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The London 2012 Summer Olympic Games: an analysis of usage of the Olympic Village 'Polyclinic' by competing athletes

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Keywords: London 2012, Olympic Games, Polyclinic, elite athlete

Abstract

Background: The London 2012 Summer Olympic Games involved 10,568 elite athletes representing 204 competing nations. To manage the varied healthcare needs of this diverse population a Polyclinic was constructed in the athletes' village.

Aim: This work aims to summarise the usage of the Polyclinic by competing athletes and the facilities available to them.

Methods: All Polyclinic encounters were entered into a database from which data was exported for the timeframe 28th July – 12th August 2012 inclusive to cover the first to last full day of competition. Only Polyclinic data involving accredited athletes was analysed. All types of encounters were collected for analysis not just sports-related issues. Data from other venue medical stations was not analysed. A sub-analysis for all encounters by athlete's continent of origin has also been performed. Data for prescriptions dispensed and pathology investigations is also presented.

Results: There were a total of 3,220 encounters within the Polyclinic. This figure combines medical consultations, radiology / pathology investigations and prescriptions dispensed. Of these 3,220 encounters there were 2,105 medical consultations; musculoskeletal comprised the greatest number (52%), followed by dental (30%) and ophthalmic (9%). The most frequently used imaging modality was magnetic resonance imaging and diagnostic computer tomography was used the least. After correction for multiple entries, Africa provided the largest proportion of athletes attending the Polyclinic (44%) and Europe the least (9%). Peak usage of all facilities was seen around days 9-10 of competition reflecting the busiest time of competition and largest number of athletes in the Village.

Conclusions: The Polyclinic managed a wide variety of both sports-related and non sports-related injuries and illnesses. The breadth of specialists available for consultation was appropriate as was the ease of access to them. The radiology department was able to satisfy demand, as were the pharmacy and pathology services. We would recommend a similar structure of facilities and available expertise in one clinic when planning future mass participation sporting events.

Keywords: Olympic Games, polyclinic, elite athlete, London 2012

Background:

The London 2012 Summer Olympic Games involved 10,568 elite athletes competing for 204 separate National Olympic Committees (NOC's). It was of comparable size to that of previous Summer Games [1,2] but over twice the size of either the 2002 Manchester Commonwealth Games (3,679 participants) [3] or 1948 Summer Olympics (4,104 participants) previously held in London. [4] To manage the varied healthcare needs of those involved, a polyclinic was constructed on the athletes' village site in Stratford, East London. The London Olympic Games Organising Committee (LOCOG) aimed to provide a dedicated on-site medical facility to be staffed by volunteer experts across multiple sports-related specialties similar to that of previous Games.[2,5] Their aim was to manage the majority of Games-related healthcare issues internally in an attempt to provide an optimal level of care and avoid pressure on local hospitals and other healthcare providers.

Protection of the health of competing athletes' remains a key objective during an Olympic Games and forms an important part of the International Olympic Committee's (IOC) agenda.[6,7] One of the main aims of the IOC is to provide freely available healthcare to all athletes during a Games as well as institute safeguarding measures to protect athletes during competition. It is accepted that the healthcare needs of elite athletes is complex and extends beyond the immediate injuries sustained in competition. Furthermore, incidence of injuries and illnesses is known to vary according to individual sports and by athlete's country of origin.[8,9]

This paper aims to summarise the utilisation of resources within the clinic as well as comment more generally on patterns of usage by different nations. In presenting data on only those competing it will provide a novel insight into the health-seeking behaviours of a diverse population of elite athletes. The scale of the facility is detailed as well as the equipment and personnel needed to service such a large event involving worldwide participants from varied domestic healthcare systems.

