



R – P – A

ENGLAND PROFESSIONAL RUGBY INJURY SURVEILLANCE PROJECT

SEASON REPORT

2019-20

RFU INJURY SURVEILLANCE PROJECTS

Professional Rugby Injury Surveillance Project (PRISP)

Gallagher Premiership and England Senior Men

Women's Rugby Injury Surveillance Project (WRISP)

Allianz Premier 15s and Red Roses

Championship Rugby Injury Surveillance Project

Greene King Championship

BUCS Super Rugby Injury Surveillance Project

Elite men's University Rugby

Community Rugby Injury Surveillance and Prevention (CRISP) Project

Levels 3-9 of adult men's community rugby

Youth Rugby Injury Surveillance Project (YRISP)

Schoolboy rugby in under 13, under 15 and under 18 age groups



**England
Rugby**

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AT-A-GLANCE SUMMARY

Premiership Rugby Match Injuries

Injury Incidence: 88/1000 hours
Injury Severity: 38 days
Injury Burden: 3334 days absence/1000 hours
Injury Event: 26% tackling; 26% being tackled
Most Common Injury: Concussion, 22% of all injuries (19.8/1000 hours)

Premiership Rugby Training Injuries

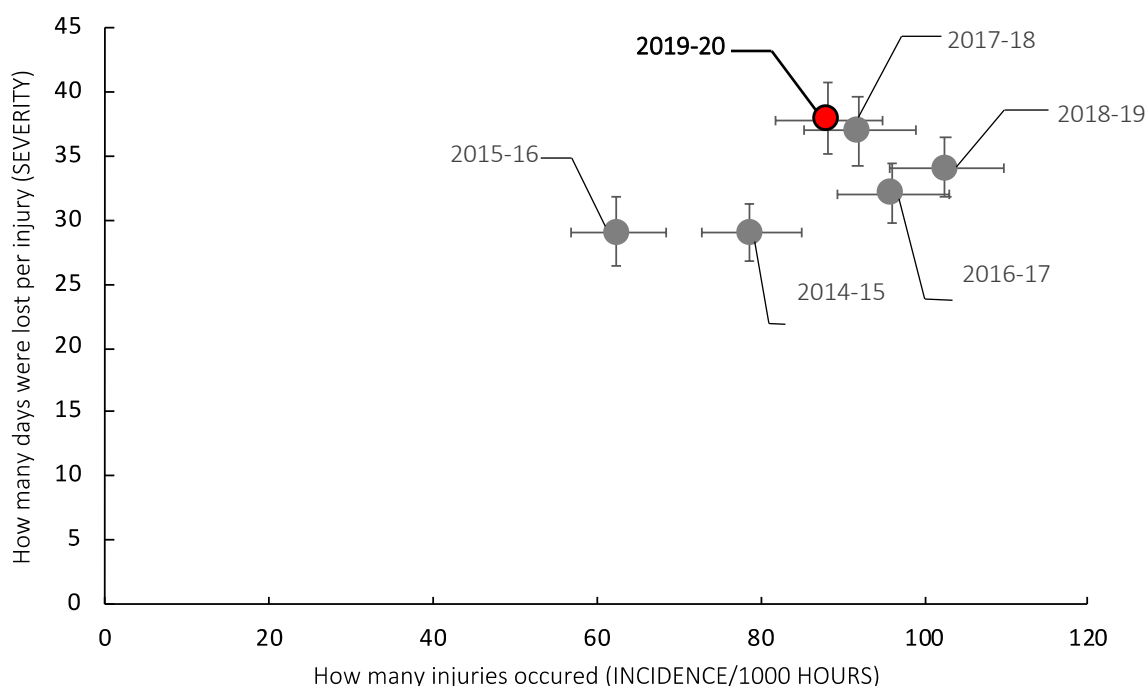
Injury Incidence: 3.0/1000 hours
Injury Severity: 35 days
Injury Burden: 105 days absence/1000 hours
Injury Event: 48% running
Most Common Injury: Hamstring muscle, 15% of all injuries

