

Grant, M.-E., Steffen, K., Glasgow, P., Phillips, N., Booth, L., Galligan, M. (2014). The role of sports physiotherapy at the London 2012 Olympic Games. *British Journal of Sports Medicine*, 48, 63-70.

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The advancing role of Sports Physiotherapy at the London 2012 Olympic Games

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Running head: London 2012 Olympic Games and Physiotherapy service

Key words: Physiotherapy, Olympic, Athlete, Non-Athlete, Encounter, Medical Records, Injuries, Overuse Injuries, first visit, follow-up, diagnosis, treatment modalities

Word count: 4,258

Abstract

Background: There is a lack of information on the utilization of physiotherapy services at the Olympic Games.

Aim: To better understand the athlete and non-athlete requirements of the physiotherapy services at the Olympic Village Polyclinic during the London 2012 Olympic Games.

Methods: From July 16 through to August 14 2012, physiotherapy encounters for athletes and non-athletes (NOC team officials, coaches, team managers, workforce, Olympic family, technical officials, and press) were recorded on the ATOS electronic medical records (EMR) system at the Polyclinic in the main Athletes' Village in Stratford.

Results: Of 1,778 encounters, 1,219 (69%) were administered to athletes and 559 (31%) to non-athletes. The anatomical areas most frequently recorded at first visits were knee (15.4%), lower lumbar spine/lower back (15.2%), and upper leg (12.6%) for athletes and lumbar spine/lower back (19.8%), knee (15.8%), and neck/cervical spine (15.2%) for non-athletes. Muscle and joint injuries were the most common diagnoses in athletes (33.3% and 24.8%) and non-athletes (24.4% and 30.1%). The 5 most frequently used treatment modalities were, massage (23.3%), mobilisation techniques (21.8%), taping (8.9%), cryotherapy (6.9%), and exercise prescription (6.4%). The most common cause of athletes' injuries was overuse (43.6%).

Conclusions: Analysis of London 2012 physiotherapy services has created a benchmark for future Games. This study highlights the physiotherapy needs of both athletes and non-athletes, the need for appropriate EMR systems and identifies high numbers of pre-existing and overuse injuries providing further insight into the advancing role of physiotherapy and reasons why athletes seek physiotherapy support during the Olympic Games.

Introduction

After 1908 and 1948, for the third time in history, the 2012 Olympic Games were hosted by London. Few sports events match the scale of the Olympic Games and capture such international attention.^{1 2} The protection of the health of the Olympic athlete is the core objective of the IOC Medical Commission.³ With increasing emphasis on prevention of injury and optimal support of the Olympic athlete, the role of physiotherapy is now widely recognised as being an essential part of the sports medicine team and the athlete's support structure. The London 2012 Olympic Games with more than 10,000 participating athletes ran from 27th July to 12th August 2012 and involved detailed planning and preparation of the physiotherapy services; recruitment of an expert physiotherapy team and planning of facilities for three Polyclinics and athlete medical rooms at 24 Olympic competition venues and 28 training venues.

The combined group of NOC (National Organising Committee) and LOCOG (London Organising Committee of the Olympic Games and Paralympic Games) physiotherapists formed the single largest professional group working at the Olympic Games.

Traditionally, sports physiotherapists and sports massage practitioners have been appointed as part of the OCOG (Organising Committee of the Olympic Games) medical team.⁴ Advances in sports medicine and science particularly over the past decade, however, have opened a wider spectrum of treatment and choices requiring a higher level of skill mix provided by a range of physical therapies disciplines.⁵ The London 2012 Olympic Games were the first Summer Games where osteopaths and chiropractors were accredited to the main Olympic Polyclinic and practicing in accordance to the IOC Medical Commission's policy on scope of practice. It is therefore of importance to gain further understanding of their role and function at the Olympic Games.

The advancing role of the sports physiotherapist is to provide treatment and rehabilitation of injuries in addition to providing support with injury prevention, maintenance, recovery and support for performance. To date, there has been only one study published, evaluating the physiotherapist services carried out in an Olympic Village Polyclinic (Athens 2004 Olympic Games),⁴ indicating a paucity of information on the utilization of physiotherapy services delivered to both athletes and the non-athletic staff competing and working at Olympic Games.

The current study aimed to provide an in-depth analysis of the physiotherapy service at the London 2012 Olympic Games to: A) describe the level and pattern of physiotherapy

activity at the main Olympic polyclinic at Stratford Olympic Village, B) to gain an understanding of athlete and the non-athlete requirements of the Polyclinic physiotherapy services in the Olympic Village by evaluating and comparing attendance and treatment modalities of the two groups, and C) to further our understanding of the evolving role of the sports physiotherapist and treatment skills required to treat and manage both the athletes and non-athletes who rely on the support of the Polyclinic Physiotherapy services during the Olympic Games.