Methods

The Polyclinic was situated within the Athletes' Village in Stratford, East London and was in close proximity to the main Olympic Park. It functioned as a small hospital and was arranged over five fully integrated floors. In the basement a small pool, zero gravity treadmills and massage tables provided rehabilitation and recovery facilities. The ground flood was the administrative

centre with a reception, pharmacy and offices. There was also an acute care department including three beds for overnight admission. The first floor was the main treatment hub and included consultation rooms (sports medicine, general medicine, therapeutic radiology), physiotherapy department and research centre. The second floor was used for sports medicine and podiatry and the top floor contained large dental and optometry departments as well as meeting rooms.

The Polyclinic was staffed entirely by volunteers and included general physicians, sports medicine doctors, dentists, ophthalmologists, optometrists, physiotherapists, podiatrists and sports massage therapists. Other services included a dispensing pharmacy and fully functioning radiology department staffed by musculoskeletal radiologists. In addition, specialists could be called upon to visit athletes in the Polyclinic and there was ready access to extensive services in the nearby Homerton and Royal London hospitals.

All medical encounters were entered into a specially designed database (Atos IT Services Limited, London, UK), which was available to all staff working in the Polyclinic. The data inputted included general athlete demographic information, history of presenting complaint, past medical conditions, examination findings and investigations requested. The pharmacy and medical departments both used the same system and therefore allowed for accurate continuity of care and confidential data collation. The database was password protected and any paperwork containing athlete information (requests or results) was destroyed after the Games to ensure confidentiality was maintained.

Comprehensive blood analysis services were provided at the Polyclinic throughout the Games period. This testing was separate from the doping blood analysis, which was performed independently by the World Anti-Doping Agency (WADA) in a separate facility. The pharmacy department was only able to dispense medication prescribed by a doctor within the Polyclinic. Private prescriptions from outside were not dispensed. It was stocked with a wide range of drugs in line with current anti-doping policy.

The radiology department was equipped with 1.5 Tesla and 3 Tesla wide bore Magnetic Resonance Imaging (MRI) scanners, Discovery 750 HD 64 slice Computed Tomography (CT) scanner, 2 Logic E9 ultrasound units and an XR656 wireless digital x-ray system. Integrated radiology information system (RIS) and Picture Archiving and Communication System (PACS) was set up with facilities for voice recognition to generate and store dictated reports. Referrals for radiological investigations were accepted directly from both team doctors and LOCOG doctors

based at the polyclinic and at the event venues. Radiology requests were entered into the RIS system and this dataset was used to obtain imaging statistics.

Experienced musculoskeletal (MSK) Radiologists reported all radiological investigations apart from general ultrasound examinations that were carried out by trained sonographers. Interventional procedures were performed both under CT and ultrasound guidance by MSK radiologists. During the Games the majority of investigations were performed on athletes, followed by team officials and then work force. Athletes still competing were given preference over athletes who had finished their events. Requests for MRI and ultrasound were still being received on the closing day of the Polyclinic.

Data was exported from Atos and RIS for the timeframe 28th July – 12th August 2012 inclusive. Although some sports e.g. football started prior to this date the opening ceremony was held on the 27th July and the first full day of competition started on the 28th.

We defined 'Polyclinic encounters' as any accredited athlete seeking medical attention for injuries and illnesses sustained in both competition and training during the London Olympic Games. This included all medical consultations, pharmacy, pathology and radiology investigations / procedures. Non-athletes such as coaches, officials and other National Olympic Committee staff seeking medical attention were excluded from the analysis. Encounters taking place in any medical facility other than the Polyclinic, including in the field of play venues, were excluded as this work relates only to usage of the Polyclinic.

Data analysis and correction for duplicate data was performed using Excel, version Mac OS X (Microsoft, Redmond, Washington). Countries have been grouped into their respective continent based on the United Nations Statistics Division classification.[10] The proportion of attendances for individual athletes was calculated by dividing the number of individuals who were seen in the polyclinic by the total number of individual attendances. We present radiology data with means and standard deviation.

