

## ORIGINAL ARTICLE

## Problems in health management of professional boxers in Japan

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**Objective:** To investigate whether the incidence of boxing accidents is higher in Japan than in other countries.

**Method:** A nationwide survey of boxers was conducted.

**Results:** A total of 632 boxers responded. Most Japanese boxers were relatively mature when they started boxing (mean starting age of 19.2 years). A high percentage of boxers was found three weight divisions higher than previously reported. Many boxers stated that losing weight was not a big problem. It was found that a punch that turns the head can cause serious physical damage, and it was clarified that only a simple punch, rather than accumulated damage from multiple punches, can cause cerebral concussion. Severe shock causing retrograde amnesia is very rare after a fight and disappears relatively quickly. Many additional symptoms are related to damage to the hearing organs, such as hearing difficulties, tinnitus, and vertigo, but these symptoms also resolve quickly. Many boxers experience memory disturbance, not just after a fight but in daily life.

**Conclusion:** The approach to boxing has become more oriented towards the method of practice and scientific training, rather than psychological factors, which used to be emphasised.

Modern boxing, which originated in England, is one of the best known combative sports. It was introduced into Japan in 1887, by Shokichi Hamada, since when it has gained mass popularity; there have been many memorable fights and the country has produced many world champions. However, the spectacle in the ring has been marred by some tragic accidents. There was a time when the death of boxers under the age of 30 was an important problem, leading to large campaigns to abolish the sport, headed by the *Journal of the American Medical Association*.<sup>1–7</sup> In Japan, 32 deaths in official professional boxing matches have been recorded,<sup>8,9</sup> the first of which was the death of Nobuo Kobayashi at a boxing match held in the Koshien tennis court in 1930. The incidence of boxing deaths is higher in Japan than in other countries. To prevent such accidents in the ring, the Japan Boxing Association (JBA), the Japan Boxing Commission (JBC), and a commission of doctors took the initiative to examine ways of ensuring boxers' safety during bouts. Progress has been made, but little is known about the health status of boxers outside the ring, as investigations have been limited to routine health checks conducted by doctors before and after the match.

To address this, we conducted a health management survey to identify the potential causes of boxing accidents. We distributed questionnaires to the 238 professional boxing gyms registered with JBC in December 1999, and analysed the problems in health management identified from the responses provided by 632 professional boxers.

## MATERIALS AND METHODS

Of the active professional boxers registered with JBC in December 1999, 2031 actually had a fight in the year 1999. On 28 January 2000, we sent questionnaire forms to all the boxing gyms to which these boxers belonged. We asked the boxers to complete the questionnaire anonymously by 28 February 2000. The respondents were asked to seal their questionnaires in an envelope to keep the name of the gym confidential. The envelopes were opened as a group on 28 February, and the responses examined. Figure 1 shows the survey questions. The questions marked with a star are multiple choice questions, and those marked with a box are "yes/no" questions.

Of the 238 gyms to which we sent the questionnaires, 107 responded. Four of the gyms failed to respond before the deadline and therefore only responses from 103 gyms were considered in this analysis. A total of 659 professional boxers responded, but 27 were excluded because of invalid responses; data from the remaining 632 respondents are reported. The response rate was 44.9%, accounting for 32.4% of the total boxing population. The boxers were classified as follows: class A boxers had won more than eight fights; class B boxers had won more than five fights; class C boxers had won less than four fights. Class A boxers fight more than eight rounds, class B boxers fight five to eight rounds, and class C boxers fight four or fewer rounds.

## RESULTS

### Boxing experience and weight division (627 respondents)

Boxing experience averaged 62.7 months and mean starting age was 19.2 years old (range 11–32). There were 186 respondents with amateur boxing experience (29.4%). On average, respondents had had 6.5 fights: class A, 15.8; class B, 8.7; class C, 1.4. Table 1 shows the classes by weight division. Almost half of the boxers (261; 41.6%) had previously changed their weight division, 60 (23.0%) to a lighter division and 201 (77.0%) to a heavier division.