Methods

Physiotherapy services were embedded in the polyclinics at the 3 Olympic Villages and available for a total of 31 days from the “*pre-competition period*” with the opening of the Olympic Village to the Opening Ceremony (16th to 26th July), the “*duration of Olympic competitions*” (27th July to 12th August), and for another two days of “*post-competition*” until the 14th August 2012. However, for the purpose of this paper, only data from the main Olympic polyclinic at Stratford were included, standing for the largest single facility of physiotherapy activity. Physiotherapy encounters administered at: the Rowing & Canoe Sprint and the Sailing Polyclinics, competition and training venues, and encounters administered by NOC physiotherapists were excluded from this study.

The Polyclinic in the Stratford Athletes Village was a purpose built 5,000m² building. Its design features were developed according to the building’s use and function “in legacy” after the Games: designed as a health and well-being centre for the local community. Physiotherapy was situated in 2 separate areas; the basement contained the hydrotherapy pool, ice baths and anti-gravity treadmills. The first floor physiotherapy treatment area (approx. 300m²) had two treatment rooms and approximately 8 treatment bays incorporating state of the art electrotherapy modalities including ultrasound, interferential, laser, and shockwave. There was a rehabilitation gym (approx. 140m²) and a wet area to provide cold therapy, which for safety reasons was separated from electrotherapy equipment. There was availability of cold therapy, ice packs and cryotherapy compression pumps.

Availability, access, and referral procedures

LOCOG made physiotherapy service available to all IOC accredited athletes and non-athletes, including NOC team officials, coaches, team managers, LOCOG workforce, Olympic family, technical officials, and press.

The 10,586 athletes could avail of the physiotherapy services in the polyclinic for assessment and treatment of an injury, but also for support with injury prevention, recovery, maintenance, and support of performance. The non-athlete group who were in excess of 15,000 personnel accredited to access the Olympic Village availed of the services for assessment and treatment of injuries, which in general tended to have occurred during the Games or presented as a 'flare up' of a pre-existing injury. An injury was defined as any musculoskeletal complaint that received physiotherapy attention regardless of the consequences with respect to absence from competition and training including newly incurred, pre-existing and not fully rehabilitated injuries. ⁶

Unlike previous Games where referral was required, ⁴ athletes and non-athletes could access the LOCOG physiotherapy services in confidence without the requirement of a referral or being accompanied. The direct access policy was possible to implement in London as the scope of practice for chartered physiotherapists in the United Kingdom as directed by their regulatory and professional bodies (Health and Care Professions Council and the Chartered Society of Physiotherapy) permit physiotherapists to treat without a referral: provided professional standards are met, particularly with respect to safety and professional ethics. Following physiotherapy assessment, athletes could be referred to other members of the multidisciplinary team, which comprised of a spectrum of medical, para-medical, dental and physical therapies disciplines.

Staff allocations and rostering of physiotherapy services

In view of the direct access policy for physiotherapy, it was necessary to recruit physiotherapists with appropriate physiotherapy education, skills and experience and preferably with an additional language (interpreters were readily available at all times). At least one team leader/senior physiotherapist was available on every shift. Staffing levels varied according to the demands on the service, on the busier days (23rd July to the 11th August) approximately 10-12 physiotherapists were required per shift and at peak times there were up to 16 required.

There were two shifts each day, an early roster from 6.30 am to 3.15 pm and a later roster from 2.30 pm to 11.15 pm with a period of crossover to provide time for transfer of information. A further ten physiotherapists were based at the polyclinic to supplement competition and training venue cover when needed, which required a flexible approach.

Medical records, encounter forms, and data recording

Physiotherapy encounters were administered by LOCOG physiotherapists, in some cases in collaboration with a NOC accredited physiotherapist. Each physiotherapy encounter was recorded on a bespoke electronic medical record (EMR) system (ATOS IT Services Limited, London, UK). Codes and classifications for physiotherapy treatments were developed in advance of the Games. Treatment modalities, anatomical areas, diagnoses, onset and cause of injury were classified and assigned specific codes. The EMR system only allowed one treatment modality to be recorded per treatment session for statistical purposes, despite multiple interventions included in the free text sections. Therefore, the modality of treatment considered as the primary treatment was recorded. The EMR system also limited the range of types of treatment modalities that could be classified with codes. Treatment encounters using modalities without a specific code were therefore recorded using generic codes.

All encounters were divided into first visits or follow-up treatments for the same injury. As an example, an initial treatment for a hamstring injury would have been recorded as a first visit. In cases where an athlete returned for treatment of a different injury (e.g. to the shoulder) this second attendance would have been recorded as a new first visit, while a treatment for the same hamstring injury from the previous attendance would have been recorded as a follow-up treatment. Physiotherapists were instructed to record each injury of a separate anatomical area as a separate encounter, except encounters aimed at more general effects such as cryotherapy baths, when the 'multiple body code' was used. All physiotherapy volunteers underwent three days of formal training with LOCOG, which included instruction on classifications and physiotherapy treatment codes for use on the medical record system.

