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# A 16 year study of injuries to professional boxers in the state of Victoria, Australia

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**Objectives:** Concerns about the significant injury risks in boxers have been well documented. To inform the continuing debate, updated information about the risk of injury for participants, and suitable means of modifying or preventing these risks, need to be identified.

**Methods:** Data describing all professional boxing fight outcomes and injuries sustained during competition, from August 1985 to August 2001, were obtained from the Victorian Professional Boxing and Combat Sports Board.

**Results:** A total of 107 injuries were recorded from 427 fight participations, corresponding to an injury rate of 250.6 injuries per 1000 fight participations. The most commonly injured body region was the head/neck/face (89.8%), followed by the upper extremities (7.4%). Specifically, injuries to the eye region (45.8%) and concussion (15.9%) were the most common. About three quarters of all injuries were lacerations/open wounds or superficial. No information was available on the mechanism of injury.

**Conclusions:** Future research should collect information on the mechanism of injury, as this is crucial for the development and implementation of effective injury prevention strategies. A suggested boxing injury report form is provided to facilitate this.

The substantial international public and medical debate over the value of boxing as a sport has arisen, in part, over concern that the level of injury risk in the sport is both unacceptable and unwarranted.[1] A large proportion of this concern relates to the fact that death and chronic neurological injuries are associated with boxing.[2] In most other contact sports, such as the football codes, the head is not a legitimate target for attack. However, in boxing, blows to the head are permissible and this places participants at risk of developing chronic brain injuries.[2]

Concern for the participants of the sport has grown so much that medical associations and councils all over the world, including America,[3] Britain,[4] and Australia[2] strongly advocate the banning or discouragement of boxing. However, many of the available data on boxing injury are from before the 1980s. To inform the continuing debate, updated information about the risk of injury for participants of boxing, and suitable means of modifying or preventing these risks, need to be identified.[1 5]

The literature on boxing injuries is largely based on retrospective studies. Injury rates in professional boxers reported in the literature show a large variation from 30 injuries per 1000 boxers per year in the 1950s[6] to 200 injuries per 1000 boxers per year in the 1980s.[7] For amateur boxers[8] and military cadets (also amateur boxing),[9] injury rates have been reported at 9.1 injuries per 100 personal exposures and 14.0 injuries per 100 boxers respectively. Depending on the study cited, 27–93% of boxing injuries reportedly involve the head region.[7–11] Fortunately, most boxing related head injuries in these studies were minor, such as lacerations and contusions—that is, non-neurological head injury.[12] Some blows to the head, however, can lead to either acute or chronic brain injury. Conclusive evidence for the risk factors associated with the development of chronic brain injury in boxers does not exist, although repeated exposure to head impacts and genetic factors are both known to be important.[5 2 13 14]

To obtain relevant information on the comparative risk of brain injury and other injuries in boxers and other sports participants, information on injuries sustained to other body regions needs to be identified.[15] Overall, there is a lack of good information about general injuries sustained by boxers, especially in Australia. Outside of the databases of fight statistics maintained by the boxing authorities, the only routinely collected Australian sources available to identify boxing injury data are from treatment settings—for example, hospitals—and coroner inquests. These databases are limited because of the small number of boxers who die or who are treated in hospital. Further, information from these settings provide details on only the most severe injuries associated with the sport, and as such do not provide an overview of the entire injury pattern for the sport.

At present, data held by the various boxing authorities are not sufficiently detailed and/or in an appropriate form for injury surveillance and prevention purposes. The most comprehensive database in Australia is that maintained by the Victorian Professional Boxing and Combat Sports Board (hereafter referred to as VPBCSB). This is a prospectively collected database with full details of all fight outcomes, including injuries, for the past 16 years (August 1986 to August 2001). It was recently recommended that the information from this database be extracted and analysed as a priority to progress knowledge of injuries to professional boxers in Australia.[1] The aim of this study was therefore to analyse the boxing injury data collected by the VPBCSB and provide recommendations for the design of future injury surveillance forms.