### Boxing performance and ranking (625 respondents)

There were 122 class A boxers (19.5%), 93 class B boxers (14.9%), and 410 class C boxers (65.6%). Boxers have experienced a knock out and/or timed knock out 0.97 times on average: class A, 1.38 times; class B, 0.99 times; class C, 0.84 times.

### Practice (625 respondents)

The respondents practiced for an average of 1.9 hours a day (class A boxers, 2.1 hours; class B, 2.0 hours; class C, 1.8 hours) and on an average of 5.5 days a week (class A, 6.0 days; class B, 5.1 days; class C, 5.0 days).

### Losing weight (620 respondents)

Eighty eight boxers (14.2%) said that they are forcing themselves to lose weight because they want to fight at

**Questionnaire**

(□:Yes/No question, ★ = Multiple choice question)

**(1) Boxing experience**

Boxing experience, starting age, amateur experience, professional debut, boxing record, number of times defeated on KO or TKO grounds, current ranking, number of hours of practice per day, and frequency of practice.

**(2) Weight**

Current weight division and past changes in weight division

Have you ever forced yourself to lose weight because you wish to minimize your weight to fight or because you believe that you cannot achieve a high rank otherwise?

How much weight do you normally have to lose before a match?

How long does it take for you to lose that much weight?

What is it like to lose weight?

1. Extremely tough
2. Somewhat tough
3. Not so tough
4. Not tough at all
5. Other (\_\_\_\_\_).

Please describe how you lose weight in detail.

Have you ever relied on dehydration methods to lose weight (e.g. sauna, diuretic)?

Have you ever felt your physical conditions deteriorate while losing weight?

Describe the symptoms if you answered yes.

**(3) Conditions before the bout**

How many rounds of sparring do you execute before a bout?

When do you stop sparring before a bout?

Have you ever felt your physical conditions deteriorate upon sparring?

Describe the symptoms if you answered yes.

**Food intake after the routine weight check on the day before a bout**

Do you eat immediately after the routine weight check?

How much do you eat then?

1. A lot
2. Same as usual
3. Slightly less than usual
4. Just a little
5. Hardly any

How much do you drink?

1. A lot
2. Same as usual
3. Slightly less than usual
4. Just a little
5. Hardly any

Do you remember how much you weighed on the day of a bout?

State how many kilograms you gained if you answered yes.

Have you ever suffered from an acute or dull headache, nausea, etc. on the day of a bout?

Describe the symptoms if you answered yes.

Have you ever had a temperature of 37°C or higher upon the routine health check on the day before a bout?

Describe the situation in which you suffered from fever if you answered yes.

What do you think was the cause of such fever?

**(4) During bout**

Do you drink water during a match?

If you answered yes: Are there any changes in your physical condition after drinking water during a bout?

Describe the nature of changes if you answered yes.

minimum weight or because they have little hope of achieving a high ranking in the existing weight division. On average, respondents lost 5.56 kg over 29.5 days. Table 2 shows the methods of losing weight. A total of 278 boxers (46.1%) occasionally forced themselves to lose weight other than by normal dieting—for example, by using saunas. In the process of losing weight, 265 boxers (42.7%) experienced deteriorating physical condition. Of the 278 boxers who relied on saunas and other extreme

measures to lose weight, 188 (67.6%) experienced a worsening physical condition. Table 3 shows the nature of their deteriorated physical state. Table 4 shows the answers the boxers gave to indicate the difficulty of losing weight. Currently, boxers are being weighed on the day before the match and also on the day of the bout; 516 respondents remembered their weight on the day of the bout, while 88 did not. On average, a boxer's weight increased by 2.42 kg on the day of the match.

**Figure 1** Questionnaire on health management of professional boxers in Japan. Continued on next page.

**(5) Punches during a fight**

\*What kind of punches make you feel dizzy?

1. Straight to the face
2. Straight to the chin
3. Straight to the temple
4. Hook to the chin
5. Upper cut to the chin
6. Body punch

What do you mean by "jarring"?

