Fifteen Years of Amateur Boxing Injuries/Illnesses at the United States Olympic Training Center

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Abstract: *We examined the incidence of health problems in elite-level amateur boxing athletes who sparred, trained, or competed at the United States Olympic Training Center in Colorado Springs, Colorado from January 1, 1977 through June 30, 1992. We think this is the first study to examine both injuries and illnesses in a population of elite-level athletes. We collected data on 1,776 reported problems (1219 injuries, 557 illnesses) from standard medical report forms completed by the permanent and volunteer sports medicine staff. We classified the information based on type, body region, location, description, and occurrence. There were significant differences between the frequency of injuries and illnesses and between the classifications and regions for each type of problem. Collectively, serious injuries represented only a relatively small percentage (6.1%) of all problems. We concluded that illnesses comprised a small but important portion of problems, that most illnesses involved respiratory tract infections (71%), that there is only a small risk for serious injury, and that injuries occur in a hierarchy of upper extremity (441, 25%), head/face (344, 19%), lower extremity (267, 15%), and spinal column (167, 9%) for amateur boxers.*

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The sports and medical literature is largely lacking in studies assessing boxing injuries in populations of elite amateur athletes.[6] Estwanik et al[1] have studied injuries from the 1981 and 1982 USA/Amateur Boxing Federation National Championships, while Jordan et al[6] examined boxing injuries at the United States Olympic Training Center (USOTC) over a 10-year period (1977 to 1987). Both of these studies found that most boxing injuries occurred in the upper extremity, specifically to the hand and wrist, but differed in their findings of cerebral injuries. Several international researchers[2–4,7–9,11,12,14] have also studied boxing injuries, but have also reported differing results.

Although important, this base of knowledge on amateur boxing injuries is far from complete, since the studies to date have examined only competitive events,[1] training periods of a short duration (typically less than 2 years),[8] or only selected types of injury, such as brain damage and thenar carpometacarpal dislocation,[2–4,7] rather than the totality of all possible instances of training, competition, and injury. The study by Jordan et al[6] is a partial exception to this trend. In addition, a further problem with most of the boxing articles published to date is that they have described only orthopaedic, neurological, or event-related injuries and have failed to address the aspect of the medical illnesses that might have been present in their athletic populations. The analysis of both injury and illness information would present a more complete picture of the epidemiology of elite athletes involved in the sport of amateur boxing.

The purpose of this article is to present a descriptive analysis of amateur boxing injuries and illnesses which have occurred at the USOTC in Colorado Springs from January 1, 1977 through June 30, 1992. A secondary purpose of this article is to examine the issue of the safety of boxing as a sport in regard to serious injuries. The injuries occurred in sessions of sparring, training, or competitive events. While inclusive of the database generated through the study by Jordan et al,[6] this article expands the existing knowledge of amateur boxing epidemiology through the use of a long-term time frame (15.5 years) and by incorporating information on both injuries and illnesses into the descriptive presentation.

Methodology

We collected data on athlete injuries and illnesses from the standard medical report forms used by the permanent and voluntary staff at the USOTC to record the cause, nature, and disposition of problems reported by athletes who sought the services of the Division of Sports Medicine from January 1, 1977 through June 30, 1992. The report forms had been completed by athletic trainers, chiropractors, family practitioners, and orthopaedic physicians. In order to ensure consistency and to limit possible variation in the diagnoses, all recorders used the same documentation procedures, which were reviewed and supervised by the permanent USOTC staff.

Data on boxing were then separated from the main database and compiled for descriptive analysis. The problems reported by the boxing athletes were classified on the basis of general type (injury versus illness), body region, location within a particular body region, and description of the problem within each location. Once the data were classified, the resultant frequencies were statistically analyzed with Chi-square tests of association.[10,13]

We also examined the data relative to the issue of the safety of amateur boxing as a sport and to the occurrence of serious injuries. The term "safety" has been defined as "the implementation of principles to reduce the hazards and risk of serious injury and illness in sports."[5] The term "serious" has been defined as "a condition which results in significant time loss from participation in sports or activities of daily living, or is nonrepairable by either physiologic means or medical intervention."[5] For this study, the term "serious" was modified to mean "a condition which could not be remediated through the typical services of an athletic trainer at the USOTC." For example, a concussion would be classified as serious, for it might require the services of a physician in order to ensure proper management of the problem, while an inversion ankle sprain would not be classified as serious, for it is usually treated appropriately by an athletic trainer. For this study, the term "safety" meant "a proportion of serious injuries less than 10%."

