to that venue.

Nine hospitals in the metropolitan Atlanta area and 8 in outlying areas formed a network of Olympic hospitals that provided care to patients who were referred from ACOG medical facilities. In the Atlanta area, each venue had a designated hospital to which patients requiring emergency treatment were referred.

Operating Costs

The cost of establishing and operating the medical care system was $4.36 million (polyclinic, $1.46 million; sports medicine and spectator care stations, $2.9 million). Because the building that housed the polyclinic had recently undergone extensive renovation, physical refurbishments for the Olympics were limited to creating 4 dental assessment and treatment rooms. Sources of funds included $450 000 from ACOG's operating budget and approximately $4 million value-in-kind donated products, including $600 000 for major equipment (eg, defibrillators, hemodynamic monitoring devices, use of MRI). No tax dollars were used to support medical service delivery. Nearly all of the equipment and unused products were returned to the original donor source (eg, hospitals, equipment manufacturers). At the end of the Games, some of the monitors and defibrillators were donated to community groups.

Medical care at the polyclinic, sports medicine stations, and spectator care stations was provided without charge to the patient. For additional medical care, ACOG, through an insurance carrier, provided coverage for medical expenses (eg, for emergency illness and unintentional injury) to athletes, officials, and members of the Olympic family. Spectators requiring additional care beyond the spectator care stations assumed responsibility for those medical expenses.

Heath Information System

A health information system was developed to monitor the health status of athletes, staff, and spectators; to document service delivery; and to identify unusual patterns of illness or injury requiring further investigation. Reports summarizing the previous 24 hours were submitted each evening to the Medical Commission of the International Olympic Committee. The 2 sources of information for these reports were logbook entries (completed for all patients seeking care) and medical encounter forms (completed for patients who were evaluated and treated by a physician).

The mobile aid teams recorded in a logbook the name and the nature of the treatment of each person who received care. For any athlete seeking care at a sports medicine station, an entry was listed in a clinic logbook. The name of any person seeking treatment at a spectator care station was listed in a medical services logbook. For a minor condition (eg, headache) that could be treated by nursing or other staff, the listing in the medical services logbook was the only documentation of the visit to the aid station. For persons with more substantial problems that were treated by a physician, medical information was recorded on a standard encounter form.

The medical encounter form was a legal-size, single-page form that was designed and pretested at 4 world-class sporting events held in the Atlanta area during 1995 and 1996. Medical encounter forms were used in sports medicine stations and spectator care stations. The practitioner used the upper portion of the form to record written notes. A listing of clinical diagnoses (ie, primary reason for visit) that the practitioner could check was printed on the lower portion of the form.

Every 2 hours, medical clerks from each Olympic venue faxed all logsheets (from mobile aid teams, sports medicine stations, and spectator care stations) and all completed medical encounter forms to a central location. Data from the logsheets and medical encounter forms were entered into a computer, results were analyzed, and daily reports were generated.

Analysis

We used data from the logbooks and medical encounter forms to determine medical service use. Logbook data were used to calculate overall service delivery (ie, number of persons seeking any treatment). Data regarding patient characteristics (eg, age, sex, accreditation status) and diagnoses were available only from the subset of patients who had medical encounter forms. Data were available from July 6, when the Olympic Village and the polyclinic opened, through August 4, the end of the Olympics. Unless otherwise specified, we did

not separate data for the preparation period (July 6-18) from data collected during the official dates of the Olympics (July 19-August 4).

To calculate physician treatment rates for persons who had been accredited, we obtained denominator data supplied by ACOG from their accreditation database. The accreditation database was a computerized listing of the names and limited demographic data (eg, age and sex) of all persons who were issued identification badges. Rates (ie, cumulative incidence) were calculated as the number of medical encounters (treated by a physician and generating a medical encounter form) per 100 persons in a given accreditation category. Dental and routine eye examinations were excluded from analysis.

To calculate use rates at competition venues, we used ticket attendance data supplied by ACOG. Analysis was restricted to the 16 venues located in the greater Atlanta metropolitan area for which complete medical records were available for inspection at the end of the Games. Medical care use rates were calculated by determining the number of logbook entries at spectator care stations, divided by total number of attendees. Physician treatment rates were calculated by determining the number of patients (excluding athletes) with medical encounter forms completed by a physician divided by the total number of attendees.