England Rugby Match Injuries

Injury Incidence: 125/1000 hours
Injury Severity: 35 days
Injury Burden: 4350 days absence/1000 hours
Injury Event: Being tackled 38%
Most Common Injury: Concussion 13%

Injury incidence and severity in the professional game 2014-15 to 2019-20

How common an injury is (incidence) increases from left to right and how many days are lost per injury (severity) increases from bottom to top. Each data point represents a season. If the lines that extend from each point do not overlap with those for other points, then there is a difference between seasons. There was a higher rate of injuries in 2019-20 than in 2015-16, a lower rate than 2018-19, but no difference from the other seasons. More days were lost per injury in 2019-20 than in 2014-15, 2015-16 and 2016-17, but this was not different from the other seasons.



EXECUTIVE SUMMARY

The 2019-20 season was unlike any previous season and it is important to consider its' unique structure when reading through this report. Firstly, 2019 was a World Cup year, meaning that the season began with 80 Premiership players representing their nations at the 2019 Rugby World Cup in Japan. Secondly, the outbreak of the Coronavirus pandemic (COVID19) resulted in the season being suspended three-quarters of the way through for a duration of 22 weeks. For the first 12 weeks of this period, a nationally enforced lockdown meant that all normal training activity was suspended. Players then returned to a 10-week team training period (around half of which was non-contact) before competition resumed. To facilitate a timely completion of the 2019-20 season, when competition restarted, a schedule that included mid-week matches was agreed by the Professional Game Board (PGB). Despite the potential for disruption to the season to result in players being unable to maintain the physical qualities necessary to protect against injury, our early analysis tells a positive story about how players were managed during these extraordinary times. Given the short turnaround between the 2019-20 season and the 2020-21 season, further analysis will be needed to determine any medium-term impact of the disruption and this will be presented in next year's report.

- In 2019-20, the match injury incidence was 88 injuries per 1000 hours. This is almost identical to the 2002-19 period mean of 87 injuries per 1000 hours and equates to nearly 2 injuries per match. On average, each match injury lasted 38 days. This is the highest recorded average severity in the surveillance period and reflects the higher rate of injuries lasting >84days and lower rate of injuries lasting 2-7days than the 2002-19 period mean.
- The injury rate in the post-suspension period of the 2019-20 season was significantly lower than both the equivalent period of the 2016-19 seasons and the 2019-20 pre-suspension period. There was no difference in the incidence, severity or burden of injuries sustained in fixtures with a shorter than normal turnaround time played during the post-suspension period.
- Concussion was the most commonly reported match injury, with an incidence of 19.8 concussions per 1000 hours. This is close to, but below the upper limit of expected season-to-season variation. On average, each match concussion resulted in 16 days missed, which is above the 2002-19 period mean, but a substantial decrease on recent years.
- 52% of all match injuries were attributed to the tackle, with being tackled and tackling each accounting for 26% of all match injuries.
- 44% of all injuries were sustained during training, which is higher than the 2002-19 period mean of 32% and is likely a result of the increased total time spent in training activity due to the unique nature of the 2019-20 season. The incidence of training injuries was stable at 3.0

injuries per 1000 hours. On average, each training injury lasted for 35 days, which is close to, but below, the upper limit of expected season-to-season variation.

- During the 2019-20 season, neither the incidence, severity nor burden of match injuries was different between artificial turf and grass. When aggregating seven seasons of match data, the incidence is not different, but the mean severity of injuries on artificial turf is 6 days greater than natural grass.
- During the 2019-20 season, the incidence of training injury on natural grass was significantly greater than on artificial turf. There was no difference in the average severity or burden. When aggregating five seasons of training data, the incidence of injuries on natural grass was higher than artificial turf, but the mean severity and burden are not different between turf types.
- The incidence of match injury for the England Senior side for 2019-20 was 112 injuries per 1000 hours, which is lower than the 2002-19 period mean of 123 injuries per 1000 hours. The mean severity of injury was 27 days, which is the second highest recorded mean severity of the surveillance period and reflects an increase in the proportion of injuries lasting >84days. The recovery time of two of the four injuries in the >84day category was lengthened as a result of the disruptions to the season.
- The incidence of training injury for the England Senior side was 5.5 injuries per 1000 hours, which is similar to the 2002-19 period mean of 5.3 injuries per 1000 hours. The mean severity was 32 days, which is higher than the 2002-19 period mean of 20 days. It should be noted however that this impacted significantly by a single long-term injury that carried a severity of 439 days. If this injury is excluded from the analysis the mean severity is 22 days.
- In 2019-20, 14 players retired because of injury.

