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

T R Zazryn, C F Finch, P McCrory

Objectives: To determine the rate and type of injuries occurring to registered professional kickboxers in Victoria, Australia over a 16 year period.

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

Results: A total of 382 injuries were recorded from 3481 fight participations, at an injury rate of 109.7 injuries per 1000 fight participations. The most common body region injured was the head/neck/face (52.5%), followed by the lower extremities (39.8%). Specifically, injuries to the lower leg (23.3%), the face (19.4%), and intracranial injury (17.2%) were the most common. Over 64% of the injuries were superficial bruising or lacerations.

Conclusion: The nature of kickboxing, whereby kicking the opponent is the prime movement and the head a prime target, is reflected in the distributions of body regions most commonly injured by participants. Further research into injury patterns in different styles of kickboxing and the mechanism of injury occurrence is required. Exposure adjusted prospective studies are needed to monitor injury rates over time.

Kickboxing is a martial art (fighting style and technique) in which the use of punching, kicking, and, under some rules, kneeing, and elbowing are permitted. The popularity of kickboxing (and other martial arts) is increasing as the self defence and physical fitness benefits are promoted. Despite this increase in popularity, very little is known about the injuries sustained during participation in the sport, with only three studies published to our knowledge.

Kickboxing is a martial art (fighting style and technique) in which the use of punching, kicking, and, under some rules, kneeing, and elbowing are permitted. The popularity of kickboxing (and other martial arts) is increasing as the self defence and physical fitness benefits are promoted. Despite this increase in popularity, very little is known about the injuries sustained during participation in the sport, with only three studies published to our knowledge.

Kickboxing is a martial art (fighting style and technique) in which the use of punching, kicking, and, under some rules, kneeing, and elbowing are permitted. The popularity of kickboxing (and other martial arts) is increasing as the self defence and physical fitness benefits are promoted. Despite this increase in popularity, very little is known about the injuries sustained during participation in the sport, with only three studies published to our knowledge.

Kickboxing is a martial art (fighting style and technique) in which the use of punching, kicking, and, under some rules, kneeing, and elbowing are permitted. The popularity of kickboxing (and other martial arts) is increasing as the self defence and physical fitness benefits are promoted. Despite this increase in popularity, very little is known about the injuries sustained during participation in the sport, with only three studies published to our knowledge.

Kickboxing is a martial art (fighting style and technique) in which the use of punching, kicking, and, under some rules, kneeing, and elbowing are permitted. The popularity of kickboxing (and other martial arts) is increasing as the self defence and physical fitness benefits are promoted. Despite this increase in popularity, very little is known about the injuries sustained during participation in the sport, with only three studies published to our knowledge.

Kickboxing is a martial art (fighting style and technique) in which the use of punching, kicking, and, under some rules, kneeing, and elbowing are permitted. The popularity of kickboxing (and other martial arts) is increasing as the self defence and physical fitness benefits are promoted. Despite this increase in popularity, very little is known about the injuries sustained during participation in the sport, with only three studies published to our knowledge.

Kickboxing is a martial art (fighting style and technique) in which the use of punching, kicking, and, under some rules, kneeing, and elbowing are permitted. The popularity of kickboxing (and other martial arts) is increasing as the self defence and physical fitness benefits are promoted. Despite this increase in popularity, very little is known about the injuries sustained during participation in the sport, with only three studies published to our knowledge.

Kickboxing is a martial art (fighting style and technique) in which the use of punching, kicking, and, under some rules, kneeing, and elbowing are permitted. The popularity of kickboxing (and other martial arts) is increasing as the self defence and physical fitness benefits are promoted. Despite this increase in popularity, very little is known about the injuries sustained during participation in the sport, with only three studies published to our knowledge.

Kickboxing is a martial art (fighting style and technique) in which the use of punching, kicking, and, under some rules, kneeing, and elbowing are permitted. The popularity of kickboxing (and other martial arts) is increasing as the self defence and physical fitness benefits are promoted. Despite this increase in popularity, very little is known about the injuries sustained during participation in the sport, with only three studies published to our knowledge.
records in the provided database. Each fight recorded in the database potentially had one or two records. Fights with one record in the database were for Victorian registered kickboxers who were either fighting an interstate kickboxer in Victoria or fighting interstate against an interstate kickboxer. No information on the interstate kickboxers competing in these fights was available. Therefore, these fights were analysed as one kickboxing fight participation (just for the Victorian kickboxer). Where two records for the one fight were recorded, this corresponded to two Victorian registered kickboxers fighting each other—that is, fight results were recorded under each contestant’s name and therefore duplicate results for that fight were recorded in the database. In this circumstance, the two separate records were analysed as two kickboxing participations. Each kickboxer within the database could have participated in more than one fight over the data collection period and therefore the number of kickboxing participations exceeded the number of registered kickboxers.

