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Medical Services at the 1st Winter Youth Olympic Games 2012 in Innsbruck/Austria

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Abbreviations:

IYOGOC: Innsbruck Youth Olympic Games Organizing Committee

IOC: International Olympic Committee

WYOG: Winter Youth Olympic Games

NOC: National Olympic Committee

YOG: Youth Olympic Games

ABSTRACT

Background: The Youth Olympic Games (YOG) are a new format designed by the International Olympic Committee. So far no reference data is available regarding the organization or implementation of the medical services that were needed for the Winter Youth Olympic Games that took place for the first time in Innsbruck January 9th – 24th 2012.

Objectives: **(1)** to provide insight into what is needed to prepare for such a complex high level sporting event from a medical perspective **(2)** to provide data on medical services for future organizing committees and **(3)** to provide information on different NOC delegation structures and the consequences of registering a National Olympic Committee Team Physician.

Methods: A medical information system in form of a patient data management system was developed with all involved parties to standardize data collection. All medical encounters occurring at any IYOGOC medical service center (including physiotherapy and psychology facilities) were tracked and collected in daily reports. Data evaluation was prepared based on different interest groups (Athletes, National Olympic Committees, Workforce, International Olympic Committee and Media) and analyzed.

Results: 327 medical encounters (42.8% athletes; out of these, 57.9% were accounted to athletes with own NOC team physician) were seen during the YOG 2012. The total number of hospital transports was 27.3%, of which 8.9% were hospitalized with an average length of 1.9 nights. Physiotherapy usage was low with only 19 medical encounters resulting in a referral to physiotherapy accounting for 67 treatments during the entire YOG. Psychological care service was not used at all. The main reason for illnesses was disorders of the respiratory system (28.8%), injuries mostly affected upper extremities (49.6%) and were mostly diagnosed with lacerations and

contusions (26.2%). Injury (70.7%) and illness (29.3%) incidences in athletes were slightly lower than previous studies showed.

40.0% of NOC delegations registered their own team physicians, which led to a significant difference in usage frequency of medical service (-3.00%, $p=0.012$).

Conclusion: Medical Service coverage at the first Winter Youth Olympic Games seemed to be appropriate. No disaster or epidemic disease challenged the medical service plan. Future Organizing committees could use the provided data as reference for their planning efforts.

INTRODUCTION

„The Olympic Games do not just happen.[...] they are the complex product of a benevolent sporting partnership between the IOC, the 205 national Olympic committees and their competitors, the international sports federations and fourth, a succession of host cities”.^[1] During the Olympics, the local organizing committee is exposed to a huge volume of people visiting the host city and its surroundings, which poses significant challenges especially to medical and public health communities.^[2] The philosophy of medical care is developed by the Medical Commission of the International Olympic Committee (IOC) and defined by given premises received through thorough review of standards and guidelines previously tested. It is re-evaluated on a regular basis and accessible to the organizing committees in form of the Olympic Games Event Manual (International Olympic Committee, 2010).

With the Youth Olympic Games (YOG), the IOC president mooted a new idea in 2001, to unite the youth of the world in a sporting, cultural and educational environment, to experience and learn about the Olympic values of excellence, respect and friendship. Though smaller in quantities, the YOG seem to oppose, at least in some functions, the same challenges to the organizing committee than Olympic Games do. They require a strictly organized medical service set up to cope with the healthcare of the Olympic Family, the workforce and the spectators. Comparable to previous Olympic Games, the basic premises of the medical services program always lie in social and medical legal

conventions requiring medical care at all sport venues, event venues, accommodation for accredited clients as well as the Olympic Village. [3-5]

The first Winter Youth Olympic Games took place from January 9th until January 24th 2012 in Innsbruck. Comprising a total of 10 competition days, 63 medal events, over 150 training sessions, more than 1.000 athletes, over 1.300 volunteers and a total of 10.574 accreditations issued. There are several reports outlining strategies to handle challenges in medical services for large gatherings of people.[2-6] To date organizing committees of Youth Olympic Games can only rely on analysis of the first Summer Youth Olympic Games in Singapore, which are limited in terms of comparison due to difference in scope, sports disciplines, geographic location and infrastructure.[7]

The present report shall give an insight view into the preparation of a complex, multi-venue sport event with focus on medical service. The aim of the study is to provide future organizing committees, especially those of Youth Olympic Games, with information on how to potentially set up an efficient medical service system including an efficient reporting system to meet the prerequisites demanded by several stakeholders. The descriptive presentation of medical encounters of the first Winter Youth Olympic Games will also provide future Youth Olympic Games Organizing Committees with valuable baseline information what to expect. Special focus is given to potential differences in the frequency of use of medical services of National Olympic Committees (NOCs) registering their own team physician. So far, findings outlined different results of medical encounters of NOCs with registered team physicians and those without.[7,8] Therefore one of the aims of this study, subsequent to outlining organizational challenges and statistics on medical encounter, is also to analyze information on the quantifiable differences for teams having an NOC Team Physician and those without for organizing committees for future reference.