In relative terms, several limitations existed with the methodology of this study. The standard procedure for reporting medical problems does not lend itself to rigorous experimental control and randomization of subjects in order to maximize the degree of internal validity. Another limitation is that the methodology could not account for any illnesses or injuries among the boxing athletes that were not reported to the USOTC sports medicine staff; unreported problems or pre-existing conditions that were not detected would obviously change the reported results. Another limitation is that information on the total number of athletes involved in the study was not obtainable, and, therefore, expression of additional descriptive data, such as injuries per athlete, is not available. The final limitation is that the study involved only elite amateur athletes at the USOTC; the results may not be the same in the broader population of all amateur boxers or in professional athletes. These relative limitations are offset by the fact that the study occurred in the actual and typical training and performance environment of the athletes, thus enhancing the overall external validity of the methodology.

Results

A total of 1,776 problems were reported at the USOTC over the 15.5-year period of survey. There were more injuries (1219/1776; 68.6%) than illnesses (557/1776; 31.4%; $\chi^2(1) = 246.8$, $p < .001$). The injuries were further classified relative to general regions of the body: upper extremities (441/1776; 24.8%), head/face (344/1776; 19.4%), lower extremities (267/1776; 15.0%), and spinal column (167/1776; 9.4%).

Both injuries and illnesses were further classified based on a general description of the type of reported problem (Table 1 and 2). Injury descriptions ranged from meniscal/plical disorders (5/1219; 0.4%) to contusions (304/1219; 24.9%)($\chi^2(14) = 1615.6$, $p < .001$), while illness descriptions ranged from an "other" description (5/557; 1.0%), which included such problems as a foreign body in the eye and impacted cerumen within the ear canal, and infections (397/557; 71.3%)($\chi^2(9) = 2380.0$, $p < .001$).

There were exceptions to the overall trend; specific significant differences existed in the frequencies of contusion and muscle strain, joint sprain and tendinitis, and tendinitis and concussion injuries, and in the frequencies of infection and gastrointestinal, gastrointestinal and inflammation, and inflammation and respiratory illnesses (Tables 1 and 2). All other comparative differences were not statistically significant.

Reported injuries were also classified relative to locations within each body region (Table 3). Significant differences existed between locations within each body region (upper extremities $\chi^2(8) = 180.7$, $p < .001$; head/face $\chi^2(6) = 245.6$, $p < .001$; lower extremities $\chi^2(6) = 104.7$, $p < .001$; spinal column $\chi^2(4) = 35.21$, $p < .001$). Table 3 also presents specific information on the description and occurrence of the injuries which were reported within each location and body region.

Analogous to the management of the data on reported injuries, illnesses were also classified by location (Table 4). Locations included the cardiopulmonary system (236/557; 42.4%), gastrointestinal system (66/557; 11.8%), skin (62/557; 11.1%), throat (49/557, 8.8%), genitourinary system (43/557; 7.7%), head/face (32/557; 5.8%), ear (22/557; 3.9%), nose (20/557; 3.6%), eye/orbit (14/557; 2.5%), mouth (12/557; 2.2%), and chest/ribs (1/557; 0.2%)($\chi^2(10) = 827.29$, $p < .001$). Table 4 also presents specific information on the description and occurrence of the illnesses that were reported within each location.