The injury data were extracted 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" by one of the authors (PMcC). Descriptive statistics were used to determine the proportion of kickboxing fight participations for each response. For each fight outcome, information was collected on the portion of kickboxing fight participations for each response. Bouts were ended early if a kickboxer appeared unable to defend him/herself (decided by the referee) or was knocked out. Paired t tests were performed to determine any significant differences in the average number of scheduled rounds and the average number actually completed for fight participations.

RESULTS
There were a total of 3481 records in the database. Therefore the total amount of exposure for kickboxers was 3481 kickboxing fight participations. Most (90.4%) of the 345 fight participations that led to injury involved participants sustaining only one injury, 29 fight participations involved kickboxers having sustained two injuries, and four fight participations led to participants sustaining three injuries. Therefore the total number of reported injuries during the 345 fight participations was 382. The overall injury rate was 109.7 injuries per 1000 fight participations. For all but 12 of the 345 fight participations resulting in injury, the injured kickboxing contestant (96.3%) was male. Injured participants had a mean age (at the time of the fight/injury) of 24.9 years (median 24.2; range 18.0–43.0) and a mean weight of 74.5 kg (median 71.0; range 52.0–118.0).

Almost two thirds (62.9%) of the fight participations in which contestants were injured resulted in a loss to the contestant, with 30.1% being a win, and the remaining 7.0% a draw. About half (49%) of the injury fights were decided by points, and a further 49.5% by a knock out or the referee stopping play. Four fight participations (1.3%) were decided through disqualification of a competitor. On average, injured participants completed significantly fewer rounds than expected for a normal fight (3.2 v 4.1; p<0.001).

Table 1 lists the proportion of injuries to each body region. The most commonly injured body region was the head/neck/face, accounting for over half of the injuries (51.6%), a rate of 56.6 injuries per 1000 fight participations. The second most common body region injured was the lower extremities (39.8%), occurring at a rate of 43.7 injuries per 1000 fight participations.

The most commonly injured body site was the lower leg, reflecting the nature of the sport. The rate of injury was 25.6 injuries/1000 fight participations (fig 1). The second most commonly injured site was the face, with an injury rate of 21.3 injuries/1000 fight participations. Intracranial injury was the third most common injury, with almost 18% of fight participations resulting in this type of injury, corresponding to an injury rate of 19.2/1000 fight participations.

Table 2 lists the five most commonly reported injury pathologies for the 382 kickboxing injuries. Together, these accounted for 90% of all injuries. The most common types of injury were superficial (including bruising and blistering) which occurred at a rate of 43.4 injuries per 1000 fight participations. Lacerations to the skin were also common, accounting for 25% of all injuries, corresponding to an injury rate of 27.3 per 1000 fight participations.

DISCUSSION
This is the first study of injuries sustained by professional kickboxers in Australia. It is also the fourth study to concentrate on kickboxing injuries in the international literature.
Descriptive data on injuries in kickboxing are required because of the increasing number of people involved in the sport or various fitness programmes that use training techniques born from kickboxing movements—for example, Taekwondo. The VPBCSB database has documented kickboxing fights for a number of different kickboxing styles and rules—that is, kickboxers competed under Australian rules, American rules, International rules, and the rules of Muay Thai kickboxing at different times. Each kickboxing style’s rules differ in what is acceptable and what is not. For example, Muay Thai kickboxing allows the use of kneeing and elbowing, whereas the Australian rules allow only punching and kicking. Unfortunately, the limitations of the database meant that we could not differentiate the type of kickboxing associated with the injuries.

Different scoring targets for striking are relevant for each style of kickboxing. As such, injuries to different areas of the body may be reported for each kickboxing style, because both the target areas for scoring and the body regions that can be used offensively are altered. Consistent across all styles, however, is the allowance of kicking and punching to the area above the waist where participants can score points against their opponent. Therefore it would be expected that the head, arms, and trunk would be the major sites of injury for kickboxers. In this study, most injuries sustained by professional kickboxers occurred to the head/neck/face (51.6% of all injuries). Injuries to the trunk, however, were low at only 2.1% of all injuries, indicating that the head region is the prime strike target. Lower extremity injuries were the second most common (39.8% of all injuries), reflecting the nature of the sport where kicking is the primary technique and movement. The high level of injuries to the lower extremities may also be explained by the fact that some styles of kickboxing include the legs in the scoring area, making them a target.