METHODS AND MATERIALS

The level of medical services was defined together with the IOC Medical Commission and based on prior experiences.[2] One major prerequisite is to ensure the standard of medical service is not lower

than the one usually provided to locals.[4] The medical service planning started 1.5 years prior to the Youth Olympic Games (YOG). The main task of the medical service was to define the level of service required by developing policies, procedures and operation plans to ensure high quality medical care for all accredited clients and spectators. The IOC Medical Commission was at all times mentoring and providing valuable advice based on their extensive experience.

Structure of Medical Service

In order to provide optimum medical care, responsibilities were shared between two separately built units: The athletes care unit and the emergency care unit. The athletes care unit consisted of highly qualified physicians with experience in sports medicine (“sport physicians”). The emergency care unit consisted of emergency doctors and paramedics from the Austrian Red Cross, qualified by their experience in medical cover for mass gatherings. They were responsible for all emergencies and additionally for the medical care of all spectators and non-accredited clients. Together with the expertise of the IOC Medical Commission, high-risk sporting events were defined (freestyle skiing and snowboard, Super-G, speed skating, short track and ice hockey). These events were covered by sport physicians with additional education in the field of trauma surgery and orthopedics. Additional specialists in pediatrics and internal medicine were included within the medical service center in the Youth Olympic Village. A total number of 37 physicians, 28 emergency physicians and 265 paramedics were involved during the YOG, covering official training sessions, competition and non-sporting events. IYOGOC sports physicians and emergency physicians provided the first line of care at competition venues. In the case of difficult access to a mountain area (alpine skiing venue) and the bobsleigh and luge track, a total of 70 qualified members (physicians and paramedics) of the Austrian Mountain Rescue were responsible for emergency care.

NOC Team Physicians

NOCs could register their team physicians for medical care within their delegation. The team physicians’ qualifications were required to be approved by the Austrian Medical Chamber. When approval was granted, the NOC team physician was then registered for the duration of their stay and

was permitted to treat and issue medical prescriptions for members of their own NOC. In addition, with prior written approval they could also treat members of other NOCs.

Medical Care at the Youth Olympic Training, Competition and Event Venues

In total there were 10 Youth Olympic Venues comprised of 6 competition and 4 event venues. Each of the Olympic Venues had the support of at least one designated medical service center. Two medical service centers were set up at the multi-sport center Olympiaworld Innsbruck, that was the biggest competition venue, with four parallel sports (ice hockey, speed skating, figure skating, short track) taking place on three ice rinks at peak times. Medical service centers at competition venues all followed the same medical team structure: At least one sport physician per sport event and at least one team of the Austrian Red Cross (emergency physician, two paramedics, one ambulance car) per venue. The exact number of paramedics and emergency physicians required to cover a venue was calculated based on the size of the venue, the number of parallel sporting events, and the estimated number of spectators in accordance with the Maurer formula,^[9] which estimates the risk of medical encounters during major events. To ensure smooth run-downs, also in cases of emergencies, one ambulance care was constantly available at the venue. No helicopters were placed at any competition and training venues, due to a maximal flight time of only 7 minutes from the heliport to any of the venues.

The Youth Olympic Village (YOV)

The YOY built an exception in medical care service, hosting all athletes and some of the NOC team officials and trainers. To manage medical needs, a medical service center, similar to a poly-clinic, was set up. The YOY medical service center was operational on a 24 hour basis staffed with one general practitioner. In addition, orthopedic and pediatric specialists together with specialists in internal were on duty during the official opening times between 8 am and 11 pm. Facilities for physiotherapy were available during official opening hours but solely for athletes who had a medical referral. In total, 29 physiotherapists were on duty during the Games. Next to physiotherapy, the YOY medical service center also disposed over a fully equipped pharmacy, operational day and night.

Due to the advice of the IOC Medical Commission, founded in experiences made in Singapore, a psychological first aid team was installed in Innsbruck located at the YOY, available 24/7 (18 psychologists).

Medical Care at the Partner Hospitals

To deal with more severe cases, as well as for complex examinations and laboratory analysis, the University Hospital Innsbruck was defined as main partner hospital. In addition, the Military Hospital Innsbruck was on alert for cases requiring quarantine. Due to its proximity, all patients could be easily transported by air- and ground transport within times less than ten minutes. This circumstance negated the need for the organizing committee to supply the medical service centers with costly equipment such as X-ray facilities. Medical transports were managed by the Austrian Red Cross (115 permanently stationed ambulance cars throughout the YOY and all competition- and event venues) and medical service volunteers (only departing from the YOY in non-severe cases).