Discussion

The primary importance of this study is that it was the first to examine the incidence of illnesses in a population of elite amateur athletes. Although illnesses occurred with a significantly lower frequency than injuries, the fact that they represented more than 30% of all reported problems should be of interest to sports medicine professionals who work with amateur boxing athletes. Also of interest is that most (71.3%) of the illnesses involved some type of an infection and that the majority of these infections occurred in the cardiopulmonary system, more specifically the upper and the lower respiratory tracts and related passages. It would be interesting to compare these findings to the relative percentages of infections found in other types of sports and to the general population, both athletic and nonathletic, in order to determine the overall importance of infections. This infor-

Table 1.—General Classification of Injuries

Description	Occurrence	Incidence %
Contusion	304 *	24.9
Muscle strain	254	20.8
Joint strain	213 *	17.5
Tendinitis	112 *	9.2
Concussion	74	6.1
Fracture	60	4.9
Laceration	50	4.1
Abrasion	41	3.4
Epistaxis	27	2.2
Degenerative changes	25	2.1
Neural disorders	17	1.4
Sublaxation/dislocation	16	1.3
Perforation/rupture	11	0.9
Bursitis/chondritis	10	0.8
Meniscal/plical disorder	5	0.4
Total	1219	100.0

* $p < .05$.

Table 2.—General Classification of Illnesses

Description	Occurrence	Incidence %
Infection	397 *	71.3
Gastrointestinal	66 *	11.8
Inflammation	32	5.7
Respiratory	14	2.5
Neural disorder	11	2.0
Cardiovascular	9	1.6
Contusion	9	1.6
Epistaxis	8	1.4
Dental	6	1.1
Other	5	1.0
Total	557	100.0

* $p < .05$.

mation is not currently available. Such data would be helpful in order to determine the overall safety of amateur boxing as compared to other sports and relative to nonathletic pursuits and activities.

Regarding the issue of safety in boxing, this study found fewer injuries of a serious nature than previous investigations. Jordan et al[6] reported surprise in finding only 29 cerebral injuries (26 mild concussions, two moderate concussions, and one traumatic headache in 447 total injuries; 6.5%), which they attributed to the fact that boxing at the USOTC is largely noncompetitive and involves more sparring and training than actual matches. This contrasts with the report of Estwanik et al,[1] who found that 48% of all injuries during boxing competition involved a blow to the head. They reported that the rate of head blows was 4.38 per 100 exposures,[1] but did not provide specific information about how many of the blows to the head resulted in an actual cerebral injury. Several Swedish researchers[2–4,8,12] used prospective and retrospective experimental designs to compare the brain and neurological functions of matched groups of amateur boxers, military conscripts, soccer players, and track and field athletes. They examined past medical histories of the subjects; performed neurological, physical, and psychological examinations on all subjects; and tested them, using either CT or MRI scans. They concluded that amateur boxing in Sweden did not lead to chronic brain damage and did not differ from other activities in terms of injuries which involved neuropsychological impairment.[2–4,8,12] The present findings of 74 concussions, or 6.1% of the total number of injuries, is slightly less than the results of Jordan et al,[6] but consistent with the totals from the Swedish investigations.[2–4,8,12]

While the importance of a cerebral injury cannot be understated, this study supports the conclusions of the Swedish researchers that amateur boxing is a safe sport secondary to the risk of serious brain injury. The risk does exist, as it exists with any sport as well as with nonathletic activities of daily living, but is relatively low compared to orthopaedic problems and illnesses. However, further research is necessary in this area to strengthen the validity of this conclusion.

The issue of safety might also be raised regarding the findings of 60 fractures, 25 situations of degenerative changes, 17 neural disorders, 16 subluxations or dislocations, and 11 perforations or ruptures (Table 1). While these problems represent only small percentages of the overall number of injuries, 4.9, 2.1, 1.4, 1.3, and 0.9%, respectively, they might detrimentally impact an athlete's career on his/her long-term health status. However, several international researchers[7,9,11,14] have concluded that the use of appropriate headgear and hand wear will decrease the risk of these problems. Further research of a longitudinal nature is necessary to determine the influence of these types of injuries on athletes' long-term health in order to more appropriately address this aspect of the relative safety of amateur boxing. The absence of such long-term information is a relative limitation of this investigation and of previous studies.[1,6,8]

With a few notable exceptions, the findings of this study parallel the results of Jordan et al.[6] This is not sur-