## METHODS

An Excel database of fight statistics describing the results of all Victorian fights participated in by Victorian registered boxing contestants during August 1985 to August 2001 was obtained from the VPBCSB. The database collected information on all fight outcomes—for example, fight result, weight of boxer, whether or not an injury was sustained and, if so, what the injury was. After each bout, an accredited doctor examined all boxers and recorded information on any injuries sustained (either reported by the participant or

**Table 1** Body regions injured by professional boxers (n=107 injuries)

| Body region injured | Percentage of all injuries | Injury rate per 1000 fight participations |
|---|---|---|
| Head/face/neck | 89.8 | 224.8 |
| Upper extremities | 7.4 | 18.7 |
| Trunk | 0.9 | 2.3 |
| Lower extremities | 0.0 | 0.0 |
| Not specified | 1.9 | 4.7 |

**Table 4** Results of fights in which boxers were participating when injured (n=94)

| Outcome* | Number of fight participations | Percentage of all fight participations |
|---|---|---|
| Lost | 52 | 55.3 |
| Won | 34 | 36.2 |
| Drew | 8 | 8.5 |
| Total | 94 | 100.0 |

*Outcome as defined for the injured boxers.

observed) on a standardised data collection form. Victorian registered boxers who fought interstate were required legally to inform the VPBCSB of their fight outcome and any injuries they sustained, and this information was also recorded on the database. In such cases, an accredited medical practitioner did not validate the injury data. Concussion was appropriately assessed through a clinical examination and a battery of simple neuropsychological tests incorporating measures of orientation and memory.[16]

Exposure was quantified in terms of the number of boxing fight participations determined by the number of records entered in the database. Each fight recorded in the database potentially had one or two records. Fights with one record in the database were for Victorian registered boxers who were fighting interstate against an interstate boxer. These fights were analysed as one boxing fight participation. Where two records for the one fight were recorded, this indicated two Victorian registered boxers fighting each other—that is, fight results were recorded for each contestant separately and therefore duplicate results for that fight were recorded. In these circumstances, the two separate records were analysed as two boxing participations. Each boxer within the database could have participated in more than one fight over the data collection period, and therefore the number of boxing participations exceeded the number of registered boxers.

The injury data were extracted, coded, and transferred into SPSS (Statistical Package for Social Sciences) version 11.0 for analysis. The injury details were coded according to the Australian Sports Injury Data Dictionary (ASIDD)[17] by one of the authors (PMcC). Descriptive statistics were used to determine the proportion of boxing fight participations for each response.

## RESULTS

There were a total of 427 boxing fight participations recorded in the database. Of these, 94 were associated with 107 injuries. This translates to a reported injury rate of 250.6 injuries per 1000 fight participations, or 220.1 injured boxers per 1000 fight participations. All boxers within the database were male with an average age of 27.3 years (range 18.2–41.7) at the time of the fight/injury and an average weight of 68.4 kg (range 51–102). Most of the 94 fight participations resulting in an injury (87%) involved a participant sustaining only one injury; 11 fight participations involved boxers sustaining two injuries, and one fight participation led to a participant sustaining three injuries.

**Table 2** Body sites injured in injured boxers (n=107 injuries)

| Injury sites | Number of injuries | Percentage of all injuries | Injury rate per 1000 fight participations |
|---|---|---|---|
| Eye, eyelid, and eyebrow | 49 | 45.8 | 114.8 |
| Concussion | 17 | 15.9 | 39.8 |
| Face | 16 | 15.0 | 37.5 |
| Cheek | 9 | 8.4 | 21.1 |
| Hands/fingers | 7 | 6.5 | 16.4 |
| Head* | 3 | 2.7 | 7.0 |
| Jaw/mouth | 2 | 1.9 | 4.7 |
| Upper limb | 1 | 0.9 | 2.3 |
| Internal organs (lungs) | 1 | 0.9 | 2.3 |
| Not specified | 2 | 2.0 | 4.7 |
| Total | 107 | 100.0 | – |

*Not eye, eyelid, eyebrow, cheek, nose, skull, or hair/scalp.

**Table 3** Injury pathologies and corresponding injury rates per 1000 fight participations (n=107 injuries)

| Injury pathologies | Number of injuries | Percentage of all injuries | Injury rate per 1000 fight participations |
|---|---|---|---|
| Open wound/laceration | 71 | 66.4 | 166.3 |
| Concussion | 17 | 15.9 | 39.8 |
| Superficial* | 8 | 7.5 | 18.7 |
| Fracture | 5 | 4.7 | 11.7 |
| Other (combined) | 6 | 5.5 | 14.1 |
| Total | 107 | 100.0 | – |

*Includes bruising, blisters, and inflammation.