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KEY FINDINGS

MATCH INJURIES

In 2019-20, match injury incidence was 88 injuries per 1000 hours, which is almost identical to the 2002-19 period mean incidence of 87 injuries per 1000 hours (**Figure 1**). An incidence of 88 injuries per 1000 hours equates to about 59 injuries per club or nearly 2 injuries per club per match during the 2019-20 season.

Note - For a normal distribution, 95% of all data should fall between (Mean – 2 x standard deviation) and (Mean + 2 x standard deviation).

Figure 1: Incidence

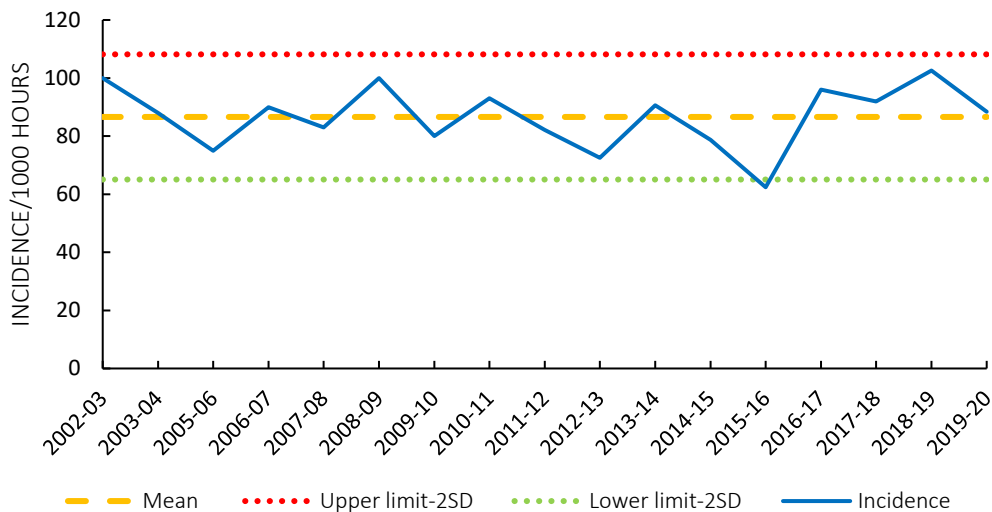


Figure 1: Incidence of match injuries over the surveillance period with mean ± 2 x standard deviation shown.

The mean severity of match injury for the 2019-20 season was 38 days lost per injury, which is 13 days greater than the 2002-2019 period mean (25 days) and the highest recorded in the surveillance period (**Figure 2**). This increase in mean severity is due to the higher rate of injuries lasting >84 days and lower rate of injuries lasting 2-7 days than the 2002-19 period mean (**Table S2**). Mean days absence provides a useful measure to assess changes in severity of injuries over time, but it can be skewed by a small number of significant long-term injuries; therefore, the median value is also useful. The median severity of injury for 2019-20 was 11 days, compared with 9 days for the 2002-19 period (**Table S1**). The burden of match injury for the 2019-20 season was 3334 days absence per 1000 hours, which is at the upper limit of expected season-to-season variation of 3388 days absence per 1000 hours (**Table S1**).