Medical Information System

Together with the medical partners, an integrated medical information system in the form of a patient data management system was developed. This system was the key to communication and reporting within the medical function and also for external communication. It was highly necessary to track all medical encounters, as well as demographic data, diagnoses and treatment procedures. The meaning of medical encounter within this study comprises all medical incidents (including physiotherapy treatments only in combination with a medical referral, therefore not counted separately), which were reported to any medical service center provided by IYOGOC. Medical incidents treated by NOC medical staff and not reported and therefore not treated by IYOGOC medical services were not tracked and analyzed as part of this study. An additional study by Ruedl et al. (2012) analyzes all medical encounters of athletes, including those treated by NOC medical staff. Medical encounters of patient groups besides the athletes, which were treated by NOC medical staff and not reported to IYOGOC medical services could not be included within this analyses and might lead to an underestimation of the results.

The partner hospital also provided us with all necessary data, as soon as a YOG accredited client was admitted to the hospital. Staff at the hospital was trained on how to proceed with accredited clients and used the accreditation number for registering the patients. Every night medical encounter report forms from all units at all venues were combined into one daily medical report, discussed every morning within the daily medical meeting.

Data Evaluation

To evaluate statistical data of the medical encounters Statistical Package for Social Sciences 20 (SPSS) was used. To evaluate data, client groups were split into five groups: (1) athletes, (2) National Olympic Committee (NOC) team officials, (3) IOC, (4) Media and (5) Workforce. In order to calculate potential significant measurable differences between the NOCs, the group of NOC team officials and athletes were combined. The different venues were separated into: competition venues (including official training venues), event venues, culture and educational program venue and the Youth Olympic Village.

Chi Square Tests and Fisher's Exact Test were used to test significant differences between NOC registering their own team physicians and those that did not, in order to evaluate the respective frequency of use of medical services provided by the organizing committee. Mann Whitney U Tests were used to calculate significant differences between delegation size and medical encounters as well as the relationship between larger NOC delegations who had registered their own team physician. The Kolmogorov-Smirnoff Test was used to define the distribution of delegates. To quantify these differences relative risks were indicated with their 95% confidence intervals, as well as risk differences. To minimize the potential confounder of delegation size, additional Chi Square –and Fisher Tests were performed, dividing the NOCs into larger (≥ 14 delegates) and smaller NOCs (< 14 delegates).

To give a more detailed overview and to predict potential numbers for upcoming Winter Youth Olympic Games incident rates of medical encounters at the venues were presented with their corresponding confidence intervals (95% confidence level). All P-values were two-tailed and values less than 0.05 were considered to indicate statistical significance.

RESULTS

Overview

In total 267 patients were seen during the YOG starting with the soft opening of the YOV on the 7th of January and ending with the lock down on the 24th of January 2012. In total, 40.4% were females and most patients had only one medical encounter (83.5%). The three groups most frequently using medical service were athletes (39.7%), followed by workforce (34.5%) and NOC team officials (10.9%). The 267 patients accounted for a total of 327 medical encounters. Excluding spectators (n=26), 241 patients out of 10.574 total accredited clients were seen (2.3%), accounting for 301 out of 327) medical encounters in total (92%). This number results in a medical encounter incidence rate of 28.5 per 1000 accredited clients (95% CI 19.1 to 40.8). Table 1 shows the top three venues and user groups of the overall distribution of medical encounters of all defined groups.

Figure 1 outlines the timeline of all medical encounters distributed over different venues. The diagram starts with day -2 being the soft opening of the YOV on the 07th of January and ends with day 15, the lock down on the 24th of January and combines injuries and illnesses.

Medical Transports and Hospitalization

In total, there were 89 transports to the University Hospital Innsbruck including one helicopter transport (cardio-vascular incident). Figure 2 outlines origins of the transports.

The majority did not require hospital admission (91.0%). In total, 5.6% led to one overnight stay, 1.1% led to two overnight stays and 2.2% accounted for four overnight stays, resulting in a hospitalization rate of 0.76 per 1000 accredited clients (95% CI 0.1 to 5.1). Hospitalization cases were caused by athletes (87.5%) and workforce (12.5%) only, mostly attributed to injuries (75%).

Illnesses and Injuries

The most common illness was respiratory problems (28.8%) followed by neurological cases (16.7%) and others (16.0%). Neurological cases included simple headaches, whereas “others” mostly refer to minor medical issues (cuts, bruises etc). Most of the illnesses were encountered at the YOV medical service center (54.5%) and at the medical service center Olympiaworld Innsbruck (15.4%).

The highest incident of injuries were reported from the following venues: YOY medical service center (31,8%), followed by the medical service centers at the Olympiaworld Innsbruck (24.7%), at the medical service center at Kühtai (10.6%) and the joint center at Olympiarun Patscherkofel (10.6%). The most commonly affected anatomical areas were the upper extremities (49.6%) which were diagnosed with laceration/abrasion (26.2%) followed by contusions (20.0%).