**Table 5** Status of fight result for fight participations leading to injury (n=79, 15 missing values)

| Fight result status | Number of fight participations | Percentage of all fight participations |
|---|---|---|
| Points | 34 | 43.0 |
| Technical knock out/referee stopped fight | 25 | 31.6 |
| Knock out | 19 | 24.1 |
| Disqualified | 1 | 1.3 |
| Total | 79 | 100.0 |

The face and head region were the most commonly injured body regions, accounting for 89.8% of all reported injuries, at an injury rate of over 224 injuries per 1000 fight participations (table 1). No injuries to the lower body were documented.

For the head/face/neck region, the most commonly reported injury site was the eye, eyelid, and eyebrow (45.8%), with an injury rate of 114.8 per 1000 fight participations (table 2). It should be noted that, although injuries in the database were recorded as being to the "eye", it is likely that in many cases this may refer to the general area of the eye, rather than the eyeball itself. This was a specific deficiency of the data collection form used. Concussions accounted for 15.9% of all injuries, at a rate of 39.8 injuries per 1000 fight participations. No deaths to Victorian registered boxers occurred over the 16 year time frame of the study.

Two thirds of the injuries sustained during the fight participations were an open wound or laceration, and these lacerations generally occurred to the face (table 3). Open wounds/lacerations occurred at a rate of 166.3 injuries per 1000 fight participations. The second most common nature of injury was concussion, which is in accordance with the head and face region being the most common site of injury.

Table 4 lists the results of the fight participations resulting in injury. Over half of the injured boxers lost their fight. Forty three percent of the injury fights were decided by points, and a further 55.7% were decided by a knockout or the referee stopping the fight (table 5).

## DISCUSSION

This is the first study of prospectively collected medical record data on all injuries sustained during professional boxing in Australia. Further, it is one of only two such studies completed in the world since the 1980s, the other being in the United States of America.[7] One fifth (22%) of boxing fight participations over the 16 year period resulted in a competitor being injured, at an injury rate of 250.6 injuries per 1000 fight participations. Given that some fights were entered into the database twice, the injury rate calculated may be underestimated.

The distribution of boxing injuries by body region from the VPBCSB database is similar to the study on injuries in professional boxers in New York in 1988.[7] It appears for the most part

Name: _____ Injured person: Contestant/Referee/Instructor/Spectator/Trainer Opponent's name: _____

DOB: __/__/__ Gender: M☐F☐ Venue/arena at which injury occurred: _____ Date of fight/injury: __/__/__

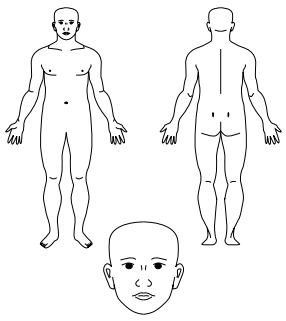
Time injury occurred: _____ AM/PM Weight of fighter: _____kg Fight result: Won/Lost/Drew

Fight result status: Points/TKO/RSC/KO/Disqualified/NCO Number of scheduled rounds: _____ Number of actual rounds completed: _____

Type of activity at time of injury
☐ training/practice/sparing
☐ competition/bout
☐ unsure/insidious onset
☐ other _____

Injury Occurrence
☐ new injury
☐ aggravated/recurrent injury
☐ illness
☐ other _____

Body Region injured
(please also indicate on diagram)
☐ head
☐ superficial
☐ intracranial (includes concussion)
☐ face
☐ eyeball ☐ eyelid
☐ eyebrow ☐ nose
☐ teeth/gums/mouth ☐ cheek
☐ ears
☐ jaw
☐ neck
☐ thorax
☐ shoulder
☐ upper arm
☐ elbow
☐ forearm
☐ wrist
☐ hands/fingers
☐ trunk (chest/abdomen/back/pelvis/hip)
☐ leg (please specify _____)
☐ other _____



Cause/Mechanism of injury
☐ collision with ropes, turnbuckles, ring uprights
☐ collision with opponent/referee (incl. headbutting)
☐ overexertion (eg muscle tear)
☐ overuse injury
☐ struck floor
☐ punched in head
☐ punched in other body region
☐ fatigue
☐ fall out of ring
☐ other _____

Nature of Injury/Illness
☐ abrasion/graze
☐ bruise/contusion
☐ concussion/brain injury/loss of consciousness
☐ dislocation/subluxation
☐ fatigue
☐ fracture (including suspected fracture)
☐ inflammation/swelling
☐ open wound/laceration/cut
☐ overuse injury to muscle or tendon
☐ repiratory problems
☐ sprain (ligament/joint)
☐ strain (muscle/tendon)
☐ other _____

Where there any contributing factors to the injury — e.g. unsuitable footwear, playing surface (wooden or padded), equipment, foul play, fatigue, weight, ill-matched competitors?
_____
_____
_____