Table 3.—Injuries by Body Region

Body region	Location	Occurrence	Incidence		Percent of problems*
			Region %	Body %	
Upper extremities	Hand	107	24.3	8.8	6.0
	Shoulder	86	19.5	7.0	4.8
	Thumb	60	13.6	4.9	3.4
	Fingers	59	13.4	4.8	3.3
	Wrist	45	10.2	3.7	2.6
	Elbow	44	10.0	3.6	2.5
	Forearm	16	3.6	1.3	0.9
	Upper Arm	16	3.6	1.3	0.9
	Clavicle	8	1.8	0.6	0.4
	Subtotal	441	100.0	36.0	24.8
Head/face	Face/Scalp	146	42.4	12.0	8.2
	Nose	71	20.6	5.8	4.0
	Eye/Orbit	44	12.8	3.6	2.5
	Mouth	30	8.7	2.5	1.7
	Jaw/Chin	28	8.2	2.3	1.6
	Ear	22	6.4	1.8	1.2
	Throat	3	0.9	0.2	0.2
	Subtotal	344	100.0	28.2	19.4
Lower extremities	Knee	78	29.2	6.4	4.4
	Ankle	68	25.5	5.6	3.8
	Thigh	40	15.0	3.3	2.2
	Leg	30	11.2	2.5	1.7
	Foot	24	9.0	2.0	1.4
	Hip/Groin	16	6.0	1.3	0.9
	Toes	11	4.1	0.9	0.6
	Subtotal	267	100.0	22.0	15.0
Spinal column	Lumbopelvic	49	29.3	4.0	2.8
	Chest/Ribs	46	27.5	3.8	2.6
	Neck	41	24.6	3.4	2.3
	Thorax	21	12.6	1.8	1.2
	Abdomen	10	6.0	0.8	0.5
	Subtotal	167	100.0	13.8	9.4
	Total	1,219		100.0	68.6

*Includes injuries and illnesses.

prising, for, as was stated previously, the present study is both an expansion and an extension of the prior study's database. While both studies reported that the greatest number and percentage of injuries occurred in the upper extremity and the fewest occurred in the lower extremity, differences exist between the two investigations on head/face and lower extremity injuries (Table 3).[6] Jordan et al found more lower extremity injuries than head/face injuries, 23.9 and 20.6% ($p > .05$), while this investigation noted a reverse relationship, 28.2 and 22.0% ($p < .01$) (Table 3).

Other differences noted are that Jordan et al found more finger than thumb injuries in the upper extremities, a fewer number of thigh injuries in the lower extremities, and a fewer number of face/scalp injuries in the head/face region as opposed to the results presented in Table 3. These differences may reflect a product of the longer period of data collection for this study compared to the prior study, a specific change in the trend of amateur boxing injuries over the past 5.5 years at the USOTC, or variability due to turnover in the personnel who recorded the data. Further research is necessary to determine the nature of this difference, as well as to more completely elucidate the factors of injury and illness in amateur boxing.

Conclusions

We conclude that:

1. illnesses comprise an important portion of health problems which affect elite-level amateur boxing athletes,
2. most illnesses in elite-level amateur boxers are infections in the upper or lower respiratory tracts,
3. serious injuries represent only a small percentage of all problems

Table 4.—Illnesses by Location

Location	Occurrence	Incidence	Percent of problems
Cardiopulmonary	**236**	**42.4**	**13.3**
Gastrointestinal	**66**	**11.8**	**3.7**
Skin	**62**	**11.1**	**3.5**
Throat	**49**	**8.8**	**2.8**
Genitourinary	**43**	**7.7**	**2.4**
Head/Face	**32**	**5.8**	**1.8**
Ear	**22**	**3.9**	**1.2**
Nose	**20**	**3.6**	**1.1**
Eye/Orbit	**14**	**2.5**	**0.8**
Mouth	**12**	**2.2**	**0.7**
Chest/Ribs	**1**	**0.2**	**0.1**
Total	**557**	**100.0**	**31.4**

which might affect elite-level amateur boxers, and

4. most elite-level amateur boxing injuries occur in the upper extremities, followed by the head/face region, the lower extremities, and the spinal column.

Acknowledgments

This research was made possible through grants from the National Athletic Trainers' Association and from Baxter Orthopaedic Services.

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