We analyzed data using Epi Info Version 6.04 (CDC, Atlanta) software, comparing means using analysis of variance and proportions using χ^2 statistics.

RESULTS

Total Patient Visits

From July 6 through August 4, the ACOG Medical Services Department provided care for 44 142 persons whose medical encounters were recorded in logbooks. Visits to spectator care stations accounted for 33 643 (76.2%) encounters, mobile aid teams provided care to 3451 (7.8%) persons, and visits to sports medicine stations accounted for 7048 (16.%) encounters. From July 6 through July 18, the daily number of encounters increased gradually (Figure), and after the opening ceremony, the number increased rapidly. From July 19 through August 4, spectator care stations averaged 2363 daily encounters; sports medicine stations, 311; and mobile aid teams, 178.

Patients Treated by Physicians

From July 6 through August 4, a total of 10 715 persons who visited sports medicine or spectator care stations were treated by a physician and had a medical encounter form completed. The temporal pattern for medical encounters treated by physicians paralleled overall medical service use. Most patients (n = 9134, 85.2%) were treated from July 19 through August 4, when the daily average was 587 patients (daily range, 233-676).

Among patients treated by physicians, spectators accounted for the largest number of visits (n = 3482, 32.5%), followed by volunteers (n = 3280, 30.6%), athletes (n = 1804, 16.8%), and other groups (Table 1). Repeat visits accounted for 893 (8.3%) of the total. Repeat visits were more common for the Olympic family, officials, and athletes; such visits were infrequent for spectators.

Characteristics of persons receiving medical care varied by accreditation status. Overall mean age was 33.9 years; the mean age of athletes was 26.0 years ($P < .001$), whereas the mean age of the media, Olympic family, and officials was older (42.1 years, $P < .001$). Among all patients, there were more males (53.4%) than females. Within accreditation subgroups, athletes, officials, the Olympic family, and the media were predominately male ($P < .001$). Only among volunteers and spectators was the majority of persons who received care female.

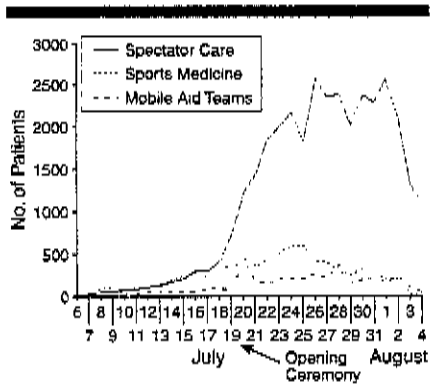
Regarding specific diagnoses, sprain/strain was the most common reason for a visit (n = 1450, 13%), followed by upper respiratory tract infection (n = 922, 9%), heat cramps/dehydration (n = 801, 8%), contusion/abrasion (n = 777, 7%), other injury (n = 520, 5%), laceration (n = 487, 4%), and nausea/vomiting (n = 387, 4%).

The distribution of reasons for receiving medical care varied by accreditation status (Table 1). Injuries predominated among athletes, accounting for 51.9% of their visits ($P < .001$). Among members of the Olympic family, upper respiratory tract infection was the most frequently listed reason for the visit, and 2 chronic conditions, diabetes and hypertension, were among the 10 most common reasons for physician care.

Heat-related illness was the most common condition among spectators (n = 752, 21.6%). Spectators and volunteers accounted for most (88.9%) of the visits for heat-related illness ($P < .001$). Heat-related illness was rare among officials, members of the Olympic family, and the media.