Protective Equipment
Was protective equipment worn on the injured body part? ☐ yes ☐ no

If yes, what type e.g. mouthguard, ankle brace, taping, headgear, etc.
_____
_____
_____
_____

Initial Treatment Ringside
☐ none given (not required)
☐ none given (referred elsewhere)
☐ RICER
☐ CPR
☐ dressing
☐ sling, splint
☐ crutches
☐ massage
☐ stretch/exercises
☐ strapping/taping only
☐ other _____

Referral for medical attention
☐ no referral
☐ to medical practitioner
☐ to physiotherapist
☐ to chiropractor or other professional
☐ ambulance transport
☐ to hospital
(specify _____)
☐ other _____

Previous fight record:
# fights # wins # losses # draws

Am

Pro

Name/signature of person filling out form: _____
_____

Today's Date: __/__/__

**Figure 1** Sample form for recording boxing injury data.

that head/face (89.7–93.4%) and upper limb (2.4–7.5%) injuries are the most common for professional boxers. The rules for professional boxers are similar (although not exactly the same) regardless of the country or state a boxer is fighting in. It would therefore be expected that injury data such as those described here for Victorian boxers would be similar to those for boxers from other countries or other states/territories in Australia. The information provided by the VPBCSB database indicates that nearly every professional boxer injured had an injury to the head region. Injury to the region around the eye accounted for over 51% of injuries to the head, and concussion, as the second most common injury, accounting for almost 18% of head injuries.

Examination of the available epidemiological literature on eye injuries in boxing suggests that they are relatively uncommon.[5] However, a more detailed study in which ophthalmological assessment was performed suggested that a high rate (66%) of boxers suffer appreciable ocular trauma that may go unrecognised in injury surveillance studies.[18] Analysis of the VPBCSB database suggests that 45.8% of all injuries are to the eye region. Reporting differences may exist where an injury reported to be to the "eye" is actually to the eyelid or eyebrow, etc. Therefore the number of injuries to the eyeball itself may be overestimated, as no acute eye injuries were noted by the medical practitioners over the study period. Although, the VPBCSB database does not have sufficient information to clarify the number of ocular injuries to boxers, the high rate of impact trauma to the eye region is consistent with the ophthalmological findings.[18]

The upper extremities, as the second most commonly reported injury site, can be injured during punching (especially the wrist, hands, and fingers of the striking fist). A factor that may be important to consider for injury prevention is the weight of the gloves being used.[1] It would appear there is limited risk of injury to the lower extremities in professional boxing, reflecting the nature of the sport in which the legs are not used for fighting.

With the exception of concussion, most injuries sustained in boxing appear not to be severe, with over 70% of injuries being lacerations and superficial injuries such as bruising and inflammation. Nonetheless, further research into boxing injuries is warranted, with continuing conjecture over injury incidence and their pathologies. Further, analysis into the injuries in amateurs and less experienced professional boxers to the sport is also important, as different injury patterns may exist according to the level of competition and experience. To ensure a broad representation of the injuries in the sport, databases such as that maintained by the VPBCSB are vital, however a number of recommendations can be made to improve the quality of information collected.

It is strongly recommended that information pertaining to the mechanism of injury—for example, head to head contact, striking the floor—is included in databases. Without this information, it is not possible to determine what strategies can be developed and implemented to prevent such injuries. A comprehensive database should also include a more detailed description of the injuries sustained including diagnosis, prognosis, treatments (where treated, by whom, and for how long), and outcomes such as missed fights or training sessions, as well as any protective equipment being worn, and what equipment the opponent was using—for example, gloves, as glove weight may affect injury severity and rates.

Further, injuries sustained during training/sparring are rarely documented. Although training is generally less intense and less competitive, more time is spent training than in competition, and injuries during this time can still occur[15] and may go unrecognised. It is recommended that collecting information on injuries sustained during sparring/training be a matter of priority. Other risk factors that information could be collected on include: age at start of boxing career; current age; age of retirement from boxing; number of fights over career (both amateur and professional); genetic disposition to chronic brain diseases; the amount of competition and training exposure time.[2 5 13 14]

Standardised data collection methodologies to improve the comparability and interpretation of data are required for the sport of boxing. Figure 1 shows a sample injury data recording form, modelled on the ASIDD guidelines.[17] This form should provide information on some of the details required so that effective injury prevention strategies can be developed and implemented to reduce injury occurrence in the sport of boxing.

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