Athletes:

Out of 1021 athletes, 106 of the athletes had a medical encounter. There were 140 medical encounters (42.8% of all medical encounters) reported to the YOG medical service centers. This represents a patient rate of 103 athletes per 1000 registered athletes (95% CI 84.0 to 123.0) accounting for a medical encounter rate of 137 medical encounters per 1.000 registered athletes (95% CI 116 to 160). Most of the encounters were reported at the YOY medical service center (55%) followed by the Olympiaworld Innsbruck (17.1%) and on third place Kühtai and Olympiarun Patscherkofel/Olympic Sliding Center (9,3%).

Injuries

70.7% of medical encounters can be accounted for as injuries (defined as newly diagnosed injuries resulting from external impact), resulting in a medical encounter injury rate of 97.0 per 1000 registered athletes (95% CI 79.4 to 117.1), caused by 77 athletes (injured patient rate of 75.4 per 1000 athletes (95% CI 59.8 to 93.6)). Most of the injuries were reported at the YOY medical service center (42.4%), followed by the Olympiaworld Innsbruck (21.2%) and Kühtai (13.3%).

Illnesses

A total of 29.3% medical encounters were registered as illness, whereas only newly diagnosed illnesses were counted. This number results in an illness rate of 40.2 per 1.000 registered athletes (95% CI 28.9 to 54.3), caused by 31 athletes (ill patient rate of 30.4 per 1000 athletes (95% CI 20.7 to 43.0)). In total, 85.7% of illnesses were reported to the YOY medical service center and 73.3% of all illnesses were pediatric cases, followed by 19.5% trauma cases, mostly allocated to muscle tensions,

noticeable through back pain after heavy workout and muscle cramps The top three most commonly affected systems were respiratory (34.2%), musculo-skeletal (17.1%), gastro-intestinal and cardiovascular (9.8%) each.

National Olympic Committee Delegations

Out of 70 participating NOCs, 28 registered team physicians. Countries were ranked according to the frequency of using IYOGOC medical services, by adjusting the medical encounters per nation with respect to the size of the delegation. The top ten countries, using medical services the most (90% of the top 20) did not have registered team physicians. India (with four delegates) was the most frequent user of medical services with a patient ratio of 1.0 (adjusted for delegation size), followed by the Philippines (0.4) and Macedonia (0.4).

Due to the non-parametric distribution of NOC delegation sizes the median of the delegation size (14 [8.0; 49.0]) is used to give an insight into the NOC delegation structure. Results of the Mann-Whitney-U Test show that it is more likely that bigger NOC delegations higher in delegates bring their own team physician than smaller (53.5 vs. 8.9, $p < 0.001$). Significant differences in delegation size and number of medical encounters can only be shown for patients encountering at least two medical incidents ($p < 0.001$), these are more likely to come from larger NOCs (≥ 14 delegates).

Chi Square as well as the Fischer's Exact Tests showed some significant differences in medical encounters reported to any medical service center by NOC members disposing over their own team physician and those who did not (table 2). Significances could not be shown while separating for groups of injuries ($p = 0.055$) and illnesses ($p = 0.119$) where they had at least one medical encounter. Combining these two groups resulted in significant results ($p = 0.012$). In cases of more than one medical encounter, NOCs with registered team physician consulted medical service of the organizing committee significantly less often ($p < 0.001$). NOC delegation size had a significant influence on medical incidences only for the group of patients facing one or more medical encounter. Separating this group into smaller NOCs (< 14 delegates) and larger NOCs (≥ 14 delegates) attempting to equalize

the confounding factor of NOC delegation size, results of the Chi Square Analysis equally show significant differences except for more than one illness ($p=0.57$) (table 3).

DISCUSSION

Planning and Organization

The main challenge of the first Winter Youth Olympic Games (WYOG) regarding the planning process was the fact, that they were the first. The only statistics to rely on came from the Summer Youth Olympic Games in Singapore 2010 which had a far wider scope than the WYOG. The success of the Innsbruck 2012 planning of medical care can be assessed by the lack of criticism earned. During the final meeting with all attending NOC physicians, the Innsbruck medical service function was commended for nearly everything done during the first WYOG. Yet, no unforeseen event such as disease outbreaks or disasters jeopardized the planning. The concept of having at least one medical service center in each venue and to differentiate separate medical care units proved to be very effective. The cooperation with the Mountain Rescue, Austrian Red Cross and team physicians at the site was exemplary. In addition, having a medical service headquarter and several links within the main operations center guaranteed fast communication and short reaction times to unforeseen events. Also the close cooperation with different International Federations ensured that prerequisites were met without excessive staffing levels, by making compromises (e.g. one combined medical service center for bob/luge and alpine skiing) was very successful. Recommendations for future organizing committees may be to investigate the potential cooperation within the available infrastructures in order to maximize cooperation and synergy.