Confidentiality and ethical approval

The system and criteria for collecting and recording information was approved by the LOCOG Medical Advisory Group and the IOC Medical Code³ on athlete confidentiality was strictly observed. All information was treated with strict confidence and the medical database anonymized at the end of the Games.

Data analysis and statistics

All physiotherapy services data were transferred from the EMR system into an Excel file (Microsoft® Excel® 2013). Data were sorted and physiotherapy encounters at the Stratford polyclinic were filtered out using SPSS Version 20 (SPSS Inc., Chicago, IL,

USA). Statistical analysis of the data was then carried out using R Version 2.15.0 (2012).⁷ Encounters were categorised by their accreditation status: athletes and non-athletes.

Data are presented as frequencies and proportions. For analysis relating to anatomical area, diagnosis, and cause of injury, only 'first visits' encounters were chosen in order to avoid bias caused by the inclusion of the same individuals on multiple occasions.

Chi-squared tests were used to test for association between nominal variables, and where relevant, post-hoc tests (chi-squared tests, or equivalently, two-proportion Z tests) were used to identify specific group differences. P-values from post hoc tests were corrected for multiple testing error using an FDR approach⁸ (and are reported as FDR-p). P-values or FDR adjusted p-values of less than 0.05 were considered to be statistically significant.

Results

Distribution of encounters

- Insert Figure 1 (Flow Chart) here

Of the 1,866 encounters recorded, 95% (1,778 encounters) recorded the accreditation category correctly (*Figure 1*). A total of 1219 (69%) were administered to athletes and 559 (31%) to non-athletes. The non-athlete group comprised of NOC team officials (n=333, 18.7%), LOCOG workforce (n=160, 9.0%), Olympic family (n=34, 1.9%), technical officials, and press (n=31, 1.7%).

- Insert Figure 2 (Encounters Bar Graph) here

Over the 12 days leading up to the Games and the start of competition (16th-26th July), there was a steep increase in the number of encounters recorded, peaking at 1st of August with 126 encounters as the busiest day, followed by 31st July, with 116 encounters (*Figure 2*) and a 2nd peak occurred on the 6th of August with 98 encounters. The non-athlete group showed a more even distribution over time in the pattern of their requirements to the physiotherapy services.

First Visits versus Follow-up Visits

There was a statistically significant difference between the proportions of first visits and follow-up visits for athletes and non-athletes ($X^2=35.95$, $p<0.01$) (*Figure 1*). Of the total number of athlete physiotherapy encounters, 501 (41%) were first visits and 717 (59%) follow-up visits compared to 316 (57%) first visits and 243 (43%) follow-up visits in the non-athletes group.

Anatomical area relating to First Visits Only

- Insert Table 1 here

In the athlete group, the highest proportions of recorded first visits describing anatomical area were: knee (15.4%), followed by lower lumbar spine/lower back (15.2%) and upper leg (12.6%). Similarly, the most commonly reported anatomical areas from first visit encounters recorded for non-athletes were: lumbar spine/lower back (19.8%) followed by knee (15.8%) and neck/cervical spine (15.2%) (Table 1).

The first 14 areas listed in Table 1 comprised more than 95% of all first visit encounters, while other anatomical areas were reported more infrequently. The remaining categories were therefore re-grouped together for statistical analysis, as “other anatomical area”.

The overall distribution of injuries across these anatomical areas differed between athletes and non-athletes ($X^2=63.21$, d.f.=14, $p<0.001$). A lower percentage of neck/cervical spine injuries was recorded for athletes (5.2%) than for non-athletes (15.2%); while a higher percentage of upper leg injuries was recorded for athletes (12.6%) compared with non-athletes (1.3%). Post hoc chi-squared tests revealed significant differences between athletes and non-athletes in the percentages of both neck/cervical spine injuries (FDR- $p<0.001$) and upper leg injuries (FDR- $p<0.001$) recorded for first visit encounters.).

Diagnosis for athletes and non-athletes

- Insert Table 2 here

Similar patterns of diagnosis were seen for athletes and non-athletes with joint and muscle injuries as most common. The diagnosis ‘other’ for a physiotherapy encounter indicated that the athlete/non-athlete availed of the physiotherapy services for assessment only, injury prevention intervention (e.g. stretching strapping, etc), recovery (e.g. massage, cryotherapy/ice baths) or general massage. For athlete first visit encounters, the most common types of diagnosis recorded were muscle injuries (33.3%), joint injuries (24.8%), and ‘other’ (16.0%). A somewhat similar pattern was seen for diagnosis in non-athlete first visits; the most common were joint (30.1%) and muscle (24.4%) injuries, with 20.6% reporting a diagnosis category of ‘other’ (Table 2).

