A Report of the 2009 World Games Injury Surveillance of Individuals Who Voluntarily Used the International Federation of Sports Chiropractic Delegation

Debra D. Nook, DVM, MBA,[a] and Brian C. Nook, DC[b]

Abstract

Objective: The purpose of this study was to describe the frequency and nature of injuries treated by the International Federation of Sports Chiropractic (FICS) chiropractic health care delegation at the 2009 World Games in Kaohsiung, Taiwan.

Methods: A cross-sectional study design with descriptive statistics was used to describe the standard patient care data recorded on FICS treatment forms of individuals voluntarily using FICS chiropractors. Data included patient demographics, region of the body, type of treatment provided, and pre- and posttreatment numerical pain levels.

Results: The FICS chiropractors recorded 1514 treatments to athletes and support personnel. There were 445 (49%) athletes and 450 (51%) nonathletes receiving care. The total number of athletes participating at the 2009 World Games was 2906 plus 2812 support staff; thus, our utilization rates are 15.31% for athletes and 16.00% for nonathletes. Total treatments were 854 for athletes and 660 for nonathletes, including follow-up care. Treatments to 17 different body regions were recorded. The highest recorded athlete treatment region was the lumbar spine at 309 (36.18%), with thoracic spine and neck being treated 195 (22.83%) and 193 (22.60%) times, respectively. Chiropractic manipulations were administered to 583 (68.27%) of the athletes treated. Mobilizations were given to 209 (24.47%), whereas 640 (74.94%) received myotherapy and 205 (24.00%) had tape applied. Pre- and posttreatment pain scales revealed that approximately 94% of patients experienced immediate improvement.

Conclusion: These results demonstrate the findings of voluntary chiropractic care at a world-class multisport competition. (J Manipulative Physiol Ther 2011;34:54-61)

Key Indexing Terms: *Chiropractic; Athletic Injuries; Population Surveillance; Sports*

The International Federation of Sports Chiropractic (FICS) is composed of national chiropractic sports councils worldwide and their individual members. The Federation has several goals, with an overarching theme of assisting athletes and international sporting organizations by providing chiropractic health care, education, research, and professionalism in the area of sport.

The International World Games Association (IWGA) is an Olympic Charter with the following objectives: "To develop the popularity of the sports or disciplines of sports of International Sports Federations in membership with IWGA, to raise the status and image of the Member Federations in international and national bodies governing sport, to improve the prominence of the sports or disciplines of sports of the Member Federations through excellence in sport, and to strengthen the bond of friendship between Member Federations and to conserve the traditional values of sport. For this purpose the IWGA shall: provide, at intervals of four years, an international top class multi-sport event for sports or disciplines of sports of the Member Federations known as The World Games, strive to provide the widest possible exposure of the sports or disciplines of sports to public and media through the World Games concept."

There is a contractual agreement between the IWGA and the FICS that mandates that chiropractors with

[a] Senior Lecturer, School of Chiropractic and Sports Science, Murdoch University, Murdoch, Western Australia, Australia.

[b] Associate Professor, Dean of the School of Chiropractic and Sports Science, School of Chiropractic and Sports Science, Murdoch University, Murdoch, Western Australia, Australia.

Submit requests for reprints to: Debra D. Nook, DVM, MBA, Senior Lecturer, School of Chiropractic and Sports Science, ECL1.008, Murdoch University, Murdoch, Western Australia 6148, Australia (e-mail: *d.nook@murdoch.edu.au*).

Paper submitted August 26, 2010; in revised form October 7, 2010; accepted October 28, 2010.

0161-4754/$36.00

doi:10.1016/j.jmpt.2010.11.003

additional training qualification of an International Chiropractic Sports Science Diploma be onsite for the duration of each games for the purpose of providing chiropractic care. Pluim et al[1] discuss the expectations of the athletes to have the organizers arrange health care providers at their events.

The FICS Games Commission established treatment care centers at various sporting venues in Kaohsiung for the 2009 World Games. Some centers were located in common, centralized venues, whereas most treatment centers were at the individual sporting venues. The World Games organizers notified all participants (athletes and support personnel) and each federation that this care was available to all officially accredited persons as part of the medical services of these games. The information was also disseminated on the World Games Web site.