Medical Encounters

The number of medical encounters in Innsbruck is difficult to compare to previous events, as the exact number of spectators attending is unknown. Looking at the rankings which patient group used the services most frequently, results from Innsbruck are comparable to previous Olympic Winter Games [2-4,6] and the Summer Youth Olympic Games.[7] Only the Paralympic Games in Vancouver

reported different results with the highest frequency in medical encounters in workforce, followed by NOCs and athletes only on third place.[5]

The timeline of medical encounters in Innsbruck (figure 1) showed a peak on day four for the event venues, which seems obvious being the day of the Opening Ceremony. The temperature during the Opening Ceremony was very cold (below 0°C and wind speeds >10m/s) resulting in many cold-related issues mostly reported by spectators. Regarding training and competition venues, a peak can be seen on day five being the first day of competition and training.

The medical service center most frequently used was in the YOY, which is comparable to previous Olympic Games and the Summer YOG.[2,3,5-7] The Olympiaworld Innsbruck (the biggest competition venue) and Kühtai (hosting most of the high-risk sports) were used the second and third most often. Noticeable, in Kühtai, 72% of medical encounters were caused by athletes. The average athlete number of the other venues was about 35%. This is another indicator for the high risk sporting events that happened in Kühtai (freestyle ski, snowboard and ski half-pipe, slope style) and can secondly be explained due to the bad weather conditions towards the end of the competition and training days potentially discouraging spectators.

The number of hospital transport (27.2%) is far higher in comparison to the SYOG Singapore (1.0%).[7] In Innsbruck all patients who were in need of further investigations were evacuated to the partner hospital, whereas in Singapore, due to infrastructural prerequisites, patients were also evacuated to the YOY poly-clinic and only severely injured patients were evacuated to the hospitals. This also explains that the mean length of stay in Singapore was much higher (7 days) than in Innsbruck (1.8 days). Also in Singapore the majority of cases were caused by athletes, followed by workforce.

Regarding illness affected systems, results of Innsbruck are comparable with previous studies of Winter Olympic Games, mostly being respiratory.[3-7] However, looking at overall diagnosis, in most of the previous studies, muscular-skeletal was reported as main reason, not applicable to Innsbruck though.[3-7] Regarding injuries, mostly upper extremities were affected mostly diagnosed with

lacerations/abrasions followed by contusions, which is also comparable to the Paralympic Games in Vancouver.[1]

Regarding athletes, the injury and illness rate in Innsbruck was slightly lower (97.0 and 40.2 per 1.000 registered athletes) than in Vancouver (111.8 and 72.1 per 1.000 registered athletes). Reason for these lower numbers might be explained in the shorter length of the event.

Results of medical encounters stated within the results section do not include encounters treated by NOC medical staff, not reported to any medical service centers, which can be seen as limitation with respect to tracking all medical encounters during the YOG. Yet the study at hand aimed at analyzing medical encounters which were handled by medical staff provided by the organizing committee, and these encounters are tracked to 100%. A more detailed analysis on exclusively all medical encounters, also those treated by NOC medical staff and not reported to IYOGOC medical services, was performed during the YOG 2012 and provides information on athletes' injuries and illnesses (Ruedl et al., 2012). Yet, this study only includes medical encounters of athletes. Therefore, an underestimation of medical encounters cannot be excluded since it might have been the case that patient groups (besides athletes), received medical services from NOC medical staff, not reported to IYOGOC medical services and therefore not counted.

The general limitation of using data from the accreditation data base has to be kept in mind. These data outline the number of accredited clients, which does not necessarily mean, that all of them were really taking part in the event, or even situated in Innsbruck.

NOC Delegations

Comparable to previous Games,[2-6] NOC delegations (including athletes) are the ones that use medical services the most. 60% of NOCs did not register a team physician in Innsbruck and comparably 61.5% did not do it for Singapore.[7] Does the registration of an NOC team physician correlate with the structure of the delegation, and are there consequences for the local organizing committee? A significant relationship between the size of the NOC and registering a team physician was pointed out ($p < 0.001$). The median for NOCs bringing their own team physician lies at 52 [36.25;70.25] delegates. Research done at the YOG in Singapore showed a percentage difference of -

42.3% of medical encounters for NOCs with registered team physicians.[7] In Innsbruck, the relative risk was used to outline whether NOC team physicians acted as “protective” factor or not. Significances could have only been shown in scenarios of more than one medical encounter per patient (table 2). Protective means in this case less medical encounters reported to medical service centers provided by IYOGOC. Especially regarding injuries, the risk of patients using medical services provided by the organizing committee is 9.4 times higher [CI 95% from 3.08 to 28.7] if the respective NOC did not register an own team physician.

This might be explained by the fact of them consulting their own team physician for follow ups instead of consulting any medical service center. It is remarkable that the attributable risk proportion of the risk difference of at least two injuries is very high (88.5%). This is a predictor that repeated injuries are most likely to be filtered by NOC team physicians. Regarding illnesses, the NOC team physicians also act as filter. Firstly, illnesses mostly showed a lower grade of severity and were mostly founded in respiratory problems (mostly common colds) easily treatable without special equipment. Secondly, medication for treating light illnesses, are more likely to be within the brought pharmaceuticals, levering out the threshold of filling a prescription for the official pharmacy.