The first 8 diagnosis categories in Table 2 accounted for more than 93% of all diagnoses recorded for first visit encounters. The remaining diagnosis categories contain limited data and were therefore grouped together for statistical analysis. A chi-squared test

revealed a statistically significant difference ($X^2 = 23.42$, $p < 0.01$) in the percentages of diagnosis types for athlete and non-athlete first visit encounters.

Post-hoc testing identified statistically significant differences in the percentages ($X^2 = 7.02$, $FDR-p < 0.05$) of first visit muscle injuries among athletes (33.3%) compared to non-athletes (24.4%); while non-athletes were recorded with a higher percentage of “arthritis or inflammatory disease/conditions” with a statistically significant difference in the percentages for athletes and non-athletes ($X^2 = 8.60$, $FDR-p < 0.05$).

Treatment types administered

A variety of different treatments were used (Table 3). Based on 1,399 encounters (‘first visits’ and follow-up treatments for athletes and non-athletes), the 5 most frequently used treatment modalities were: treatment massage (23.3%), mobilisation techniques (21.8%), taping (8.9%), cryotherapy (6.9%), and exercise prescription (6.4%).

- Insert Table 3 here

The types of treatment modalities administered to athletes varied depending on the diagnosis (Table 4). For those diagnosed with a muscle injury, treatment massage (33.3%), mobilization (10.6%), cryotherapy (10.6%), and acupuncture (8.3%) were utilized most often. Athletes diagnosed with a joint injury were most commonly treated with mobilization (27.2%), joint manipulation (21.7%), massage (13.0%), and cryotherapy (8.7%). For athletes diagnosed with tendinopathy, the most common treatment types administered were treatment massage (28.6%), ultrasound (12.2%), alter G (10.2%), and mobilisation (10.2%).

- Insert Table 4 here

Cause of injury and onset of symptoms related to ‘Diagnosis of injury’

Of the 501 ‘first visits’ recorded, 374 reported the cause of injury. The most frequently reported causes of injury were overuse (43.6%), non-contact trauma (23.8%), no injury (15.5%) and other causes of injury (7.8%). Less frequently reported causes of injury were falls (1.1%) and collision (0.3%).

Pre-existing injuries accounted for almost half of the 436 first visit encounters ($n = 198$, 45.4%) with information available on onset of symptoms, and while 162 (37.2%) accounted for onset during training, 60 encounters (13.7%) were related to competition. A total of 16 encounters (3.7%) had to be classified as “other onset” (Table 5). For the most common injury type, muscle injuries, 32.2% arose prior to the Games, 45.9%

happened during training and 16.4% occurred during competition. Joint injuries were the second most common injury seen; of these 46.4% were reported to have occurred prior to the Olympic Games, 40% during training and 8.2% during competition.

- Insert Table 5 here

Discussion

This study highlights the advancing role of physiotherapy in supporting both athletes and non-athletes during an Olympic Games. In addition, support provided to athletes in the form of maintenance, recovery and performance were identified. To date, there has only been one study published on physiotherapy services during Olympic Games (Athens 2004),⁵ and only a few studies from major multi-sport competitions are available for comparisons with the present findings.^{9 10 11}

Distribution of encounters among athletes and non-athletes

The pattern of physiotherapy activities mirrored the competition schedule of events for the 26 Olympic sports competing in the London Games. The build-up and gradual reduction in physiotherapy activity over the period of competition was similar to the pattern seen in the previously reported studies on physiotherapy in Athens 2004⁴ and the overall polyclinic activity during the 2012 Olympic Games.^{12 13}

The major emphasis of the physiotherapy services in the Polyclinic was orientated towards the needs of competing athletes and the present findings reflect this support strategy, with 69% of treatments given to athletes and 31% to non-athletes. There was also a significantly higher proportion of follow-up visits recorded among athletes, indicating that this group to a larger degree tend to require more than one session of treatment for the same condition/injury. We also observed that the distribution of injuries varied significantly across anatomical areas, with more treatment encounters for the cervical spine among non-athletes and a higher requirement for thigh treatment among athletes, which is similar to previous studies^{5 10 14} and reflects the different individual physical demands. As in previously reported incidence studies,^{4 14 15 16} we identified that muscle injuries were among the most common injuries in athletes (33%), compared with non-athletes who presented with a lower incidence (24%).

These different needs and requirements, together with different languages and cultures must be taken into consideration when planning physiotherapy services for future Olympic Games. Our findings also highlight the role of physiotherapists in supporting

performance through effective maintenance of the musculoskeletal system, injury prevention strategies and assistance with recovery.

Types of treatment administered

The data demonstrate that not all athlete attendances were for treatment of an injury. Evaluation of those encounters identified a high number of interventions, coded as 'other' (16%), which typically denoted that the athlete did not have an injury, but attended for assistance with recovery, for example, cryotherapy (11%).¹⁷ It should be noted that the use of cryotherapy baths was administered largely by the commercial supplier, and presented data may therefore not reflect the full extent of cryotherapy activity. However, these observations also reflect the changing focus of physiotherapy support at competition time from purely injury management to performance issues.