Despite the importance of punching as a method of attack, fewer than 3% of injuries sustained were to the upper extremities, indicating that this method of attack does not cause many injuries. As with other studies into kickboxing and general martial arts, most injuries appeared to be lacerations and bruising, occurring at an injury rate of 70.7 per 1000 fight participations. A kickboxer injured in a fight is likely to have the fight discontinued—that is, he/she will not complete the scheduled number of bouts. This may be an indication of the severity or nature of the injuries being sustained, in that it would be unsafe, or the kickboxer be physically unable to, complete the bout. However, except for concussion (sustained on 67 occasions), severe injuries that may require extensive medical attention or time away from the sport appear relatively uncommon, with fractures, dislocations, sprains, and strains sustained by only 30 kickboxers over the 16 year period.

Differences in the proportion of injuries sustained by professional kickboxers in the VPBCSB database were found compared with the reports resulted for participants of Muay Thai kickboxing by Gartland et al. For example, the Victorian kickboxers sustained more head injuries than those from the United Kingdom and Holland (51.6% vs 42.5%), but fewer lower extremity injuries (39.8% vs 53.4%). A possible explanation is that, in the former, injuries were recorded by a medical practitioner, whereas, in the latter, injuries were self reported. Further, the VPBCSB database did not record under which rules the kickboxer was competing when injured, and therefore information about injury patterns in the different styles of kickboxing could not be determined and compared with the previous study. Accordingly, specific recommendations about injury prevention strategies cannot be made from this study as these are, to a certain extent, dependent on the rules of the sport. It is recommended that further research be undertaken to document injuries in each style of kickboxing to identify priority areas that require the implementation of injury prevention measures.

It should be noted that, at present, the VPBCSB database also does not provide information on how the injury actually occurred. Information about the cause and mechanism of injury—for example, collision with opponent—is important for injury prevention, because, without it, opportunities for strategies to be developed and implemented to prevent another injury occurring in the same fashion cannot be identified. Further, limited information is provided about the outcomes of the injuries, such as treatment time and time out of the sport for rehabilitation. This information is needed to identify the most severe injuries that require priority attention for injury prevention purposes. It is important that as much detail as possible about the injured kickboxer and the circumstances in which the injury was sustained is identified to decrease the likelihood of a similar injury occurring.

**Table 2 Five most common injury pathologies and corresponding injury rates per 1000 fight participations (382 injuries)**

<table>
<thead>
<tr>
<th>Injury pathology</th>
<th>Number of injuries</th>
<th>Percentage of all injuries</th>
<th>Injury rate per 1000 fight participations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superficial (includes bruise, blister, graze)</td>
<td>151</td>
<td>39.5</td>
<td>43.4</td>
</tr>
<tr>
<td>Open wound/laceration</td>
<td>95</td>
<td>24.9</td>
<td>27.3</td>
</tr>
<tr>
<td>Concussion</td>
<td>67</td>
<td>17.5</td>
<td>19.2</td>
</tr>
<tr>
<td>Fracture</td>
<td>25</td>
<td>6.5</td>
<td>7.2</td>
</tr>
<tr>
<td>Injury to internal organ</td>
<td>6</td>
<td>1.6</td>
<td>1.7</td>
</tr>
<tr>
<td>Not specified</td>
<td>19</td>
<td>5.0</td>
<td>5.5</td>
</tr>
<tr>
<td>Other (combined)</td>
<td>19</td>
<td>5.0</td>
<td>5.5</td>
</tr>
<tr>
<td>Total</td>
<td>382</td>
<td>100.0</td>
<td>-</td>
</tr>
</tbody>
</table>

**Conclusion and recommendations**

This study provides the first data on injuries sustained by Australian professional kickboxers, and provides a basis for hypothesis generation for further research into the sport. Continued research into injuries that occur in kickboxing is needed, as few international data have been collected on injuries sustained during participation under different rules, beginner and amateur participants, and during training time. It is recommended that a standardised data collection form be developed and implemented by all kickboxing organisations, and this information be analysed on a regular basis to monitor
any trends in injury occurrence over time. Continuing prospective data collections should also include exposure (or participation) data so that injury rates can be monitored over time.

ACKNOWLEDGEMENTS
The Victorian Professional Boxing and Combat Sports Board, in particular Bart McCarthy, are thanked for their support and involvement in providing the database for analysis.

Authors’ affiliations
T R Zazryn, C F Finch, Department of Epidemiology & Preventive Medicine, Monash University Medical School, Prahran, Victoria, Australia
P McCrory, Centre for Sports Medicine Research & Education and Brain Research Institute, University of Melbourne, Melbourne, Australia

REFERENCES