There were 5 objectives for this injury surveillance study at the 2009 World Games. The primary objective of this study was to determine the utilization rate of voluntary chiropractic care to athletes and nonathletes; secondary objectives were to determine the injury prevalence per sport or activity at the chiropractic care center, to determine the frequency of the anatomical region of treatment, to gather patient pre- and posttreatment pain levels, and lastly to report on the various forms of treatments provided by the chiropractors.

Methods

This is an observational study using data recorded on the FICS treatment form completed during each patient visit at treatment centers at the 2009 World Games. After arriving at a FICS treatment center, patients were given an information letter that outlined the methods and goals of this research project that they could volunteer to participate in.

A translator was available in the event that the patient was not able to understand English. The patients were given the opportunity to ask the researchers any questions they had before reading and signing the consent form. These practices were developed in accordance with the standards set and approved by Murdoch University's Human Ethics Committee. The chief investigator of this observational study is not a chiropractor and did not provide any of the treatments.

After consent was obtained, the patient was issued an identification number that was recorded on a log sheet separate from all treatment forms. This ensured patient anonymity and confidentiality. The same number was used to identify patient's repeat visits. The patient was then introduced to his or her treating chiropractor, and his or her number was recorded on the FICS treatment form.

This form included the patient's demographics, pretreatment history, physical examination results, working diagnosis, forms of treatment, posttreatment instructions, and 2 measured pain scales on which the patient could assess his or her pain levels pre- and posttreatment. All data for this observational study were taken from the 1514 FICS treatment forms completed by the delegation at the FICS treatment centers located at various sports venues during the duration of the World Games.

The chiropractor recorded the patent's information on the treatment form including age, nationality, sport and sex. The patient was examined by the chiropractor and recorded. The patient was given the opportunity to record his or her perceived pain level by placing a mark on a horizontal measured line bracketed by the words *no pain* and *severe pain*. This is in compliance with the visual analog scale (VAS) method of evaluating pain. The chiropractor then established a working diagnosis and commenced an appropriate treatment.[2,3] Forms of treatment may include manual manipulation, mobilization, myotherapy, stretching, ice, compression and the application of supportive taping, or referral to another health care professional. All aspects of the treatment were recorded on the FICS treatment form.

After each treatment, the patient was asked to reassess his or her pain level by marking it on another horizontal line. The patient was advised to return to play or work, to commence stretching or warm-up exercises, or to return for another treatment at a scheduled time; was referred to another health care provider; or was given other advice. This advice was also recorded on the FICS treatment form. The FICS treatment form was held in a folder by the research team and could be accessed by chiropractors if the patient returned for a repeat visit. After the completion of the games, all data from the forms were recorded on an Excel spreadsheet for appropriate analysis. Using methods of descriptive statistics, the data were processed to obtain the following results. The total number of participating athletes of 2906 and 2812 support staff was officially accredited by the IWGA.

Results

Utilization of Voluntary Chiropractic Care

Chiropractic treatments were provided on a voluntary basis and as part of the medical services at various sporting venues for athletes and nonathletes participating in the World Games. All patients who requested care completed the consent form, with 100% of patients agreeing to participate in the research; and a corresponding treatment record was completed by the treating chiropractor. One thousand five hundred fourteen treatments were recorded on the FICS treatment form. There were a total of 895 first-visit treatments to 445 athletes and 450 nonathletes. Of these 895 individuals, 305 (34%) returned for a repeat visit at least once. Table 1 demonstrates the number of athletes treated per country out of the possible