Cause and onset Injury

This study highlights that 45% of encounters were related to ongoing management of pre-existing injuries, which reflects the significant level of persisting musculoskeletal problems amongst athletes entering major sport events.¹⁰ These findings reflect the challenges that physiotherapists face in supporting athletes which may not necessarily be captured in traditional surveillance studies.^{6 12 14 16 18} This also has implications for estimating physiotherapy workforce requirements at future Games and strongly suggests that further advances are needed for injury prevention.

We identified overuse injuries as the most common reason for physiotherapy attendance among athletes (44%). Overuse injuries in many sports still present a significant challenge;¹⁹ we know that, athletes with persisting injuries often continue training and competition with reduced volume, intensity, and performance, worsening their health problems. The findings in this study suggest that further expansion of the present surveillance systems would be a positive advancement in order to more accurately account for injuries and symptoms associated with overuse problems that pre-exist and often manifest as 'injuries'. This would also provide a greater level of understanding of the nature and extent of physiotherapy support required during the Olympic Games.

Methodological considerations

This study describes and evaluates attendance patterns and treatment modalities of physiotherapy services delivered to athletes and accredited non-athletes during an Olympic Games, inclusive of the pre- and post-competition days of athletes' occupancy of the Olympic Village.

The main limitation of this study related to the challenges associated with data recording during the Olympic Games. The medical encounter system (EMR) was not created for the primary purpose of carrying out this type of analysis and there was a considerable amount of missing data which may be due to a number of reasons such as: limited availability of codes and classifications, such as ‘tendinopathy’ to record both tendon pain and/or tendinopathy. Treatment modality data were limited by the EMR system, which only allowed data to be collected on the primary modality per encounter, which did not allow a complete presentation of activity. Therefore the use of other modalities is under-represented: in many cases physiotherapists recorded the manual aspect of their treatments as their prime treatment modality. In some cases staff were either not sufficiently familiar with the EMR system, or did not record data due to workload or limited access to computer terminals. Some practical challenges arose in entering contemporaneous information into the database system, because of difficulty accessing computer terminals during busy periods. Therefore, some of the information was entered into the system at a later convenient time but within 24 hours.

It is recommended that volunteer training for physiotherapists is more specific to the requirements of this group of the workforce and could be modified in terms of appropriate use of codes and classifications.^{20 21} Motivation and vigilance with compliance on accurate and complete record keeping is also an essential aspect of the role of volunteers.²² In addition to training, organizers also need to consider availability and accessibility of computer terminals to facilitate compliance of accurate and complete record keeping.

In order to avoid duplication and to ensure accuracy, first visit encounters only were used for some of the statistical analysis, for example when analysing diagnosis categories, cause of injury etc. It was not possible using the current system to analyse the numbers of follow-up visits for a specific diagnosis. In future it is recommended to develop a system that would allow for data collection that more accurately reflects physiotherapy activity during the Olympic Games.

Future suggestions/Implications

High reliance on physiotherapy services has been reported in previous studies;^{22 23} the introduction of direct access for physiotherapy (no referral required) for the LOCOG physiotherapy services was a significant advancement in terms of the scope of physiotherapy and offered athletes a higher level of access to physiotherapy support.

In addition, the inclusion in the multidisciplinary team of sports massage, osteopaths and chiropractors who practiced in accordance with the IOC Medical Commission's (MC) policy on scope of practice created a new benchmark for future OCOG's in terms of the skill mix available and access to the different physical therapies for athletes during the Olympic Games.

Extended scope of physiotherapy practice is evidenced in the advancing role of the sports physiotherapist at the 2012 Olympic Games. The type of treatment techniques and modalities used by physiotherapists are constantly evolving based on current research. The treatment profile examined in this analysis indicates a leaning towards more manual treatments (54%).

Further research to gain more knowledge and understanding of physiotherapy and physical therapies activity during major multi-sports competition is essential to ensure that service providers continue to advance and evolve in the important role they play in support of high performance athletes and to ensure that IOC MC's mission statement to 'protect the health of the athlete' continues to be realised. The present findings also reflect the ongoing need for monitoring and analysis of physiotherapy services during an Olympic Games and at other major sporting events in order to understand and further advance prevention and treatment,^{24 25} rehabilitation and support of performance for the high performance athlete.