Patient Disposition

Most of the patients treated by physicians were released, either to their own physicians (n = 9275) or for follow-up in another ACOG medical facility (n = 808). A few patients (n = 63, 0.6%) left before being seen or against medical advice. A total of 569 patients were transferred to the polyclinic, another outpatient facility, or a hospital. Of the 432 patients transferred to hospitals, 271 required emergency (ie, ambulance) transport. Most emergency transports involved spectators (n = 155, 57.2%) or volunteers (n = 61, 22.5%). Diagnoses among the 271 persons who required emergency transport included heat-related illness (n = 27, 10%), injuries (n = 62, 22.9%), and other medical illness (n = 182, 67.2%). Of those persons with medical illness, 98 received emergency transport for cardiac disorders (ie, diagnoses of chest pain, ischemic heart disease, or hypertension). Three patients sustained cardiac arrest; 2 were successfully resuscitated and transferred to a hospital and 1 died. Forty-one patients were transported via ambulance for gastrointestinal tract disorders (ie, abdominal pain, nausea/vomiting).



Number of patients listed on log sheets, by type of service and date, 1996 Summer Olympics, Atlanta, Ga.

Hospital Admissions

Patient outcome data were available for the 3 major Atlanta hospitals responsible for providing care to athletes, the Olympic family, the media, residents of the Olympic Village, and 10 large competition venues (eg, Olympic stadium). Transfers to these hospitals accounted for 183 (67.6%) of all emergency transfers.

Of the 101 persons admitted to these hospitals, 23 were admitted for chest pain, 8 of whom had confirmed myocardial infarctions, and 2 of whom had subsequent coronary angioplasty. Two underwent coronary artery bypass graft surgery. Other reasons for hospitalization include injuries (n = 19, mostly athletes), gastrointestinal tract disorders (n = 11, eg, 5 with upper gastrointestinal tract bleeding), renal disorders (n = 8, eg, 3 with renal stones), infectious diseases (n = 7, eg, 2 with malaria), pulmonary conditions (n = 7, eg, 3 with pulmonary embolus), and central nervous system disorders (n = 5, eg, 1 with sei-

Table 1.—Characteristics of Persons Receiving Medical Care at the 1996 Summer Olympics by Accreditation Status*

Characteristic	Accreditation Status						
	Athletes	Officials	Olympic Family	Media	Volunteers	Spectators	Total
Mean age, y (SD)	26.0 (5.3)	44.4 (10.2)	41.8 (19.5)	39.6 (9.4)	34.4 (13.2)	32.6 (18.1)	33.9 (14.7)
Age range, y	14-58	15-75	0-84	16-77	10-85	0-94	0-94
% Male	64.6	83.1	61.5	83.3	46.3	38.1	53.4
No. of visits							
Heat-related illness, No. (%)†	95 (5.3)	6 (0.7)	5 (1.2)	10 (1.3)	187 (5.7)	752 (21.6)	**1056** (9.9)
Injury, No. (%)‡	936 (51.9)	225 (25.3)	89 (18.5)	167 (21.4)	1272 (38.8)	1045 (30)	**3734** (34.8)
Other illness, No. (%)	773 (42.8)	659 (74.0)	385 (80.2)	602 (77.3)	1821 (55.5)	1685 (48.4)	**5925** (55.3)
Total, No. (%)	**1804 (100.0)**	**890 (100.0)**	**480 (100.0)**	**779 (100.0)**	**3280 (100.0)**	**3482 (100)**	**10 715 (100.0)**
No. (%) of repeat visits	214 (11.9)	133 (14.9)	78 (16.2)	63 (8.1)	304 (9.3)	101 (2.9)	**893** (8.3)

*Patient treated by a physician and visit recorded on medical encounter form.
†Includes heat cramps/dehydration, heat syncope, and heat stroke.
‡Includes concussion, fracture/dislocation, sprain/strain, contusion/abrasion, laceration, foreign body, multiple trauma, burn/scald, other burn, and other injury.

Table 2.—Clinical Services and Diagnostic Tests at the Olympic Village Polyclinic During the 1996 Summer Olympics

Service (No. of Patients)	No. of Services Provided
Laboratory services	
Complete blood cell count	213
Biochemical profiles	129
Urinalyses	114
Group A streptococci screening	42
Erythrocyte sedimentation rate	33
Other tests performed at polyclinic	189
Referral to hospital laboratory*	217
Total (500)	**937**
Diagnostic tests	
Magnetic resonance imaging (204)	204
Radiography examinations (634)	744
Ultrasound (112)	112
Pharmacy	
Prescriptions filled	3500
Dental services	
Dental radiographs	500
Fillings	400
Extractions	84
Endodontal procedures	62
Oral surgery	14
Total (910)	**1060**
Eye services	
Eyeglasses	620
Contact lenses	50
Other	120
Total (790)	**790**

*Includes stool samples for culture, thyroid profiles, and malaria smears.

zures). Two persons were admitted for heat exhaustion. There were no deaths among persons admitted to hospitals.