Table 1. *Number of athlete treatments by country*

Country	No. of athletes attending	First-visit treatments	Follow-up treatments	Total treatments	% Utilization (first visits/athletes attending)	% Treatments/total (854)
Argentina	17	0	0	0	0.00%	0.00%
Australia	90	35	35	70	38.89%	8.20%
Austria	31	7	5	12	22.58%	1.41%
Azerbaijan	4	0	0	0	0.00%	0.00%
Belarus	16	0	0	0	0.00%	0.00%
Belgium	45	0	0	0	0.00%	0.00%
Bolivia	4	0	0	0	0.00%	0.00%
Bosnia-Herzegovina	2	1	3	4	50.00%	0.47%
Brazil	47	1	2	3	2.13%	0.35%
British Virgin Island	1	1	1	2	100.00%	0.23%
Bulgaria	10	0	0	0	0.00%	0.00%
Canada	101	41	90	131	40.59%	15.34%
Chile	15	1	2	3	6.67%	0.35%
China	63	2	0	2	3.17%	0.23%
Chinese Taipei	295	54	32	86	18.31%	10.07%
Colombia	20	3	1	4	15.00%	0.47%
Costa Rica	2	0	0	0	0.00%	0.00%
Croatia	31	3	0	3	9.68%	0.35%
Czech Republic	39	3	0	3	7.69%	0.35%
Denmark	9	3	0	3	33.33%	0.35%
Dominican Republic	3	1	0	1	33.33%	0.12%
Ecuador	6	1	0	1	16.67%	0.12%
Egypt	21	5	5	10	23.81%	1.17%
El Salvador	2	0	0	0	0.00%	0.00%
Estonia	11	1	0	1	9.09%	0.12%
Fiji	12	0	0	0	0.00%	0.00%
Finland	20	11	6	17	55.00%	1.99%
France	134	5	0	5	3.73%	0.59%
Great Britain	137	37	55	92	27.01%	10.77%
Germany	158	25	15	40	15.82%	4.68%
Greece	6	3	1	4	50.00%	0.47%
Guatemala	4	0	0	0	0.00%	0.00%
Hong Kong	26	2	1	3	7.69%	0.35%
Hungary	73	6	1	7	8.22%	0.82%
India	6	1	1	2	16.67%	0.23%
Indonesia	7	0	0	0	0.00%	0.00%
Iran	6	0	0	0	0.00%	0.00%
Ireland	12	0	0	0	0.00%	0.00%
Israel	12	2	0	2	16.67%	0.23%
Italy	115	10	6	16	8.70%	1.87%
Japan	154	19	10	29	12.34%	3.40%
Kazakhstan	10	0	0	0	0.00%	0.00%
Korea	49	6	3	9	12.24%	1.05%
Kuwait	1	0	0	0	0.00%	0.00%
Kyrgyzstan	2	0	0	0	0.00%	0.00%
Latvia	18	0	0	0	0.00%	0.00%
Lithuania	10	2	0	2	20.00%	0.23%
Luxembourg	1	0	0	0	0.00%	0.00%
Macao	9	0	0	0	0.00%	0.00%
Macedonia	8	4	2	6	50.00%	0.70%
Malaysia	17	0	0	0	0.00%	0.00%
Mexico	10	2	1	3	20.00%	0.35%
Moldova	2	0	0	0	0.00%	0.00%
Mongolia	7	0	0	0	0.00%	0.00%
Montenegro	4	1	4	5	25.00%	0.59%
Netherlands	69	4	1	5	5.80%	0.59%
Norway	22	6	4	10	27.27%	1.17%
New Zealand	39	10	5	15	25.64%	1.76%
Oman	10	2	2	4	20.00%	0.47%
Pakistan	8	1	1	2	12.50%	0.23%

Table 1. (*continued*)

Country	No. of athletes attending	First-visit treatments	Follow-up treatments	Total treatments	% Utilization (first visits/athletes attending)	% Treatments/total (854)
Peru	1	0	0	0	0.00%	0.00%
Philippines	9	1	0	1	11.11%	0.12%
Poland	22	3	1	4	13.64%	0.47%
Portugal	37	9	5	14	24.32%	1.64%
Qatar	1	0	0	0	0.00%	0.00%
Romania	9	0	0	0	0.00%	0.00%
Russia	151	17	6	23	11.26%	2.69%
Senegal	1	1	1	2	100.00%	0.23%
Singapore	38	2	0	2	5.26%	0.23%
Slovakia	16	0	0	0	0.00%	0.00%
Slovenia	18	1	0	1	5.56%	0.12%
South Africa	57	7	2	9	12.28%	1.05%
Spain	28	1	2	3	3.57%	0.35%
Switzerland	74	18	20	38	24.32%	4.45%
Sweden	57	16	13	29	28.07%	3.40%
Tanzania	1	0	0	0	0.00%	0.00%
Thailand	34	0	0	0	0.00%	0.00%
Turkey	17	5	3	8	29.41%	0.94%
Ukraine	98	2	0	2	2.04%	0.23%
United Arab Emirates	1	0	0	0	0.00%	0.00%
United States	140	36	61	97	25.71%	11.36%
Uzbekistan	3	0	0	0	0.00%	0.00%
Venezuela	19	3	0	3	15.79%	0.35%
Vietnam	11	1	0	1	9.09%	0.12%
Totals	2906	445	409	854	15.31%	100.00%