1. Cloudy head and wobbly legs
2. Fatigue
3. Mentally weakened
4. Others

We believe that some punches turn the head and others move the head laterally. Which do you consider to be more jarring?

Turn/lateral movement

**(6) Questions for boxers who have been knocked out during a fight**

Were you knocked out after several punches or after one punch?

After several punches/one punch

Have you ever lost consciousness after a KO?

Have you ever lost memory of a fight after a KO?

\*For boxers who answered yes, what was the period of memory loss?

1. Do not remember anything before the fight
2. Do not remember anything during the fight
3. Do not remember the KO punch
4. Do not remember anything after the KO
5. Do not remember anything after the fight

\*What precautions did you take after the KO?

1. Rest at home
2. Always accompanied by someone
3. Visit a doctor at a later date
4. Limit training for a while
5. Nothing in particular
6. Others ( )

Did damage from the KO linger more than one week?

Give specific details if you answered yes.

**Food and drink (589 respondents)**

After being weighed on the day before the bout, 529 boxers (89.8%) said that they ate food immediately. There were 204 respondents (34.6%) who drank water during a fight, 53 of which (25.5%) claimed that they experienced changes in their physical condition after drinking: 20 boxers felt more energetic and recovered; 19 felt more relaxed; seven felt less thirsty; three were able to move faster than before.

**Health conditions during daily practice (615 respondents)**

Before a bout, the boxers sparred a total of 42.5 rounds on average: class A boxers, 64.6 rounds; class B, 42.6 rounds; class C, 35.1 rounds. On average, boxers continued sparring up to 6.5 days before a fight. Ninety six boxers (15.6%) felt their physical

condition worsened during sparring: 24 were injured, 22 had an acute or dull headache, nine had neck ache, back ache, or muscle pain, and seven felt tired or weak. Thirty three boxers (5.4%) were in a poor physical state on the day of the fight: 11 had an acute or dull headache, seven suffered from nausea, three felt weak, and three felt dizzy. A third of the boxers (208; 33.8%) had a temperature of 37°C or higher according to the routine health check conducted before the day of the fight. Of these, 174 described the causes of the temperature: dehydration (59 respondents), weight loss (49), nervousness (28), cold (23), training shortly beforehand (8), and other (7).

**Damage during a fight (563 respondents)**

There is a "jarring" punch, which only boxers who have experienced this type of punch can know, as well as a "non-jarring"

Figure 1 contd on next page.

**(7) After the fight**

Figure 1 contd

\*Did the following conditions continue on the day following the fight and after?

1. Headache
2. Nausea
3. Vomiting
4. Double vision
5. Tilted vision
6. Ringing in the ears
7. Hearing difficulties
8. Vertigo
9. Weakening of the legs or hands on either side
10. Shaky hands
11. Forgetfulness

\*Did the following conditions exist during daily living?

1. Headache
2. Nausea
3. Vomiting
4. Double vision
5. Tilted vision
6. Ringing in the ears
7. Hearing difficulties
8. Vertigo
9. Weakening of the legs or hands on either side
10. Shaky hands
11. Forgetfulness

**(8) What is the most important factor to win a bout?****(9) What do you think about referees and ring doctors' policy to stop a bout at an early stage in the event of injury?****Table 1** Distribution of boxers according to weight division and the number of fights correlated with the weight division