Results

Usage of Polyclinic departments

1. Medical Consultations

(i) General

Medical consultations included interactions with any of the healthcare specialists i.e. general physicians, sports medicine doctors, dentists, ophthalmologists, optometrists, physiotherapists, podiatrists and sports massage therapists. In total 2,105 medical consultations took place over the 16-day period. This data is summarised in figure 1 and illustrates a peak attendance around days 9 and 10 of competition when over 250 consultations took place each day. A sub-group analysis of this data has been performed to establish patterns of usage by athlete's continent of origin, which is presented later.

Figure 1. Summary of all medical consultations which occurred in Polyclinic during Games period. Peak usage was seen around day 9-10 of competition when 270 and 261 consultations occurred each day. The average (mean) was 201 daily consultations.

Musculoskeletal (52% of all encounters) and dental care (30%) were the most common category under which encounters were logged. Consultations covered a wide range of medical specialties and were not only limited to exercise-related complaints (table 1).

Table 1. Summary of all medical encounters

Category (total)	Details	Encounters (% of total)
Musculoskeletal(1457)	See table 2.	1457 (52)
Dental (858)	Caries, extraction, calculus / tartar, endodontics	305 (11)
	Mouthguard	273 (10)
	General 'check-up' consultation	207 (7)
	Gingivitis / Pulpitis / abscess	42 (1.5)
	Broken tooth / filling	31 (1)
Ophthalmic (238)	Eye test	213 (8)
	Foreign body, laceration, conjunctivitis	25 (0.9)

Ear, nose & throat	Sinusitis, otitis media / externa, tonsilitis	98 (3.5)
Dermatological	Thrush, acne, cellulitis, ezcema	60 (2)
Gastro-intestinal	Abdominal pain, nausa / vomiting, diarrhoea	44 (1.5)
Genito-urinary	UTI, pregnancy test, menstrual disorder	30 (1)
Neurological	Headache, collapse	15 (0.5)
Cardiovascular	Hypertension / Chest pain	4 (0.1)

(UTI = urinary tract infection)

(ii) Musculoskeletal encounters

The sub-division of complaints within the category is illustrated in table 2. On reviewing clinical records the 31% who were logged as involving 'multiple locations' most commonly related to athletes seeking physiotherapy or sports massage with multiple muscle tension points.

Table 2. Summary of musculoskeletal encounters seen in Polyclinic during Games period

Description	Totals (%)
Multiple locations	453 (31)
Muscle (injury / pain)	371 (25)
Joint injury	200 (14)
Tendinopathy, tenosynovitis, tendon rupture	141 (10)
Neck / back pain	112 (8)
Bone (fracture / pain)	81 (6)
Contusion	28 (2)
Laceration / abrasion	21 (1)
Fasciitis	20 (1)
Inflammatory arthritis	11 (1)
Bursitis	7 (0.5)
Head injury	7 (0.5)
Dislocation / subluxation	5 (0.3)

2. Radiology

A wide range of diagnostic investigations and imaging guided interventional procedures were performed on athletes during the games (figure 2), with MRI constituting the greatest component of daily workload (mean 34, SD 9). MRI showed a generally upward trend, peaking on day 9, with 50 MRIs before steadily declining to 25 MRIs on day 16. Diagnostic ultrasounds peaked on

the 10th day with 18 examinations, before coming down to 8 examinations on day 16. Compared to MRI and ultrasound, the number of plain x-rays performed had a slightly delayed peaked, on day 13 with 24 examinations. A total of 36 diagnostic CT scans were performed.

In contrast to the trends observed for MRI, ultrasound and plain films, the demand for interventional procedures was steady throughout the Games. Imaging guided interventional procedures on peripheral extremities such as corticosteroid and local anaesthetic injections for indications such as tenosynovitis and bursitis were performed under ultrasound guidance. Spinal interventions e.g. selective nerve root blocks, facet joint and epidural injections were performed under CT fluoroscopy.