Polyclinic Services

The clinical services and diagnostic tests provided at the polyclinic are summarized in Table 2. Most of the MRI and ultrasound tests were for musculoskeletal conditions. Use of these tests increased steadily during the Games.

Use Rates Among Persons With Accreditation

A total of 178 367 persons were accredited to participate in the Olympics (Table 3). The majority of accredited persons were volunteers (n = 136 660, 76.6%). The overall medical use rate (based on data from the 6690 persons for whom complete information on age and sex were available) was 3.8 encounters per 100 persons. Use rates varied markedly by accreditation status. Unadjusted use rates were highest for athletes (16.2 per 100, $P < .001$) and lowest for volunteers (2.0 per 100). Use rates did not vary by sex, except for volunteers, for whom the rate was higher for females than for males (2.6 vs 1.6 medical encounters per 100 accredited persons). Use rates adjusted for age and sex were similar to unadjusted rates, except among members of the Olympic family. Adjustment for age and sex lowered the Olympic family use rates from 7.7 to 5.8 per 100.

Use rates (ie, number of medical encounters treated by a physician per 100 accredited persons) varied by age and displayed distinct patterns for athletes compared with other accredited persons (Table 3). For athletes, use rates gradually increase with age, except for a decline among persons aged 50 to 59 years (which is based on more limited data). For officials, the rate declined with increasing age. For the Olympic family and volunteers, the distribution of use rates is U-shaped, with higher rates among younger and older persons and the lowest rates among persons aged 20 to 39 years. Rates among members of the media did not exhibit a pattern.

Use Rates at Competition Venues

From July 19 through August 4, the total number of patients (recorded in spectator care logbooks) treated at competition venues ranged from 75 at Clark Atlanta University (a small stadium where field hockey was played) to 4840 at the Olympic Stadium (site of the track and field competition and the opening and closing ceremonies) (Table 4). The overall use rate was 22.9 patients per 10 000 in attendance (range, 8.4-130 per 10 000). The number of patient visits that required treatment by a physician at each venue ranged from 14 to 742. The overall physician treatment rate for this period was 4.2 patients per 10 000 in attendance (range, 1.6-30.1 per 10 000).

COMMENT

The 1996 Summer Olympics was a mass gathering with unique characteristics that created complex demands on medical service delivery. These characteristics include the large number of participants and spectators (the largest peacetime gathering in history), long duration (31 days, beginning with the opening of the Olympic Village), and areas of high population density (with 12 of the 24 venues located within a 5.2-km-diameter circle in downtown Atlanta). The Olympics medical services had to be fully coordinated with emergency medical services, disaster planners, and local, state, and federal health officials.

Planning for medical services at the Olympics began in 1991.[13] Because of Atlanta's climate, heat-related illness was expected to pose substantial risk. Injuries were expected to produce a major proportion of medical visits.[14,15] Outbreaks of infectious diseases, such as common-source foodborne outbreaks, were possible, as were person-to-person transmission of disease among athletes and airborne transmission of diseases (eg, measles) within the confines of indoor venues.[16,17] Finally, planning efforts also recognized that the highly publicized Olympics might attract a terrorist attack with a biological or chemical weapon.[11]

In contrast with previous studies of medical care at Olympics held in North America, we analyzed data by accreditation status of the participants.[14,15,18] We found differences in the types of medical problems and use rates across categories of participants. The variability in use probably reflects the different types of activities and exposures that members of each group experienced. For example, volunteers and spectators experienced most of the heat-related illness, and generally relied on walking or using public

Table 3.—Medical Encounters and Use Rates at the 1996 Summer Olympics by Accreditation Status and Age*