Conclusion

Analysis of London 2012 physiotherapy encounters demonstrated that as the largest single professional discipline within the multidisciplinary team, expertise and experience was useful in the delivery of physiotherapy services. This is the first study to identify the variation in physiotherapy activity between the athletes and non-athletes highlighting the different needs of the each group. There is a need for appropriate EMR systems and expansion of the current injury surveillance systems to accurately record the range of physiotherapy activity during an Olympic Games. The range of treatment modalities utilized demonstrates the advancing role of the sports physiotherapist beyond treatment of injury to a broader role including support of athlete performance by providing assistance with injury prevention, recovery and maintenance. The high numbers of pre-existing and overuse injuries identified, provides further insight into the reasons why athletes seek the support of physiotherapists during the Olympic Games.

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Acknowledgement

We thank all members of the LOCOG Physical Therapy Services Workstream and volunteer (Games Maker) physiotherapists for the collection of the physiotherapy data.

Funding

Non applicable

Competing interests statement

No competing interests

Contributor statement

MEG, PG and NP were responsible for the conception and design of the study. MEG, NP and LB coordinated the study and managed all aspects, including data collection. All authors had full access to all data. MEG, KS and MG initialized and conducted the analyses, which were planned and checked with the other co-authors. MEG wrote the first draft of the paper and all authors provided substantive feedback on the paper and contributed to the final manuscript. MEG and KS are the guarantors.

What are the new findings?

- Identifies the variation in physiotherapy activity between the athletes and non-athletes highlighting the different needs of the each group.
- Further insight into the reasons why athletes seek the support of physiotherapy during the Olympic Games highlighting the advancing role of physiotherapists in supporting athlete performance.
- Demonstrates the high incidence of pre existing and overuse injuries.

How might this paper impact on clinical practice in the near future?

- Future OCOG's need to plan and provide physiotherapy services to meet the needs of athletes and non-athletes.
- Implementation of further injury prevention strategies to reduce the high incidence of athletes presenting with pre – existing and overuse injuries
- Development of improved EMR systems to accurately record Physiotherapy data.
- Provision of a multidisciplinary team of sports massage, osteopaths and chiropractors has created a new benchmark for future OCOG's in terms of the skill mix available and access to physical therapies for athletes during the Olympic Games.

Table 1: Frequencies and percentages of Anatomical Areas recorded for all First Visit encounters and for First Visit encounters with athletes and non-athletes separately. FDR adjusted p-values from post hoc chi-squared tests (athletes vs. non athletes) are reported in the rightmost column.

Anatomical area	All encounters n=765	Athletes n=462	Non-athletes n=303	FDR-p
Lumbar spine/lower back	130 (16.7)	70 (15.2)	60 (19.8)	0.456
Knee	119 (15.6)	71 (15.4)	48 (15.8)	0.977
Neck/cervical spine	70 (9.2)	24 (5.2)	46 (15.2)	<0.001
Upper leg	62 (8.1)	58 (12.6)	4 (1.3)	<0.001
Thoracic spine/upper back	58 (7.6)	30 (6.5)	28 (9.2)	0.539
Shoulder/clavicle	52 (6.8)	27 (5.8)	25 (8.3)	0.539
Lower leg	52 (6.8)	32 (6.9)	20 (6.6)	0.977
Ankle	35 (4.6)	22 (4.8)	13 (4.3)	0.977
Foot	34 (4.4)	19 (4.1)	15 (5.0)	0.969
Pelvis/sacrum/buttock	31 (4.1)	22 (4.8)	9 (3.0)	0.558
Hip	29 (3.8)	21 (4.5)	8 (2.6)	0.539
Achilles tendon	27 (3.5)	17 (3.7)	10 (3.3)	0.977
Multiple body locations	19 (2.5)	14 (3.0)	5 (1.7)	0.560
Other anatomical area				
Elbow	9 (1.2)	7 (1.5)	2 (0.7)	
Groin	8 (1.1)	7 (1.5)	1 (0.3)	
Abdomen	6 (0.8)	4 (0.9)	2 (0.7)	
Wrist	6 (0.8)	5 (1.1)	1 (0.3)	
Finger	4 (0.5)	3 (0.6)	1 (0.3)	
Upper arm	3 (0.4)	2 (0.4)	1 (0.3)	
Forearm	3 (0.4)	3 (0.6)	0 (0)	
Thumb	3 (0.4)	1 (0.2)	2 (0.7)	
Chest	2 (0.3)	2 (0.4)	0 (0)	
Hand	2 (0.3)	1 (0.2)	1 (0.3)	
Other medical	1 (0.1)	0 (0)	1 (0.3)	

Table 2 Frequencies and percentages of type of diagnosis made during first visits and follow-ups and calculated for athletes and non-athletes separately. Also shown are FDR adjusted p-values from post hoc chi-squared tests for most common categories of diagnosis (athletes vs. non athletes) for first visit encounters.