Figure 2: Severity

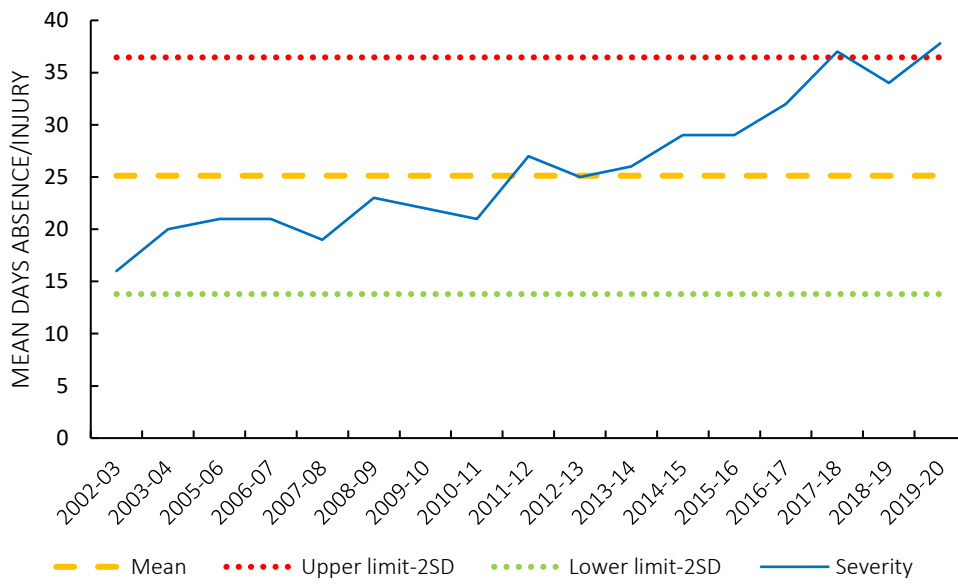


Figure 2: Mean severity of match injuries over the surveillance period with mean ± 2 x standard deviation shown.

TRAINING INJURIES

A total of 551 time-loss training injuries were reported in 2019-20, representing 44% of the total injury proportion for the season. The training injury incidence was 3.0 injuries per 1000 hours, which is higher than the 2002-19 period mean incidence of 2.5 injuries per 1000 hours, but falls within the limits of season-to-season variation (**Figure 3**). An incidence of 3.0 injuries per 1000 hours equates to about 46 training injuries per club per season. The mean severity of training injuries in 2019-20 was 35 days absence per injury, which is 10 days greater than the 2002-2019 period mean (25 days), but falls within the limits of expected season-to-season variation. The burden of training injuries was 105 days absence per 1000 hours, which is at the upper limit of expected season-to-season variation(**Table S3**).

Figure 3: Incidence

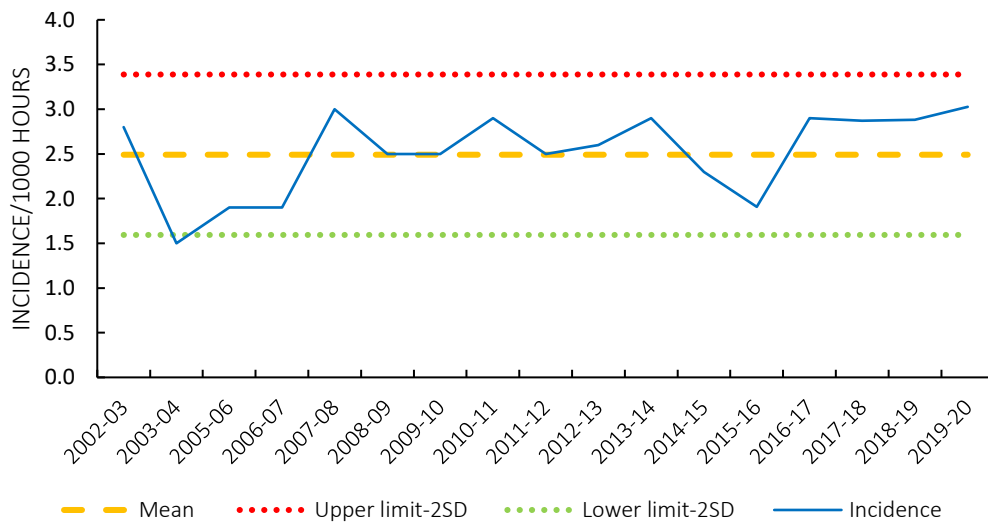


Figure 3: Incidence of training injuries over the surveillance period with mean $\pm 2 \times$ standard deviation shown.