Weight division (lbs)	Number of respondents	Percentage of weight division	Percentage of bouts in 1999
Minimum (<105)	12	1.9	2.7
Light fly (105–108)	41	6.6	7.1
Fly (108–112)	59	10.5	10.0
Super fly (112–115)	47	7.5	8.2
Bantam (115–118)	68	10.9	10.6
Super bantam (118–122)	82	13.2	12.0
Feather (122–126)	83	13.3	15.0
Super feather (126–130)	69	11.1	10.2
Light (130–135)	69	11.1	9.2
Super light (135–140)	34	5.5	5.5
Welter (140–147)	28	4.5	4.6
Super welter (147–154)	12	1.9	0.8
Middle (154–160)	17	2.7	2.9
Super middle (160–168)	2	0.3	0.4
Light heavy (168–175)	1	0.2	0.0
Cruiser (175–190)	1	0.2	0.1
Heavy (>190)	1	0.2	0.4

punch. When asked to describe “jarring”, boxers gave the following answers: cloudy head and wobbly legs (76.2%), fatigue (4.6%), mentally weakened (27%), weakened legs (8.5%), and temporary loss of memory or consciousness (5.7%). Jarring punches were variously described as a punch that moves the head laterally (38.7%), a punch that turns the head (58.5%), and unknown (12%). Table 5 describes the specific types of punches. Of the 339 boxers who have been knocked out during a boxing match, 262 (77.3%) said that they were knocked out by one punch, and 72 (21.2%) said that they collapsed after several punches. In addition, 57 (16.8%) answered that they lost consciousness after the knock out, and 94 (27.7%) responded that they had memory disturbances after the knock out. Table 6 gives details of the period of memory disturbance after a knock out.

**Condition after a fight (589 respondents)**

A total of 280 boxers (47.5%) said that they experienced some kind of symptoms after a knock out. Sixteen of these (2.7%) said that symptoms lingered for more than a week after the bout. The symptoms that lingered for more than a week included headache/heaviness in the head (7), ache from contusions (3), and vertigo (2). A total of 178 boxers (30.2%) answered that some symptoms continued on the day following the bout and after. Symptoms included headache (64), nausea (13), vomiting (6), double vision (1), tilted vision

**Table 2** Methods of losing weight

Only food dieting	222
Water dieting after food dieting	69
Food dieting after training	32
Only water dieting	31
Training after food dieting	28
Increased the load of training	27
Perspiring after food dieting	19
Food dieting after water dieting	15
Food dieting after perspiring	10
Training after water dieting	5
Water dieting after training	4
Perspiring after water dieting	4
Only perspiring	3
Perspiring after training	2
Saunas	2
Others	7

**Table 3** Nature of deteriorated physical state while losing weight

Symptom	Number
Fatigability	109
Exhaustion	68
Dizziness or vertigo	52
Tiredness	19
Pyrexia	19
Lack of concentration	16
Deteriorated ability	13
Nausea	8
Headache	8
Irritability	6
Insomnia	5
Thirsty	5
Paralysis	5
Others	11

**Table 4** Answers to the question "What is it like to lose weight?"

Answer	Number
Extremely tough	28
Somewhat tough	207
Not so tough	340
Not tough at all	46
Others	2

(9), tinnitus (39), difficulty in hearing (34), vertigo (20), weakness in the legs or hands on either side (13), shaky hands (7), and forgetfulness (35) (table 7). Ninety nine boxers said that they experienced symptoms in their daily life, including headache (36), nausea (4), double vision (6), tilted vision (2), ringing in the ears (13), difficulty in hearing (8), vertigo (10), weakness in the legs or hands on either side (2), shaky hands (3), and forgetfulness (48) (table 8). The precautions taken after a knock out were described by 313 boxers: rest at home (187), always accompanied by someone (106), visit a doctor at a later date (39), limit training for a while (104), no particular precautions (69), restrict the consumption of alcohol (4), and restrict the number of outings (2).

#### Individual views on boxing (520 respondents)

Roughly speaking, there were three types of response to the question "What is the most important factor to win a boxing match?" Psychological factors, such as mental strength, fight-

**Table 5** Answers to the question "what kind of punches make you feel dizzy?" (multiple choice)

Kind of punch	Number
Straight to the face	174
Straight to the chin	241
Straight to the temple	286
Hook to the chin	222
Upper cut to the chin	95
Body punch	21

**Table 6** For boxers who answered yes to the memory loss question, answers to the question "what was the period of memory loss?" (multiple choice)

Answer	Number
Do not remember anything before the fight	9
Do not remember anything during the fight	40
Do not remember the KO punch	59
Do not remember anything after the KO	41
Do not remember anything after the fight	11

KO, Knock out.