	Accreditation Status											
	Athletes (N = 11 064)		Officials (N = 9202)		Olympic Family (N = 6048)		Media (N = 15 393)		Volunteers (N = 136 650)		Total (N = 178 367)	
Age, y	No.	Rate†	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
0-9	0	0	0	0	9	4.6	0	0	0	0	9	4.6
10-19	151	14.4	5	12.8	116	17.1	7	4.9	349	3.1	630	4.8
20-29	1259	15.9	55	8.8	17	3.2	105	4.0	876	2.4	2312	4.7
30-39	347	18.2	225	9.4	41	4.1	288	4.6	632	1.8	1533	3.2
40-49	36	23.5	312	9.9	77	5.3	265	6.2	525	1.7	1215	3.0
50-59	2	9.5	212	9.9	126	9.5	87	4.9	261	1.7	688	3.3
60-69	0	0	52	7.3	51	8.0	21	6.4	111	2.1	235	3.4
>70	0	0	6	5.0	26	12.3	1	3.1	35	2.9	68	4.3
Total	1795	16.2	867	9.4	465	7.7	774	5.0	2789	2.0	6690	3.8

*Data exclude 543 persons with unknown age or sex.
†Indicates number of medical encounters per 100 persons.

Table 4.—Medical Service Use at the 1996 Summer Olympics by Competition Venue

Venue	Event	No. of Patient Visits*	No. of Patients Treated by Physicians†	Total Attendance‡	Use Rate§ per 10 000	Physician Treatment Rate‖ per 10 000
Clark Atlanta University	Field hockey	75	14	88.7	8.4	1.6
Aquatic Center	Aquatics	963	259	735.9	13.1	3.5
Alexander Memorial Coliseum	Boxing	418	181	318.4	13.1	5.7
Georgia Dome	Gymnastics, basketball, handball	2504	370	1844.6	13.6	2.0
Morehouse College	Basketball	160	50	107.0	15.0	4.7
Omni	Basketball	1210	192	645.6	18.7	3.0
Atlanta Fulton County Stadium	Baseball	2484	474	1198.3	20.7	4.0
Georgia World Congress Center	Handball, fencing, weight lifting	1955	478	838.2	23.4	5.7
Atlanta Beach	Beach volleyball	301	84	128.0	23.5	6.6
Morris Brown University	Field hockey	732	69	303.9	24.0	2.3
Olympic Stadium	Track and field	4840	742	1722.7	28.0	4.3
Wolf Creek	Shooting	183	56	62.5	29.3	9.0
Stone Mountain Cyclodrome	Cycling	908	78	227.4	39.9	3.4
Stone Mountain Archery	Archery	576	106	122.4	47.1	8.7
Georgia Horse Park	Equestrian, biking	2388	468	492.7	48.4	9.5
Ocoee	Canoeing, kayaking	608	141	46.8	130.0	30.1
Total		20 315	3762	8883.2	22.9	4.2

*Total number of persons listed on log sheets of spectator care stations.
†Number of patients treated by physicians at spectator care stations.
‡Indicates thousands.
§Number of persons listed on log sheets per 10 000 in attendance.
‖Number of patients treated by physicians per 10 000 in attendance.

transportation, whereas members of the other groups usually were provided with special transportation. For the Olympic family and spectators, the higher use rates among younger and older persons reflect a pattern commonly seen in rates for visits to outpatient and emergency facilities.[19]

Three cardiac arrests occurred at the venues, and most emergency transports from venues to hospitals were for cardiac conditions. These findings underscore the importance of having advanced cardiac life support capability within each venue and of coordinating ACOG medical services with experienced emergency medical services, transportation systems, and local hospitals. The bombing incident in Centennial Olympic Park occurred in the early morning of July 27, after the spectator care station had closed for the night. The number of casualties was so large that local first responders (ie, firefighters and police) immediately assumed responsibility, as planned, for evacuating injured persons to local hospitals. Our study does not include data on immediate treatment for bombing victims.

Operation of the ACOG medical care system was fully integrated with the activities of public health and other government officials. During the Olympics, CDC operated the health information system that generated daily reports (in English and French) and summarized medical activity for review by the International Olympic Committee. Local, state, and federal public health officials reviewed daily medical service data.