2906 athletes, and Table 2 demonstrates the number of treatments per category of the 2812 nonathletes in attendance including 1170 volunteers from Chinese Taipei. The utilization rates per group are 15.31% for athletes and 16.00% for nonathletes. Treatments were provided to athletes from 54 (64.28%) of the 84 countries participating in the games. There were 1250 female and 1692 male accredited athletes, of which 200 (16%) female and 245 (14.78%) male athletes sought chiropractic care at least once. All treatment forms were complete and used with no missing data in the fields analyzed in this study. There were 4.17% forms missing complete VAS scores for pre- and posttreatment pain scales; this is most likely due to clerical error.

The utilization rates by country (the number of athletes from each country who used chiropractic care divided by the number of athletes from each country) are depicted in Table 1. This calculation has been defined as the *response rate* in the article by Junge et al.[4] The highest utilization rate of countries with greater than 20 accredited athletes was Finland (55%). Canada and Australia represented the next largest utilization rates (39.42% and 38.89%, respectively), with 131 and 70 athletes attending. The percentage of total treatments by country shows that the 5 countries with the highest proportion of chiropractic treatments were Canada (8.65%), the United States (6.41%), Great Britain (6.08%), Chinese Taipei (5.68%), and Australia (4.62%). There were 2 countries with a utilization rate of 100%: The British Virgin Islands and Senegal; however, these countries only had one accredited athlete each.

There was one community of nonathlete patients, the group of volunteers from Chinese Taipei, which had an incredibly high rate of utilization of 29.91%, where 350 of 1170 requested chiropractic care. This is much higher than that for athletes (15.31%) and nonathletes from other countries (6.09%). Treatments from this population contributed to 34.41% of the total treatments.

Injury Prevalence per Sport

Athletes from 25 (78%) of the 32 various sports present at the World Games sought treatment from the FICS delegation. The 4 sports with the highest utilization rates of first visits per accredited athletes are water ski (46; 60.53%), tchoukball (52; 47.71%), flying disc (31; 41.33%), and racquetball (11; 37.93%), as seen in Figure 1.

Injury Prevalence of Anatomical Region of Treatment

Treatments to athletes were divided into 17 different body regions. Figure 2 demonstrates the highest recorded treatment area as the lumbar spine at 309 (36.18%) of all recorded treatments to athletes. Thoracic spine and neck treatments were recorded at 195 (22.83%) and 193 (22.60%), respectively.

Table 2. *Treatment numbers based on nonathlete classification*

Nonathlete patients		First-visit treatments	Total treatments	Follow-up treatments	Total	% Utilization	% Treatments out of total (1514)
Medical	Medical doctors, physical therapists, nurses, trainers	19	24	5	1642	6.09%	9.18%
Officials	Officials, referees, judges, coaches	81	115	34			
Chinese-Taipei volunteers	Volunteers and Kaohsiung organizing committee members	350	521	171	1170	29.91%	34.41%
Totals		450	660	210	2812	16.00%	43.59%