**Table 7** Did the following conditions continue on the day following the fight and after?

Condition	Number
1. Headache	64
2. Nausea	13
3. Vomiting	6
4. Double vision	1
5. Tilted vision	9
6. Tinnitus	39
7. Hearing difficulties	34
8. Vertigo	20
9. Weakening of the legs or hands on either side	13
10. Shaky hands	7
11. Forgetfulness	35
12. Others	11

The number is the number of boxers who answered yes.

ing spirit, self control, willpower, and confidence, were stressed by 165 boxers (31.7%), 221 (42.5%) emphasised practical factors, such as daily practice, training method, and quality of trainer, and 116 (22.3%) focused on health management, such as method of weight loss, control of physical condition, and injury prevention. Eighteen boxers (3.5%) mentioned factors that did not belong to the three major groups. When asked their opinion about the policy of the referee or ringside doctor to stop a bout at an early stage of injury, 333 boxers (64.0%) were in favour, 166 (31.9%) were against it, and 21 (4.0) were indifferent.

## DISCUSSION

The boxers were asked to complete the questionnaire at their discretion. We therefore assumed that there was a bias for the respondents to be more interested in health management than the average boxer. In addition, some questions were vague and the answers were therefore very subjective.

#### Boxing experience and weight division

It is thought by some that boxing should not be started until growth is finished.<sup>10</sup> However, age does not appear to be a

**Table 8** Did the following conditions exist during daily living?

Condition	Number
1. Headache	36
2. Nausea	4
3. Vomiting	0
4. Double vision	6
5. Tilted vision	2
6. Tinnitus	13
7. Hearing difficulties	8
8. Vertigo	10
9. Weakening of the legs or hands on either side	2
10. Shaky hands	3
11. Forgetfulness	48
12. Others	6

The number is the number answering yes.

problem here as the boxers began their sport at a mean age of 19.2 years. Boxers with amateur experience, who accounted for 29.4% of the total, started boxing slightly earlier than those without, at the age of 17.7 on average. There was a significant difference between boxers with amateur experience and those without (paired *t* test:  $p < 0.05$ ).

Most boxers were either bantamweight or featherweight (table 1). As the number of fights correlated with the weight division in 1999, weight division biases appear to be limited.

The peak weight has shifted up by about three weight divisions (approximately 3.2 kg) since 1989,<sup>11,12</sup> when the peak was between flyweight and bantamweight. Among the respondents, 41.6% had changed their weight division in the past, with 77% moving to a heavier weight division. This shows that boxers today are more willing to fight in their optimal weight division than they were 10 years ago.

### Boxing performance and ranking

We compared the weight division of boxers who participated in the survey with the division of boxers who are registered with the boxing commission: in class A, the former accounted for 19.5%, and the latter for 16.7%; in class B, the former accounted for 14.9% and the latter for 12.2%; in class C, the former accounted for 65.5% and the latter for 71.1%. Boxers who had experienced more bouts seem to have been more responsive to this survey. Although we had expected boxers with more boxing experience to have lost more bouts on knock out or timed knock out grounds, there was little difference between ranks.

### Practice

High ranked boxers tended to practice more in terms of the number of hours and days. This may be because higher ranked boxers are better placed to concentrate on boxing.