The maximum number of interventional procedures in a day was 6 on days 1 and 7 (figure 2). Although diagnostic CT was a less utilised resource, the use of CT fluoroscopy for spinal interventional procedures and in evaluating possible bony stress fractures was thought invaluable. In this application, CT fluoroscopy had a major influence on future participation and performance outcome during the competition.

Figure 2. Line graph of daily number of procedures performed by radiology department in Polyclinic.

3. Pathology & Pharmacy

A total of 290 pathology tests were performed. These were performed at a steady rate throughout the Games with an average of 19 pathology tests performed daily (figure 3). In total 930 prescriptions were dispensed with a mean of 62 prescriptions each day. In a similar pattern to the peak in demand for other services, a rise in prescriptions was seen on day 10 when 122 prescriptions were processed.

Figure 3. Line graph of daily number of prescriptions and pathology requests performed in the Polyclinic.

Distribution of encounters by continent

Over the 16-day period under scrutiny there was a total of 3,220 encounters within the Polyclinic (table 4). This table combines usage of all services within the facility such as medical consultations, radiology / pathology investigations and prescriptions dispensed. Each encounter has been further analysed to establish the continent of origin of the athlete.

Table 4. Distribution of Polyclinic encounters by athlete continent of origin with correction for duplicate attendances

				Correction for duplicates		
Continent	**Total competing athletes**	**Polyclinic encounters**	**Proportion of total encounters (%)**	**Number of individual athletes**	**Proportion of total encounters**	**Proportion of athletes seeking attention (%)**
Africa	898	922	28.6	393	24.8	43.8
Asia	1757	520	16.1	249	15.7	14.2
Europe	5230	718	22.3	465	29.4	8.9
America	2009	843	26.2	273	17.2	13.6
Oceania	670	217	6.7	204	12.9	30.4
Independent Olympic Athlete	4	0	0.0	0	0.0	0.0
TOTAL	**10568**	**3220**	**100**	**1584**	**100.0**	

The greatest proportion of total encounters was from athletes competing for African nations (28%) followed by athletes from America (26%). Once corrected for duplicate encounters from the same athlete, Africa had the highest proportion of athletes seen at the Polyclinic (43.8%) and Europe the least (8.9%).

Discussion

This work highlights the broad range of diagnostic and therapeutic services available to athletes during the London 2012 Olympic Games. Peak usage of many of the facilities was seen around day 9-10 of competition (5^{th} – 6^{th} August 2012). This is when there is the greatest number of event finals occurring[11] and the athletes' village is at its busiest. As expected most consultations were musculoskeletal in origin but a sizeable proportion also related to dental and ophthalmic

complaints. The demand for MRI was significant reflecting the fact that this resource is considered not as freely available otherwise as it is during Games time. Pathology investigations were performed steadily throughout the period of competition but the demand for pharmacy services did spike considerably.

It is interesting to note from the continent sub-analysis that the greatest proportion of attendances was from athletes from African nations. This was for the gross number of overall attendances and also when corrected for multiple attendances by individual athletes. It is also interesting that although Oceania provided the smallest proportion of overall attendances (6.7%) this constituted the second largest fraction of visits by individual team members (30.4%). This reflects the fact that Oceania fielded the smallest number of athletes (670) therefore individual attendances would constitute a greater proportion of the small Oceania cohort.

Athletes were able to self-present to the Polyclinic and would often be accompanied by their NOC's medical or administrative staff. On arriving at the Polyclinic they were quickly triaged to the appropriate department and rarely had a significant delay in being seen. Staffing levels appeared to meet the demands effectively, however, minimal waiting time was seen for some of the busier services such as physiotherapy, sports massage and radiology. Despite being serviced entirely by volunteers, staff had undergone a comprehensive recruitment and selection process involving an induction and orientation to the building and working environment prior to the start of the Games. This enabled an efficient working environment right from the start of the Games and limited any start-up issues. Daily work-force meetings at the start and end of each shift further reinforced good communication and working relations amongst staff from different departments in the Polyclinic.