Figure 4: Severity

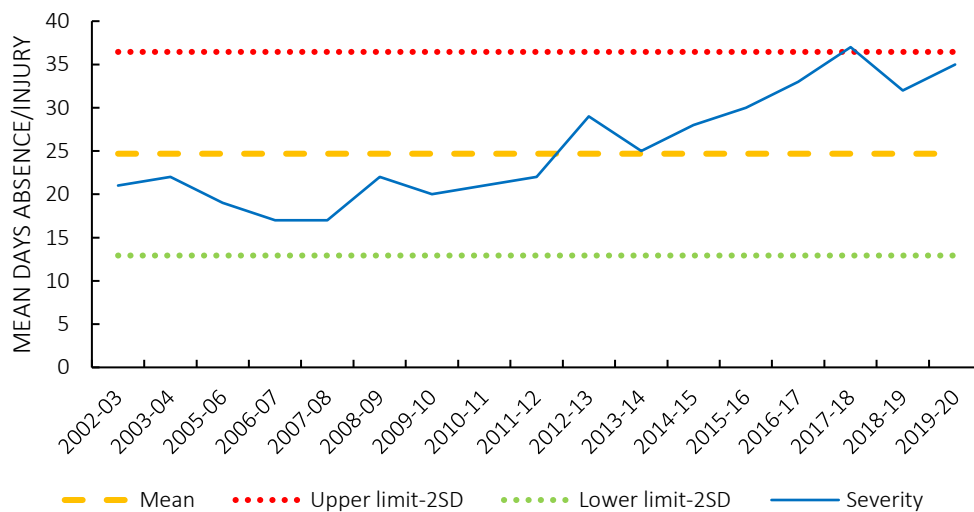


Figure 4: Mean severity of training injuries over the surveillance period with mean $\pm 2 \times$ standard deviation shown.

THE COVID19 RESTART

The outbreak of the Coronavirus pandemic (COVID19) resulted in the 2019-20 season being suspended for a 22-week period, from March to August. For the first 12 weeks of this period, a nationally enforced lockdown meant that all normal training activity was suspended. During this time players were unable to train together as a team, access training facilities, have in-person contact with coaching and conditioning staff and only had access to medical staff to receive essential treatment. Any training completed by players was done at home with the equipment and space available to them. Players then returned to a 10-week team training period, comprising four weeks of limited, socially distanced training and six weeks of normal contact training before competition resumed.

MATCH INJURIES

Due to COVID19 regulations, one European Challenge Cup and four Gallagher Premiership matches were cancelled, resulting in a total of 100 match hours not being played as originally scheduled. Despite the suspension of competition and normal training activity, the 2019-20 mean injury rate was not different to the 2002-19 period mean (**Table S1**). To explore the season in more detail we have compared it with the previous three seasons. The 2019-20 mean injury rate was lower than the 2016-19 period mean (88/1000 hours vs 96/1000 hours) (**Table 1**). The injury rate of the pre-suspension period of the 2019-20 season was similar to the equivalent time period of the 2016-19 season, while the 2019-20 post-suspension injury rate was equivalent to the 2019-20 pre-suspension and significantly lower than the equivalent period of the 2016-19 season (**Table 1**).

Table 1: Incidence, severity and burden of match injuries sustain pre- and post-suspension of the 2019-20 season.

		2016-19	2019-20
Incidence (95%CI)	Overall	96 (92-100)	88 (82-95)
	Pre-suspension	95 (91-100)	93 (85-101)
	Post-suspension	97 (90-104)	77 (67-89)
Mean severity (95%CI)	Overall	34 (33-35)	38 (35-41)
	Pre-suspension	33 (31-34)	40 (37-44)
	Post-suspension	36 (34-39)	32 (27-36)
Median severity (IQR)	Overall	12 (6-38)	11 (5-38)
	Pre-suspension	12 (5-36)	11 (5-34)
	Post-suspension	14 (6-41)	13 (6-46)
Burden (95%CI)	Overall	3248 (2658-3968)	3334 (2706-4108)
	Pre-suspension	3110 (2544-3802)	3728 (3043-4568)
	Post-suspension	3496 (2865-4267)	2430 (1944-3038)

MATCH CONGESTION

When the competition restarted in August, mid-week matches were introduced. As such, some match fixtures had a *shorter* than *normal* turnaround time whereby less than 6 days had elapsed since the previous fixture, as opposed to a *normal* turnaround time of 6 or more days. There was no significant difference in the incidence, severity or burden of injuries sustained in *shorter* vs *normal* fixtures (**Table 2**).