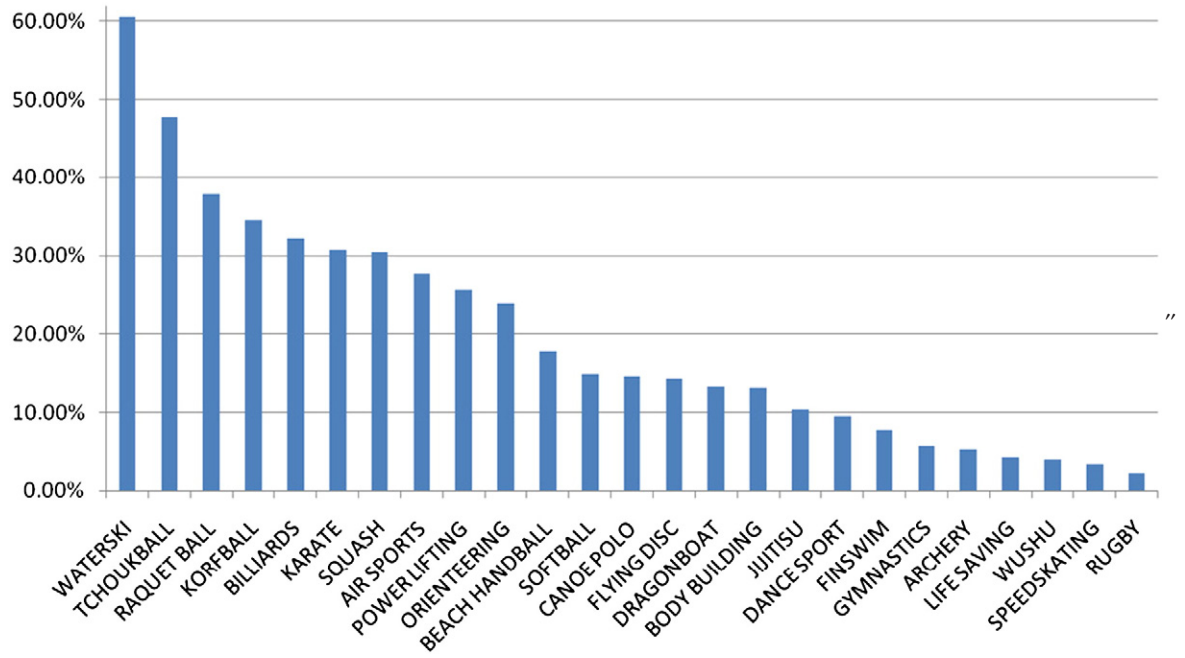

Fig 1. *Athlete utilization percentage of accredited athletes by sport.*

Other Relevant Observations

Pre- and posttreatment VAS pain scales were completed by the patient. Of the 1514 treatments provided, 1451 treatment forms contained complete data of both VAS lines, which yields a 95.83% completion rate as Table 3 indicates. The number of treatments resulting in immediate decrease in VAS scores was 1366 (94.14% of the 1451 completed forms). These results are divided into athletes recording a 93.50% improvement immediately posttreatment and 94.96% improvement for nonathletes. The mean pretreatment VAS score was 4.58 and the posttreatment VAS score was 1.82, leading to a 60.20% mean improvement in pain scores based on the VAS scores provided by the patients.

Chiropractic manipulations were administered to 1140 (75.30%) of those requesting chiropractic care. Figure 3 shows that mobilizations were used for 380 (25.10%) treatments, whereas 1153 (76.16%) received myotherapy and 280 (18.49%) had supportive tape applied. Many patients received more than one method per treatment session, and every patient received a minimum of one treatment method.

Discussion

The FICS Games Commission assigned 2 Chefs de Mission for the 2009 World Games. They oversaw 29 chiropractors in attendance. Four nonchiropractors were also included in the FICS team to fulfill the research requirements. The FICS treatment forms were fully completed by these chiropractors and are used as the data of this study. The FICS team consisted of members from 13 different countries, all of whom spoke English. Some members were bilingual, including one individual from Chinese Taipei; and her language skills facilitated the team's communication with members of the host country.