Obviously, there is a significant decrease in using medical services provided by the organizing committee for those NOCs that register own team physicians. This leads to a minimized workload for the medical staff employed by the organizing committee. Taking the overall number of injuries and illness combined, an increase of 3% can be seen for each NOC without team physicians (table 2). For Innsbruck, adding up this number means an increase of one medical encounter per 1000 athletes. For the planning process of medical service, less medical encounters, caused by registering team physicians would result in fewer emergencies, which could lead to a different staffing policy and potential cost savings. Confounding in form of delegation sizes was analyzed only for the group of patients facing at least two medical encounters (the patient group facing only one medical encounter showed no significant relationship to delegation size). Adjusted values also showed significant results except the group of patients facing more than two illnesses ($p=0.57$) (table 3). Also other confounder leading to NOCs registering own team physicians cannot be excluded. An additional limitation linking

back to the Games accreditation database is the fact, that potentially not all medical staff travelling with NOCs, for example physiotherapists, was registered as such. Physiotherapists also were not obliged to register with the Austrian Medical Chamber and therefore it is possible that NOC did have medical personnel without our knowledge, potentially falsifying results.

CONCLUSION

In summary, despite facing the challenge of the “unknown”, the provision of medical care at the first Winter Youth Olympic Games was adequately organized. The study at hand outlined one possible example on what is needed to provide efficient medical care for a complex high-level sport event. Medical encounters were handled efficiently. Staff was well trained to fulfill every required role. Although the medical focus of the entire region was set on accredited clients of the Youth Olympic Games, the high-quality medical service for the local population was not impacted. Medical encounters happening during the Games can be categorized as a little below average while comparing the results with prior Olympic Winter Games and the Summer Youth Olympic Games. These results provide interesting data for future organizing committees in respect to planning and staffing their medical services. A further conclusion that can be drawn from this study is that the appointment and registration of an NOC team physician will result in less dependence on the organizing committee’s medical services and in addition, might have beneficial effects on the organizing committee’s staffing policy.

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COMPETING INTERESTS

None.

ETHICS APPROVAL

Institutional Review Board and the ethic committee of the Leopold-Franzens-University of Innsbruck

WHAT ARE THE NEW FINDINGS

- Organization and implementation of medical services for Winter Youth Olympic Games
- Data on medical encounters during Winter Youth Olympic Games
- Information on NOC delegation structures at Youth Olympic Games
- Influences of registered NOC team physicians on usage frequency of medical services provided by the organizing committee

HOW MIGHT IT IMPACT ON CLINICAL PRACTICE IN THE NEAR FUTURE

- Support future organizing committees in regard to set up of medical services
- Encourage National Olympic Committees to register own team physicians

CONTRIBUTORS

All listed authors have significantly contributed to this work to justify authorship. This study was conceived and designed by CB, WS, GR, LE and PS. Literature search was done by CB and WS.

Acquisition of data and statistical analysis were done by CB, WS, GR, SH and CF. All listed authors (CB, LE, PS, GR, SH, CF, WS) contributed to the interpretation and discussion of the findings and participated in editing or re-writing of the article lead by CB (the guarantor).

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Table 1: Distribution of Medical Encounters regarding Venues and User Group

Medical Encounters	Youth Olympic Village	Olympiaworld Innsbruck	Kühtai
All (%) [95% CI]	42.5 [37.1;48.1]	20.2 [16.0;24.9]	5.5 [3.3;8.6]
Athletes (%) [95% CI]	55.4 [46.7 ,63.8]	36.4 [24.9;49.1]	72.2 [46.5;90.3]
NOC Team Officials (%) [95% CI]	23.7 [16.9;31.7]		5.6 [0.14;27.3]
Workforce (%) [95% CI]	18.7 [13.0;26.2]	34.8 [23.5;47.6]	11.1 [13.6;34.7]
Spectators (%) [95% CI]		10.6 [4.4;20.6]	11.1 [13.6;34.7]

Olympiaworld Innsbruck: Ice Hockey, Speed Skating, Short Track, Figure Skating

Kühtai: Freestyle Ski, Snowboard

Table 2: Comparison of Medical Encounters of National Olympic Committees (NOC) with registered Team Physicians and without registered Team Physician