	First Visits		FDR-p	Follow-up Visits	
	Athletes n=501	Non-athletes n=316		Athletes n=717	Non-athletes n=241
Muscle injury	167 (33.3)	77 (24.4)	0.036	228 (31.8)	74 (30.5)
Joint injury	124 (24.8)	95 (30.1)	0.204	196 (27.3)	54 (22.2)
Other	80 (16.0)	65 (20.6)	0.204	110 (15.3)	33 (13.6)
Tendinopathy	64 (12.8)	26 (8.2)	0.170	102 (14.2)	38 (15.6)
Arthritis-Inflammatory	5 (1.0)	14 (4.4)	0.030	1 (0.1)	12 (4.9)
Other bone injuries	11 (2.2)	7 (2.2)	0.970	11 (1.5)	7 (2.9)
Contusion/hematoma/bruise	10 (2.0)	7 (2.2)	0.970	7 (1.0)	1 (0.4)
Nerve root or spinal cord injury	7 (1.4)	3 (0.9)	0.970	18 (2.5)	8 (3.3)
Tenosynovitis	3 (0.6)	6 (1.9)	0.970	4 (0.6)	3 (1.2)
Other diagnosis categories					
Fasciitis	4 (0.8)	3 (0.9)		9 (1.3)	3 (1.2)
Bursitis	5 (1.0)	1 (0.3)		3 (0.4)	0
Fracture - stress	5 (1.0)	0		10 (1.4)	1 (0.4)
Fracture - closed	3 (0.6)	1 (0.3)		1 (0.1)	1 (0.4)
Laceration/abrasion	4 (0.8)	0		3 (0.4)	0
Muscle rupture	2 (0.4)	2 (0.6)		9 (1.3)	1 (0.4)
Dislocation/subluxation	1 (0.2)	2 (0.6)		0	1 (0.4)
Tendon - rupture	1 (0.2)	2 (0.6)		3 (0.4)	4 (1.6)
Abdominal pain	1 (0.2)	1 (0.3)		1 (0.1)	0
Peripheral nervous system	1 (0.2)	1 (0.3)		0	0
Allergy	0	1 (0.3)		0	0
Blister	0	1 (0.3)		0	0
Diabetes mellitus	0	1 (0.3)		0	0
Major trauma	1 (0.2)	0		0	0
Menstrual disorder	1 (0.2)	0		0	0
Muscle tone	1 (0.2)	0		0	0
Clotting, abnormal	0	0		0	1 (0.4)
Deep vein thrombosis	0	0		0	1 (0.4)
Infection	0	0		1 (0.1)	0

Table 3: Frequencies and percentages of encounters during which each treatment modality was recommended, for first and follow-up visits of athletes and non-athletes separately, and for all physiotherapy encounters

Treatment type	First Visits		Follow-up Visits		All visits n=1399
	Athletes n=376	Non-athletes n=251	Athletes n=516	Non-athletes n=175	
Treatment massage	93 (24.7)	42 (16.7)	149 (28.9)	28 (16.0)	326 (23.3)
Mobilisation (act./pass.)	62 (16.5)	71 (28.3)	94 (18.2)	51 (29.1)	305 (21.8)
Strapping/taping	28 (7.4)	25 (10.0)	51 (9.9)	16 (9.1)	125 (8.9)
Cryotherapy	40 (10.6)	14 (5.6)	31 (6.0)	12 (6.9)	97 (6.9)
Joint manipulation	32 (8.5)	27 (10.8)	17 (3.3)	10 (5.7)	89 (6.4)
Exercise	11 (2.9)	11 (4.4)	32 (6.2)	13 (7.4)	89 (6.4)
Ultrasound	19 (5.1)	10 (4.0)	45 (8.7)	8 (4.6)	86 (6.1)
Acupuncture	17 (4.5)	13 (5.2)	16 (3.1)	22 (12.6)	70 (5.0)
Muscle stretches	14 (3.7)	5 (2.0)	24 (4.7)	4 (2.3)	47 (3.4)
Advice/reassurance	8 (2.1)	14 (5.6)	10 (1.9)	3 (1.7)	37 (2.6)
General massage	15 (4.0)	4 (1.6)	8 (1.6)	3 (1.)	31 (2.2)
Alter G	11 (2.9)	4 (1.6)	11 (2.1)	0 (0)	26 (1.9)
Hydrotherapy	4 (1.1)	0 (0)	8 (1.6)	0 (0)	12 (0.9)
Laser	2 (0.5)	0 (0)	9 (1.7)	0 (0)	11 (0.8)
Verbal advice and guidance	4 (1.1)	4 (1.6)	1 (0.2)	0 (0)	10 (0.7)
Shockwave therapy	4 (1.1)	1 (0.4)	2 (0.4)	0 (0)	7 (0.5)
Heat	2 (0.5)	1 (0.4)	1 (0.2)	2 (1.1)	6 (0.4)
Gait re-education	2 (0.5)	2 (0.8)	1 (0.2)	0 (0)	5 (0.4)
Interferential	1 (0.3)	1 (0.4)	1 (0.2)	2 (1.1)	5 (0.4)
Longwave ultrasound	2 (0.5)	1 (0.4)	0 (0)	1 (0.6)	4 (0.3)
Pre-event massage	1 (0.3)	1 (0.4)	2 (0.4)	0 (0)	4 (0.3)
Fitness testing	0 (0)	0 (0)	2 (0.4)	0 (0)	2 (0.1)
LPUS-U/S bone-healing sys	2 (0.5)	0 (0)	0 (0)	0 (0)	2 (0.1)
Combined U/S & I/F	0 (0)	0 (0)	1 (0.2)	0 (0)	1 (0.1)
Electromagnetic field unit	1 (0.3)	0 (0)	0 (0)	0 (0)	1 (0.1)
Basic wound care	1 (0.3)	0 (0)	0 (0)	0 (0)	1 (0.1)