### Losing weight

Contrary to expectations, only 14.2% of the boxers said that they forced themselves to lose weight because they could not achieve a high rank otherwise. The mean weight loss was approximately 5.5 kg. In an extreme case, one boxer said that he had to lose up to 15 kg. Although the survey results indicate that boxers in heavier weight divisions tend to make more weight losing efforts, the difference was not significant. Most boxers required about a month to lose weight, accounting for 60% of the total. The time taken to lose weight appeared to be proportional to the amount of weight loss required. The method of losing weight was left to the individual boxer and there was no standard method adopted by each gym. Most boxers said that they increased the load of training and gradually decreased food intake until they reached the target weight. When such methods were insufficient, they often limited the intake of fluids and encouraged perspiration. Few

boxers fasted and denied themselves fluids. It should be noted that as many as 67.7% of the boxers suffered from deteriorating physical condition after using a sauna to lose weight. Symptoms included weakness, exhaustion, tiredness, dizziness, lack of concentration, and decreased ability to think. Most of these symptoms are regarded as being detrimental to any bout or practice, which could lead to injuries during a match. Boxers lost 5.5 kg on average, and most of them ate and drank after passing the routine weight check procedures, gaining 2.4 kg on average by the following day. However, no boxers saw their physical condition worsen as a result of such weight gain, which may be one of the merits of checking a boxer's weight on the day before the bout.

### Food and drink

Many boxers said that they ate and drank immediately after passing the routine weight check. Most ate and drank about as much as they normally do, or slightly less. In Japan, boxers are only allowed to drink pure water during a bout. Few (about 35%) drank water during a bout. It is notable that none of the respondents claimed that drinking water during a bout made them feel worse. In fact, more boxers claimed that drinking water made them feel more energetic and relaxed, and even enabled them to move faster. Although there seems to be a strong tendency for the professional boxing world to reject the idea of drinking water during bouts, the survey results indicate that boxers should be encouraged to drink more water.

### Health during daily practice

Higher ranked boxers tend to spar more. However, as mentioned in the section relating to practice time, this is probably because boxers with a good track record are in a better environment than those without. Few boxers experienced serious injury or illness during practice, partly because boxing instructors and the boxers themselves are aware of health management. About 30% of boxers have had a temperature of 37°C or higher according to the routine health check on the day before a bout. About half of them believed that the high temperature was caused by weight loss and dehydration, but some attributed it to nervousness. The combination of extreme nervousness and dehydration may be the cause of such fever.

### Damage during a fight

The descriptions of "jarring" that led us to assume that symptoms such as cloudy head, loss of memory or consciousness, and wobbly legs were caused by cerebral concussions represented 90% or more of the relevant answers.<sup>13,14</sup> In terms of punch type, a punch rotating the head was the more common answer than a punch moving the head laterally. Specifically, many boxers said that a hook type punch turned the head laterally. Our assumption that external force with rotating acceleration, which causes more damage to the brain, tends to cause concussion in more cases than external force with parallel acceleration was verified.<sup>9,14,15</sup> Although acute subdural haematoma and subsequent swelling of the brain are the cause of most boxing related deaths, it is difficult to confirm that they are the result of cerebral concussion.<sup>8</sup> In response to the number of blows up to a knock out, 77% answered one punch caused the damage rather than accumulated damage by multiple punches.<sup>16</sup> If one punch can be a fatal blow, it is impossible to stop a fight by predicting this fatal punch. Of the boxers who have been knocked out in the ring, 27.7% experienced memory disturbances.<sup>17</sup> Generally speaking, the degree of brain damage correlates with the length of time that retrograde amnesia is experienced.<sup>14,17</sup> Some 9% of the boxers said they did not remember anything before the fight.

### Symptoms after a fight and during daily life

After a fight many boxers complained of symptoms caused by concussion, such as headache, nausea, vomiting, and minor

### Take home message

Health management of professional boxers in Japan has become more scientifically oriented.

hemiplegia, as well as tinnitus, vertigo, and hearing loss.<sup>14-18</sup> Only 2.7% said that these symptoms continued for more than one week after the fight, so we assume that damage to the brain and hearing organs is transitory rather than serious. However, the number of boxers who stated that their memory had deteriorated during their daily life was higher than during the period just after a fight.<sup>19-20</sup> Therefore it is dangerous to speculate that this is the result of accumulated damage to the brain, but the result is interesting nevertheless. For precautions after a knock out, only a small number of boxers said that they would visit a doctor at a later date, and we therefore believe that education by the medical staff is insufficient.<sup>21</sup>