Table 2: Incidence, severity and burden of injuries sustained in normal and shorter in the post-suspension period of the 2019-20 season.

	Number	Incidence (95%CI)	Mean severity (95%CI)	Median severity (IQR)	Burden (95%CI)
Normal (≥ 6 days)	81	71 (57-88)	27 (22-34)	11 (5-39)	1930 (1529-2435)
Shorter (<6days)	107	82 (68-99)	35 (29-42)	15 (6-56)	2871 (2313-3563)
<i>Overall</i>	<i>188</i>	<i>77 (67-89)</i>	<i>32 (27-36)</i>	<i>13 (6-46)</i>	<i>2431(1945-3039)</i>

TRAINING INJURIES

The unique nature of the 2019-20 season meant that the structure of training during the post-suspension period of the season would likely differ from both the pre-suspension period of the 2019-20 season and with previous seasons. Firstly, the 10-week training period following the nationally enforced lockdown and before competition resumed is not something that has previously been encountered. Secondly, the introduction of mid-week matches may have led teams to adopt a different in-season training schedule.

Overall, the mean injury rate for rugby skills contact training was higher in the 2019-20 season than the 2002-19 period mean (9.1/1000 hours vs 5.6/1000 hours). It can be seen in **Table 3** that this is predominantly due to the significantly higher rate of *rugby skills contact* training injuries sustained during the official 2019-20 preseason and during the 10-week training period allowed before competition resumed, in comparison to the two in-season periods of the 2019-20 season (**Table 3**).

Table 3: Training injury incidence by period of the 2019-20 season.

	Incidence/1000 hours (95%CI)					
	2002-19	2019-20	Periods of the 2019-20 season			
			Official 19/20 pre-season period	In-season, pre-covid period	10-week post-suspension training period	In-season, post-covid period
Rugby skills contact	5.6 (5.3-5.8)	9.1 (8.1 - 10.2)	20.1 (15.5 - 26.1)	6.7 (5.7 - 8.0)	15.8 (12.5 - 20.0)	6.3 (4.5 - 9.0)
Rugby skills non-contact	1.5 (1.4-1.6)	1.9 (1.5 - 2.3)	2.9 (2.0 - 4.4)	1.2 (0.9 - 1.7)	2.9 (1.9 - 4.4)	1.9 (1.1 - 3.2)
Conditioning weights	0.8 (0.7-0.9)	0.2 (0.1 - 0.3)	0.2 (0.1 - 0.6)	0.2 (0.1 - 0.4)	0.4 (0.2 - 1.0)	0.1 (0.0 - 0.8)
Conditioning non-weights	5.2 (4.9-5.5)	6.4 (5.4 - 7.6)	5.2 (4.0 - 6.8)	5.3 (3.7 - 7.6)	9.2 (6.8 - 12.5)	12.7 (6.8 - 23.6)
<i>Overall</i>	<i>2.5 (2.3-2.8)</i>	<i>3.1 (2.8-3.3)</i>	<i>3.7 (3.1-4.3)</i>	<i>2.3 (2.0-2.7)</i>	<i>4.7 (4.0-5.6)</i>	<i>2.6 (2.0-3.3)</i>

One of the primary concerns for players was that the disruptions and unusual nature of the 2019-20 season would result in an increased injury risk. It is important to acknowledge the positive findings from this early dataset that suggest that players were well managed to cope with the extraordinary conditions of the season.