Efficient assimilation and storage of medical encounter data was crucial throughout the Games. Workstations connected to the Games network were available in all medical venues including all fields of play to allow timely data-input. This meant that records were kept contemporaneously and could be referred to during successive visits for the same individual. The Atos database provided an effective platform for this data to be securely stored and contained relevant data fields to be comprehensive and appropriate.

Practical implications and further research

The Polyclinic provided an appropriate breadth and accessibility of expertise and facilities to safeguard athlete health at the Games. Although staffed entirely by volunteers a high level of care was delivered and the aims of LOCOG and the IOC were achieved. The healthcare of elite athletes remains a key priority in the organisation of major sporting events although the specifics impact of this can be hard to predict. The work here provides clear details of what to expect and what is required for those planning similar future endeavours.

There are several other methods for estimating healthcare needs of such a population e.g. the World Health Organisation health impact assessment (HIA).[12] The HIA was found to be a useful tool in planning the public health agenda for the 2014 Commonwealth Games [13] but is generally considered to lack robust evidence to consider it reliable in predicting impact accurately.[14]

Alternative strategies to monitor an athlete's health include the collation of epidemiological data on injuries and illnesses sustained during major championships. There are many examples of this in the literature to include youth and adult cohorts participating in a wide range of sporting pursuits. [15-29] The longitudinal evidence acquired from successive championships has increased the scientific strength of these studies making them of vital importance in the monitoring of athlete health and wellbeing. Work by the International Olympic Committee has emphasised the importance injury surveillance [1] and now collects data on each Summer and Winter Games.[8,9,30]

The work presented highlights those health issues which could not be managed internally by the NOC's own medical staff. Examples include: access to pharmacy medication, use of specialist rehabilitation equipment, diagnostic imaging or obtaining specialist medical opinion. This may be due to a lack of medical personnel travelling with the team or the resources available to them domestically or at the Games. Teams with a small number of athletes are limited in additional personnel travelling with the team and will often chose coaching staff over a team doctor or physiotherapist.

It is acknowledged, however, that long distance travel is an independent risk factor for illness risk amongst elite athletes in competition.[31] In contrast, several of the larger teams choose to travel with extensive medical support diminishing the need to utilise Polyclinic services. These support staff are often present at pre-Games training camps and their own medical facilities could be seen throughout the athletes' village. It is noted, however, that America still comprised 26% of all Polyclinic encounters despite their large number of support staff.

In summary, this work provides details of the patterns of daily usage and the facilities required by elite athletes attending the London 2012 Olympic Games. Planning and provision of healthcare at an Olympic Games is a complex task which we feel was adequately achieved at these Games. The pattern of healthcare demands at this event will provide invaluable information for planning future mass participation sporting events. It is important to remember that this is only one facet of healthcare provision at an Olympic Games. It must be combined with field of play data as well as 'illness and injury' data such as that collected by the IOC to produce a more complete picture of all medical needs during these events.

Conclusion

The London 2012 Summer Olympic Games was the largest mass participation sporting event to be held in the U.K. It saw over ten thousand competing athletes from 204 separate nations. Much of these athletes' healthcare needs was provided by the Polyclinic located in the athletes' village. A wide range of diagnostic and therapeutic services were provided by the Polyclinic and these met the demands of this unique population of elite athletes. Provision and safeguarding athlete health is of paramount importance to the IOC and this was achieved through the role of the Polyclinic.

Summary box:

- The London 2012 Olympic Games was the largest sporting event in the UK to date and was over 2 ½ times the 1948 London Games
- 10,568 elite athletes participated from 204 separate nations
- This is the first paper to categorise attendance by continent of origin and analyse Polyclinic usage using this method
- Peak usage is expected by day 9-10 of competition coinciding with the greatest number of event finals and number of athletes resident in the Village.

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