			Reported to YOG medical service center [#]	p-value (df)	Relative Risk [CI _{95%}]	Risk Difference
at least one medical encounter	Injury or Illnes	No NOC Physician	8.6 %	0.012 (1)	1.55 [1.09;2.17]	3.00%
		NOC Physician	5.6 %			
	Injury	No NOC Physician	5.5%	0.055 (1)	1.52 [0.99;2.34]	1.90%
		NOC Physician	3.6%			
	Illness	No NOC Physician	3.1%	0.119 (1)	1.59 [0.89;2.84]	1.10%
		NOC Physician	2.0%			
at least two medical encounter	Injury or Illness	No NOC Physician	4.2%	< 0.001 ^{##} (1)	6.05 [2.97;12.32]	3.50%
		NOC Physician	0.7%			
	Injury	No NOC Physician	2.4%	< 0.001 ^{##} (1)	9.40 [3.08;28.70]	2.10%
		NOC Physician	0.3%			
	Illness	No NOC Physician	1.8%	0.004 ^{##} (1)	4.13 [1.58;10.8]	1.40%
		NOC Physician	0.4%			
[#] off all NOC delegates ^{##} Value of the Fisher's Exact Test						

Table 3: Adjusted Comparison of Medical Encounters of National Olympic Committees (NOC) with registered Team Physicians and without registered Team Physician

			Reported to YOG medical service center [#]	p-value (df)	Relative Risk [CI _{95%}]	Risk Difference
at least two medical encounter	Injury or Illness	No NOC Physician	2.8%	0.001 ^{###} (1)	3.99 [1.62;9.83]	2.1%
		NOC Physician	0.7%			
	Injury	No NOC Physician	2.1%	0.001 ^{###} (1)	8.23 [2.34;28.98]	1.8%
		NOC Physician	0.3%			
	Illness	No NOC Physician	0.7%	0.571 ^{###} (1)	1.57 [0.33;7.51]	0.3%
		NOC Physician	0.4%			
[#] off all NOC delegates ^{###} Value of the Fisher's Exact Test						