To summarise, the survey results indicate that professional boxers realise that external force with rotating acceleration causes most damage. According to the present rules of JBC, only an open punch should be subtracted during bouts, however we should prohibit this kind of punch. It has been suggested that professional boxers should wear head gear, but we think this would increase the external force with rotating acceleration and therefore it is not appropriate.<sup>22</sup>

A knock out often accompanies cerebral concussion. It is claimed that when a boxer experiencing the after effects of concussion receives further damage, it is likely to be catastrophic (second impact syndrome).<sup>14-23-26</sup> According to the survey, boxers who lost a bout by a knock out recover to a certain extent from the damage within a week. However, to fall in line with guidelines in other countries,<sup>24-25-27-28</sup> JBC has changed its policy and banned boxers who have lost a bout due to a knock out or timed knock out from participating in any bouts for at least 90 or 60 days respectively. Despite the changes in the rules, the number of accidents during bouts have not decreased. The survey results point to the need to establish a system for checking boxers who are clearly suffering from cerebral concussion, by cephalic computed tomography, magnetic resonance imaging, and other imaging techniques before their next bout, and through careful interviews to determine their neurological status.<sup>29</sup>

Thanks to efforts made by referees and other professionals in the boxing industry, there have been no fatal accidents during bouts in the past four years or so. Quicker intervention to halt bouts is believed to have played a part.<sup>30-31</sup> Thus, medical attendants will still be required in the future.<sup>21-32</sup>

### Individual views on boxing

Few boxers mentioned willpower, effort, and other "outdated" beliefs. The infiltration of sports science in recent years is reflected in most respondents emphasising methods of training and management of physical condition as important factors to success. This may be because more boxing instructors and owners of boxing gyms consider boxing as a sport, and it may also reflect the thinking of young people today.

As many as 64% of the boxers were in favour of the policy to stop a bout in the event of injury earlier than used to be the case. Although the excitement of boxing has traditionally lain in the possibility of an overpowered boxer reversing the situation with a single blow, boxing strategy is expected to become more point oriented in the future.<sup>21-33</sup>

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..... **COMMENTARY** .....

No significant contribution to existing knowledge of boxing trauma was provided by this article. However, it reports on an underanalysed population—Japanese boxers. The conclusions are not novel, but allow a perspective on the oriental adaptation to a western sport.

The lack of typical amateur progression into professional ranks and the late starting age of 19.2 years old could easily modify injury exposure and dynamics.

Many of the conclusions from this Japanese nationwide survey have been previously well documented and substantiated. However, responses from 632 professional boxers provides opinions, trends, and athlete perspective worthy of future injury prevention analysis.

Further integrated analysis of the authors' reports of boxing experience as the ratio of exposure to knock out (KO)/timed knock out (TKO) produces a strong conclusion that "experience counts".

Class A boxers (experienced 10 rounders): 1.38  
KO/TKO divided by 15.8 bouts = 8.7% chance of  
KO/TKO

Class B boxers (intermediate 6–8 rounders): 0.99  
KO/TKO divided by 8.7 bouts = 11.3% chance of  
KO/TKO

Class C boxers (novice 4 rounders): 0.84 KO/TKO  
divided by 1.4 bouts = 60% chance of KO/TKO

This conclusion does not agree with their statement "although we had expected boxers with more boxing experience to have lost more bouts on KO or TKO grounds, there was little difference between ranks". Referees and ringside doctors expect fewer KO/TKO results from experienced boxers with well trained defences.

My analysis of their data predicts and encourages strict surveillance and referee attention to professionals who start boxing at an older age and possess little experience.

The fact that 99 of 632 surveyed boxers said they experienced neurological symptoms in daily life supports the need for legislative mandates not only for the existing suspension periods but also mandatory imaging studies and clinical evaluation before return.

The recent four year absence of fatal accidents speaks highly of the skill of attentive referees, ringside doctors, and concerned coaches in Japan.

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