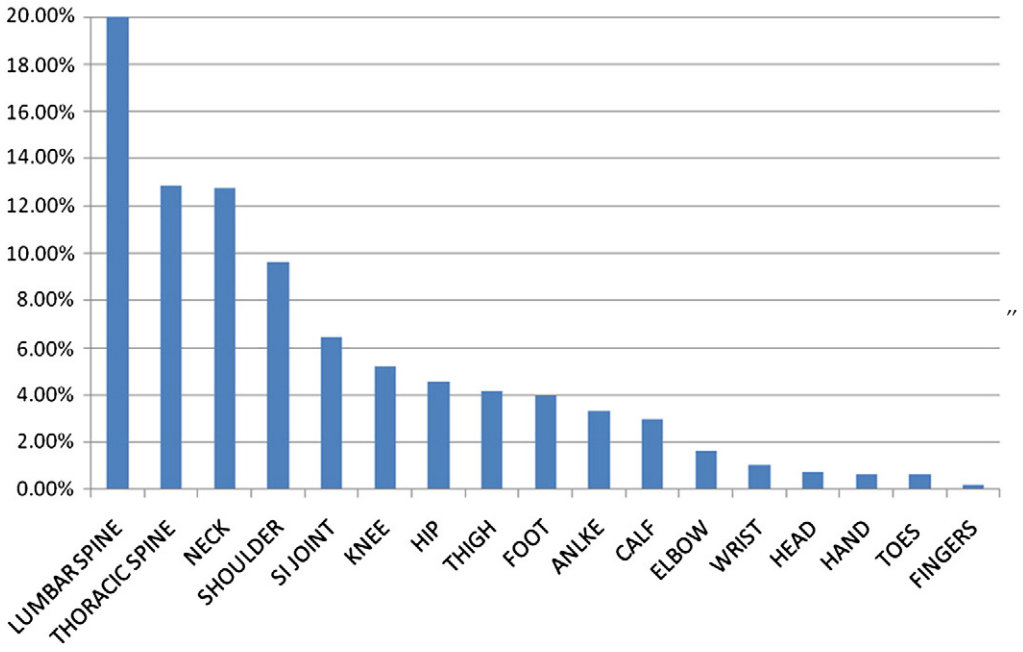

Fig 2. *Percentage of athlete treatments by body region.*

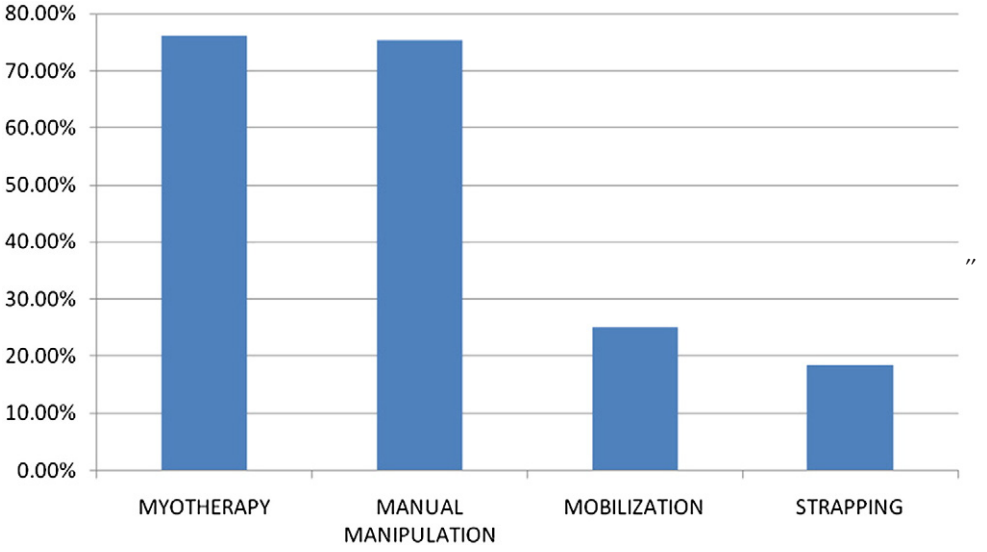

Fig 3. *Percentage of total treatments using each treatment method.*

A limited number of surveillance studies have been published on the utilization of chiropractic care at national and international levels involving multisport events. Junge et al[5] published results of a medical study at the 2008 Summer Olympic Games indicating that approximately 10% of athletes sustained injury during the event. Some publications have been written in relation to a specific sport such as the data presented by Stump and Redwood[6] on National Football League players and Kazemi et al[7] dealing with taekwondo athletes. Another study by Hoskins et al[8] looked at low back pain in a variety of ball sports such as Australian rules football, soccer, rugby and nonathletic controls.

Previous authors have conducted and published results from the Sixth All Africa Games in 1997.[9] This study used similar data collection methods with results of nearly 2000 treatments provided to athletes and support personnel. The utilization rate in this earlier study was higher at 33%. This

Table 3. *Pain VAS change for athletes, nonathletes, and total*

Variable	Athletes	Nonathletes	Total
Total treatments	854	660	1514
Forms with complete VAS	816	635	1451
Mean pretreatment VAS for pain	4.49	4.69	4.58
Mean posttreatment VAS for pain	1.89	1.73	1.82
Mean percentage of pain reduction	57.86%	63.08%	60.20
No. of treatments resulting in immediate decrease in VAS for pain posttreatment	763	603	1366
Percentage of treatments resulting in immediate decrease in VAS for pain posttreatment	93.50%	94.96%	94.14%

difference is most likely due to the fact that the participating African teams did not have their own medical personnel other than local medics and the FICS delegation, whereas at the World Games, many sports teams brought their own medical professionals as part of their athlete care. Whereas the All Africa Games study was valuable in providing data relating to the effects of chiropractic care in international sporting events, the current study not only adds to the amount of data available for the scientific community, but also shares findings relating to sports that were not represented in the previous study. This study also adds value to the literature, as it offers insights into the political and social aspects of chiropractic by Chinese Taipei volunteers.