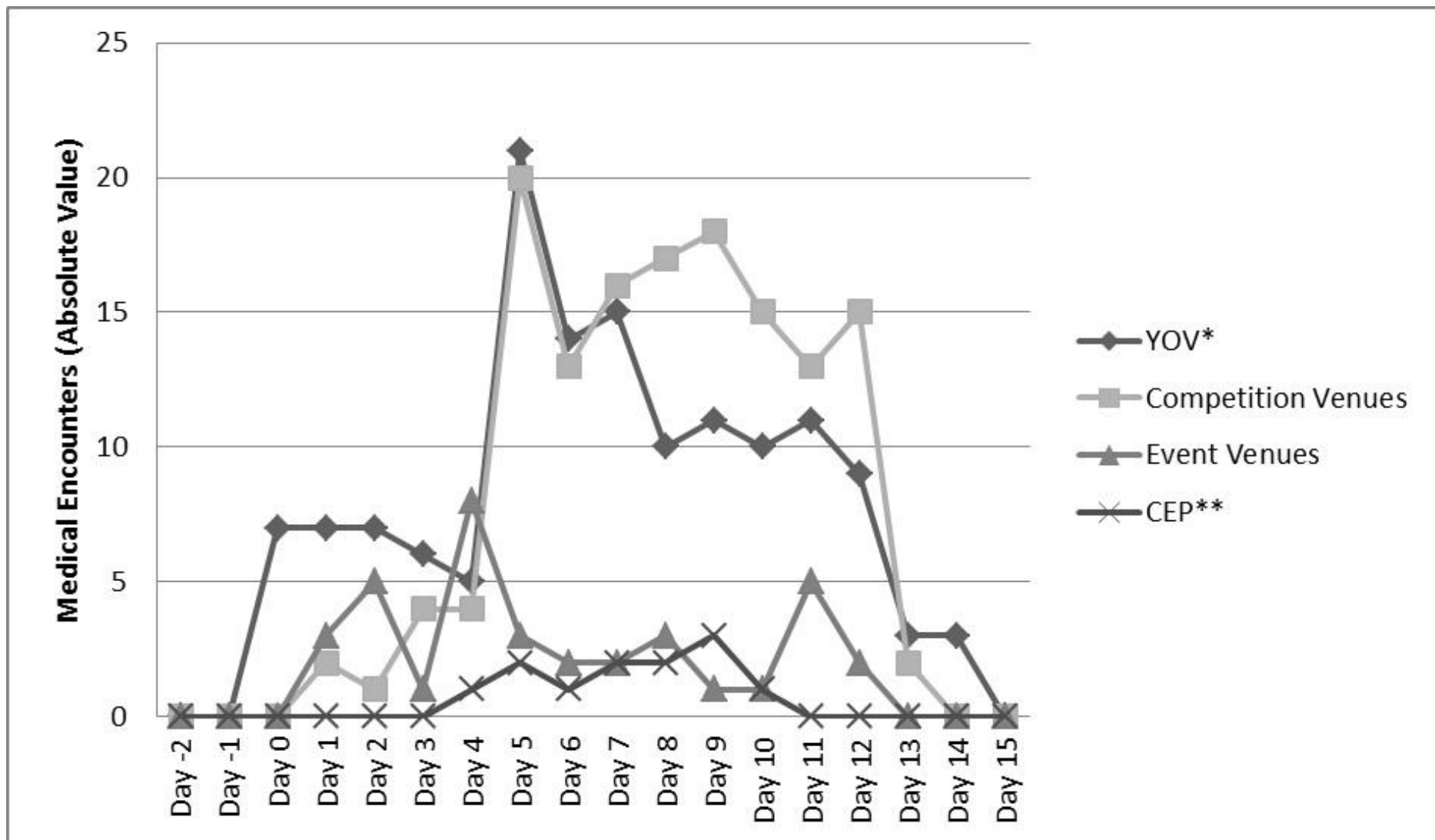


Figure 1: Time Distribution of Medical Encounters. (* Youth Olympic Village ** Cultural and Educational Program)

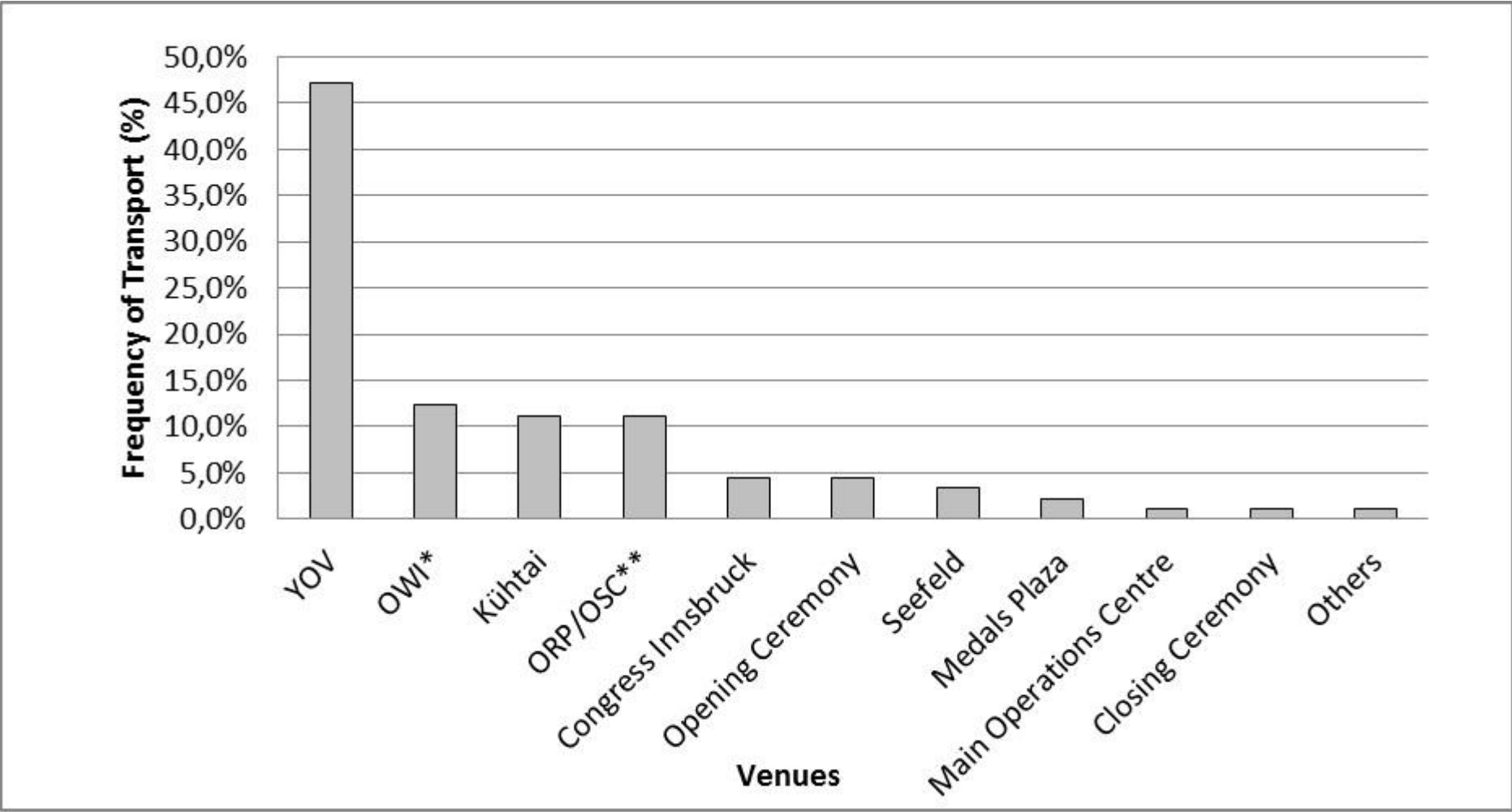


Figure 2: Departure Venue of Medical Transports (*Olympiaworld Innsbruck **Olympiarun Patscherkofel/Olympic Sliding Center)