Table 4 . Frequencies and percentages for treatment modalities for joint and muscle injuries, tendinopathy and “other” (athlete first visits).

Treatment type	Joint injury n=92	Muscle injury n=132	Tendinopathy n=49	Other n=57
Acupuncture	4 (4.4)	11 (8.3)	0	1 (1.8)
Advice/assessment	2 (2.2)	1 (0.7)	3 (6.1)	1 (1.8)
Alter G	0	3 (2.3)	5 (10.2)	1 (1.8)
Basic wound care	0	0	0	0
Combined U/S & I/F	0	0	0	0
Cryotherapy	8 (8.7)	14 (10.6)	3 (6.1)	6 (10.5)
Electromagnetic field unit	1 (1.1)	0	0	0
Exercise	3 (3.3)	0	3 (6.1)	1 (1.8)
Fitness testing	0	0	0	0
Gait re-education	0	0	0	0
General massage	2 (2.2)	8 (6.6)	0	5 (8.8)
Heat	-	2 (1.5)	0	0
Hydrotherapy	1 (1.1)	2 (1.5)	0	0
Joint manipulation	20 (21.7)	1 (0.7)	1 (2.0)	4 (7.0)
Interferential	0	0	0	0
Laser	1 (1.1)	0	1 (2.0)	0
Longwave ultrasound	1 (1.1)	1 (0.7)	0	0
LPUS-U/S bone-healing sys	0	1 (0.7)	1 (2.0)	0
Mobilisation (act./pass.)	25 (27.2)	14 (10.6)	5 (10.2)	11 (19.3)
Muscle stretches	3 (3.3)	7 (5.3)	0	3 (5.3)
Pre-event massage	1 (1.1)	0	0	0
Shockwave therapy	0	1 (0.7)	3 (6.1)	0
Strapping/taping	5 (5.4)	11 (8.3)	3 (6.1)	4 (7.0)
Treatment massage	12 (13.0)	44 (33.3)	14 (28.6)	17 (29.8)
Ultrasound	2 (2.2)	7 (5.3)	6 (12.2)	3 (5.3)
Verbal advice and guidance	1 (1.1)	0	1 (2.0)	0

Table 5: Frequencies and percentages for encounters reporting 'onset of symptoms' for each diagnosis (athlete first visits).

Diagnosis	Pre-Games n=198	Training n=162	Competition n=60	Other n=16	Total n=436
Abdominal pain	1 (100.0)	0	0	0	1
Arthritis inflammatory	5 (100.0)	0	0	0	5
Bursitis	2 (40.0)	3 (60.0)	0	0	5
Contusion/haematoma/bruise	1 (11.1)	5 (55.6)	3 (33.3)	0	9
Dislocation/subluxation	0	1 (100.0)	0	0	1
Fasciitis	2 (50.0)	1 (25.0)	0	1 (25.0)	4
Fracture - closed	0	0	1 (100.0)	0	1
Fracture - stress	2 (66.7)	1 (33.3)	0	0	3
Joint injury	51 (46.4)	44 (40.0)	9 (8.2)	6 (5.5)	110
Laceration/abrasion	3 (75.0)	1 (25.0)	0	0	4
Major trauma	0	1 (100.0)	0	0	1
Menstrual disorder	0	0	0	1 (100.0)	1
Muscle injury	47 (32.2)	67 (45.9)	31 (21.2)	1 (0.7)	146
Muscle rupture	1 (50.0)	1 (50.0)	0	0	2
Muscle tone	1 (100.0)	0	0	0	1
Nerve root or spinal cord injury	5 (100.0)	0	0	0	5
Other	29 (47.5)	16 (26.2)	9 (14.7)	7 (11.5)	61
Other bone injuries	6 (60.0)	2 (20.0)	2 (20.0)	0	10
Peripheral nervous system	1 (100.0)	0	0	0	1
Tendinopathy	38 (62.3)	19 (31.2)	4 (6.6)	0	61
Tendon - rupture	1 (100.0)	0	0	0	1
Tenosynovitis	2 (66.7)	0	1 (33.3)	0	3