The utilization rates of voluntary chiropractic care were 15.31% for athletes and 16.00% for nonathletes, which are above mean US chiropractic utilization rate of 7.50%.[10] Chiropractic is becoming an accepted form of health care around the world and is gaining positive public perception in the area of musculoskeletal conditions.[11-13] Hurwitz et al[14] published data concluding that there was a doubling of chiropractic treatments for low back from 1985 to 1991. However, in Chinese Taipei, chiropractic is not recognized and is considered by the government to be illegal to practice.[15-17] The data collected from this study provide an insight into this paradigm. The results show a high utilization rate of nonathletes totaling 521 volunteers from Chinese Taipei. The findings of relatively high utilization by the Chinese Taipei volunteers would indicate their interest in chiropractic care. The incorporation of chiropractic into the medical team authorized by the Chinese Taipei Minister of Health increased the exposure to all personnel and athletes at these games.

The utilization rate for athletes was lower than expected at 15.31% and can be explained by the fact that many countries attending these games travel with their designated musculoskeletal care team, including physical therapists, massage therapists, as well as their own team chiropractor. The FICS delegation was present at selected venues, which will bias the utilization rates by sport because of location. It is recommended that the delegation is present at all venues to provide better coverage and obtain clearer statistics.

Chiropractic is becoming an accepted form of health care around the world.[13] However, in Chinese Taipei, chiropractic is not recognized as an official health care practice; and the Chinese Taipei government has deemed it illegal.[15-17] However, the utilization rate of treatment by Chinese Taipei in this study, for individuals who were mainly volunteers from Kaohsiung, is high at 18.31% (twice as high as the United States national mean). This demonstrates that there is interest in the benefits of chiropractic in the Chinese Taipei populace. However, because of local laws, most Chinese Taipei residents have not been exposed to chiropractic care before the appearance of the FICS chiropractic team; and these facts suggest that there is a desire or need for chiropractic professionals to be allowed to provide chiropractic care in Chinese Taipei. This information will be made available to the Taiwan Chiropractic Association to aid in their efforts to become accepted as a profession within the health care provider's schema.

Sports incur a certain risk of injury. Injury was first recognized by the National Health and Medical Research Council as a national health priority in 1986.[18] During the 1990s, injury was responsible for more than 7000 deaths and 14.7% of years of potential life lost, 400 000 hospitalizations, and direct medical costs of $2607 million per year in Australia. Accordingly, (1) prevention development and (2) intervention evaluation for sporting injuries were identified as broad priorities for injury prevention.

The sports that used chiropractic care with the highest percentages of total treatments out of the total number of accredited athletes were tchoukball (154; 18.03%), water ski (97; 11.36%), flying disc (93; 10.89%), and korfball (70; 8.20%). These levels of utilization are most likely due to the chiropractic delegation being present at established treatment centers for these events. The location, advertisement, and ease of access all contributed to the high number of athletes seeking chiropractic care.

Correlation of sport and injury prevalence to body regions is of great interest to sports chiropractors as well as coaches and trainers. The data from the FICS treatment records indicate that lumbar spine treatments provided to athletes had the highest prevalence at 309 of the 854 treatments, followed by treatments to the thoracic spine and to the neck. Other areas of interest were the shoulder and the sacroiliac joint, recording 146 (17.10%) and 98 (11.48%), respectively. Sports that recorded a high number of lumbar spine treatments included tchoukball (47; 15.21%), waters ski (40; 12.95%), and korfball (33; 10.68%).

These data must be interpreted with caution because of the inherent implication of descriptive methodology. Some limitations of the study would include that the VAS scores were only offered to the patient immediately after treatment, with no long-term follow-up. These evaluations were completed in the presence of the treating

chiropractor; this may have influenced the patient's response. Further data collection is recommended at national and international events.