The primary objective of our system was to monitor the health and safety of athletes, staff, and spectators who sought care at any Olympic medical site. The system was not designed to monitor patterns of use of existing medical facilities such as emergency departments. During the Olympics, the Georgia Department of Human Resources monitored emergency department encounters in 8 sentinel hospitals. Overall use of these facilities did not markedly change from the baseline period preceding the Games, and the number of emergency department visits for heat-related illness actually decreased during the Olympic period.[20] A decrease in the number of visits to hospital emergency facilities during the Olympics has been previously described.[15]

During the Games, ACOG used medical service data to redirect resources (eg, to assign additional medical personnel to the spectator care stations in Centennial Olympic Park, a popular gathering spot), to identify persons whose diagnoses (eg, bloody diarrhea or jaundice) had potential public health impact, and to correct environmental hazards at the venues.

The 1984 Olympic Games in Los Angeles, Calif, was the most recent summer Olympics held in North America. Com-

pared with those Games,[14] the 1996 Summer Olympics were considerably larger, with nearly 8 million spectator tickets, double that in Los Angeles. Data from logbooks show that although the total number of persons treated was 44 142 in Atlanta and 5516 in Los Angeles, total use rates were comparable in Atlanta (22.9 visits per 10 000 in attendance) and Los Angeles (16 per 10 000 in attendance). Moreover, the proportion of total patient visits requiring treatment by a physician was comparable (26.3% in Atlanta vs 29% in Los Angeles).

We calculated use rates using 2 different methods. Among accredited persons, we calculated the number of medical encounters as a proportion (ie, cumulative incidence) of the number of persons within a given accreditation category. Thus, in planning similar events, the anticipated number of persons within a given category (eg, number of athletes) can be used to calculate expected number of medical encounters. For use rates at venues, we used total attendance in the denominator. Organizers, knowing the expected attendance at their venue, can use these data to predict patient loads.

Actual use of ACOG physicians and medical services, particularly for athletes, can be influenced by several factors. The presence of team physicians from other countries decreases the demand for services from ACOG, although US specialists who were volunteering at the polyclinic were frequently sought for consultations. Furthermore, the rules of each sports federation that governed a particular sport often determined whether an ACOG volunteer physician or a physician working for the federation would provide initial care to an athlete during competition. Finally, the athletes commonly seek the services provided in the polyclinic, such as dental and ophthalmic care and diagnostic imaging tests, that may be less readily available in their own countries.

Several potential limitations in these data should be noted. With the large number (n = 664) and high turnover of volunteer physicians involved in the Olympics, the recording of diagnoses may not have been standard across sites. Because our interest is in aggregated categories (eg, injuries or heat-related illness), however, such variability should not substantially affect the results.

Incomplete reporting of medical encounters can produce biased results. Data on age and sex were missing on 5.2% and 2.9% of forms, respectively. We encouraged timely and complete reporting of data from the venues by training clerical and professional staff, conducting frequent site visits, and providing daily feedback reports. Thus, although underreporting was an ongoing concern, this potential bias did not substantially influence our summary results. At the completion of the Centennial Olympic Games, original records were received from nearly all venues and were checked for completeness. Reporting was probably less complete from the 4 soccer venues located in other states (and 4 venues in the Atlanta metropolitan area), from which final medical records were not available to verify completeness. Because reports from these sites represent a small proportion of the number of visits, such underreporting is unlikely to have substantially influenced our results.

In planning for mass gatherings, medical personnel and other organizers need to identify comparable events and experiences that can provide the best guidance for estimating the number of patients, types of medical problems, and estimated use rates. The medical service data from the 1996 Olympics provide valuable information for planning upcoming mass gatherings (eg, the 1998 Goodwill Games in New York, NY and the Summer Olympics in Sydney, Australia, in 2000 and Athens, Greece, in 2004). The surveillance methods that we developed and implemented to monitor medical care delivery for the Games illustrate the evolving challenges and benefits of establishing flexible and useful health information systems. These systems must satisfy multiple needs to operate effectively at the complex interface between the practices of clinical medicine and the assurances of public health.

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