Conclusion

These findings demonstrate participation of voluntary chiropractic care at this world-class level of completion. The results show the types of musculoskeletal conditions presented and treated through chiropractic care. The patients received chiropractic treatments as well as soft tissue treatments, with a high degree of improvement posttreatment. These results will be disseminated to the World Games organizers as well as the International Olympic Committee and the individual International Sport Federations that were present at these games. In this example, chiropractic played an integral part in restoration to athletic function without the use of medications and should be available at all international level play.

Practical Applications

- Athlete demand supports FICS delegations' involvement in international sporting events.
- Pain rating scale rates improved immediately after chiropractic treatment.
- The delegation treated injuries to all areas of the body, although the majority was to the spine.
- Location of chiropractic service at the venue correlates to utilization by the athletes, and the involvement of chiropractic services at all venues should be supported.
- Multiple sports and athletes not currently involved in the Olympic Games used chiropractic services.

Funding Sources and Conflicts of Interest

No funding sources or conflicts of interest were reported for this study.

References

1. Pluim BM, Fuller CW, Batt ME, Chase L, Hainline B, Miller S, Montalvan B, Renstrom P, Stroia KA, Weber K, Wood TO. Consensus statement on epidemiological studies of medical conditions in tennis, April 2009. Br J Sports Med 2009;43:893-7.
2. de Boer AG, van Lanschot JJ, Stalmeier PF, van Sandick JW, Hulscher JB, de Haes JC, Sprangers MA. Is a single-item visual analogue scale as valid, reliable and responsive as multi-item scales in measuring quality of life? Qual Life Res 2004;13:311-20.
3. Gift AG. Visual analogue scales: measurement of subjective phenomena. Nurs Res 1989;38:286-8.
4. Junge A, Engebretsen L, Alonso JM, Renstrom P, Mountjoy M, Aubry M, Dvorak J. Injury surveillance in multi-sport events: the International Olympic Committee approach. Br J Sports Med 2008;42:413-21.
5. Junge A, Engebretsen L, Mountjoy ML, Alonso JM, Renstrom PA, Aubry MJ, Dvorak J. Sports injuries during the Summer Olympic Games 2008. Am J Sports Med 2009;37:2165-72.
6. Stump JL, Redwood D. The use and role of sport chiropractors in the national football league: a short report. J Manipulative Physiol Ther 2002;25:E2.
7. Kazemi M, Shearer H, Choung YS. Pre-competition habits and injuries in taekwondo athletes. BMC Musculoskelet Disord 2005;6:26.
8. Hoskins W, Pollard H, Daff C, Odell A, Garbutt P, McHardy A, Hardy K, Dragasevic G. Low back pain status in elite and semi-elite Australian football codes: a cross-sectional survey of football (soccer), Australian rules, rugby league, rugby union and non-athletic controls. BMC Musculoskelet Disord 2009;10:38.
9. Nook B, Nook D. Demographics of athletes and support personnel who used chiropractic physicians at the 6th All Africa Games. J Sports Chiropractic Rehab 1997;11:4.
10. U.S. National Center for Health Statistics. Adults 18 years and over who used complementary and alternative medicine in the past 12 months 2008. Available from: http://www.census.gov/compendia/statab/2010/tables/10s0161.xls.
11. Cambron JA, Cramer GD, Winterstein J. Patient perceptions of chiropractic treatment for primary care disorders. J Manipulative Physiol Ther 2007;30:11-6.
12. Lawrence DJ, Meeker WC. Chiropractic and CAM utilization: a descriptive review. Chiropractic & Osteopathy 2007;15:1-27.
13. Xue CC, Zhang AL, Lin V, Myers R, Polus B, Story DF. Acupuncture, chiropractic and osteopathy use in Australia: a national population survey. BMC Public Health 2008;8:105.
14. Hurwitz EL, Coulter ID, Adams AH, Genovese BJ, Shekelle PG. Use of chiropractic services from 1985 through 1991 in the United States and Canada. Am J Public Health 1998;88:771-6.
15. Shan S. Medical groups object to "chiropractor-friendly" bill. 448 Taipei Times February 22, 2006.
16. Sui C. Practice of chiropractic faces challenges in Taiwan. 450 Taiwan Today November 9, 2009.
17. Sui C. In Taiwan, these doctors must treat patients undercover. 452 China Post April 29, 2009.
18. Injury as a National Health Priority Area (NHPA). Australian Government National Health and Medical Research Council 2010. [updated 2010; cited]; Available from: http://www.nhmrc.gov.au/your_health/facts/injury.htm#p3.