CONCUSSION

In 2019-20, there were 159 match concussions and 34 training concussions, therefore 19% of concussions occurred in training. Seventeen percent of players sustained at least one match concussion and 4% sustained more than one. The incidence of match concussion was 19.8 concussions per 1000 hours, which is close to, but below, the upper limit of expected season-to-season variation (**Figure 5**). Improving the detection of these complex injuries to ensure safe removal of concussed players remains a priority, as is developing and evaluating strategies to reduce concussion incidence and optimally managing recovery after concussion.

Figure 5: Incidence

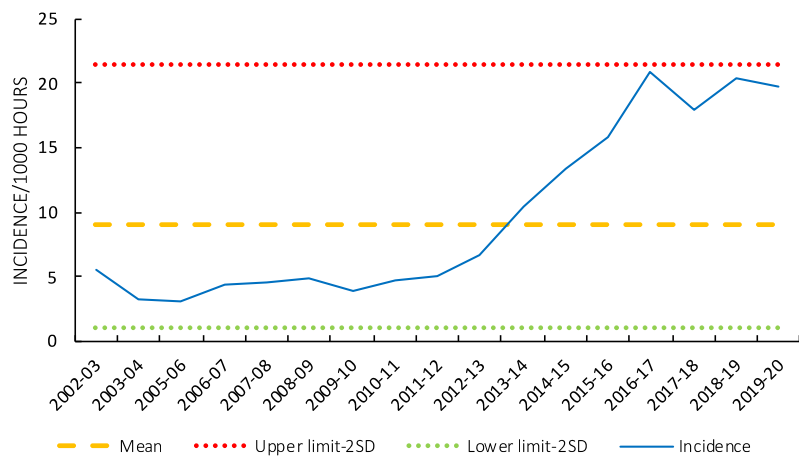


Figure 5: Incidence of reported match concussions by season with mean $\pm 2 \times$ standard deviation shown.

The mean severity of match concussions was 16 days in 2019-20. This is 3 days longer than the 2002-19 period mean of 13 days absence per concussion, but reflects a decrease from recent years (**Figure 6**). Median severity of concussion was 8 days, which is identical to the 2002-19 period mean. Of the players who sustained a concussion in 2019-20, 42% returned within 7 days, 48% within 28 days and 3% had not returned within 84 days (**Table S4**). The decrease in mean severity can, in part, be attributed to the decrease in proportion of concussions lasting longer than 84 days over recent seasons. The burden of match concussion in 2019-20 was 317 days absence per 1000 hours. This value is lower than recent years and reflects the substantial decrease in mean severity (**Table S5**).

Figure 6: Severity

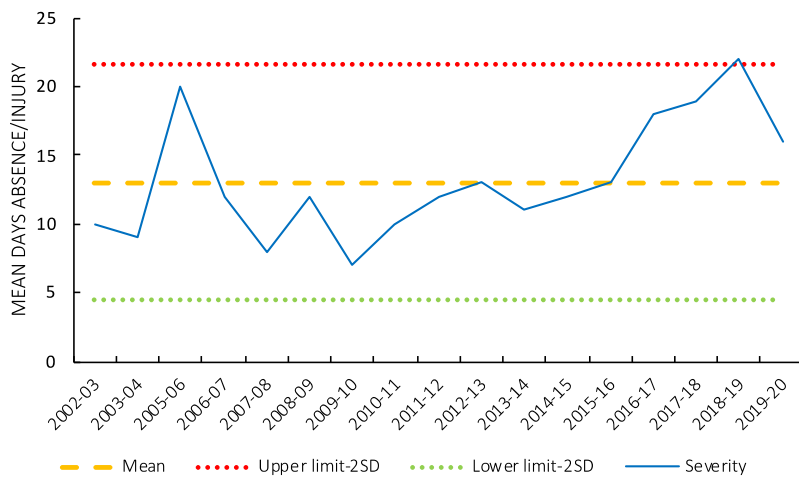


Figure 6: Mean severity of reported match concussions by season with mean $\pm 2 \times$ standard deviation shown.

THE TACKLE

The tackle was the match event most likely to result in an injury in 2019-20, with 52% of all injuries attributed to the tackle. Being tackled and tackling equally accounted for 26% of injuries respectively (**Figure 7**).

Match injury event

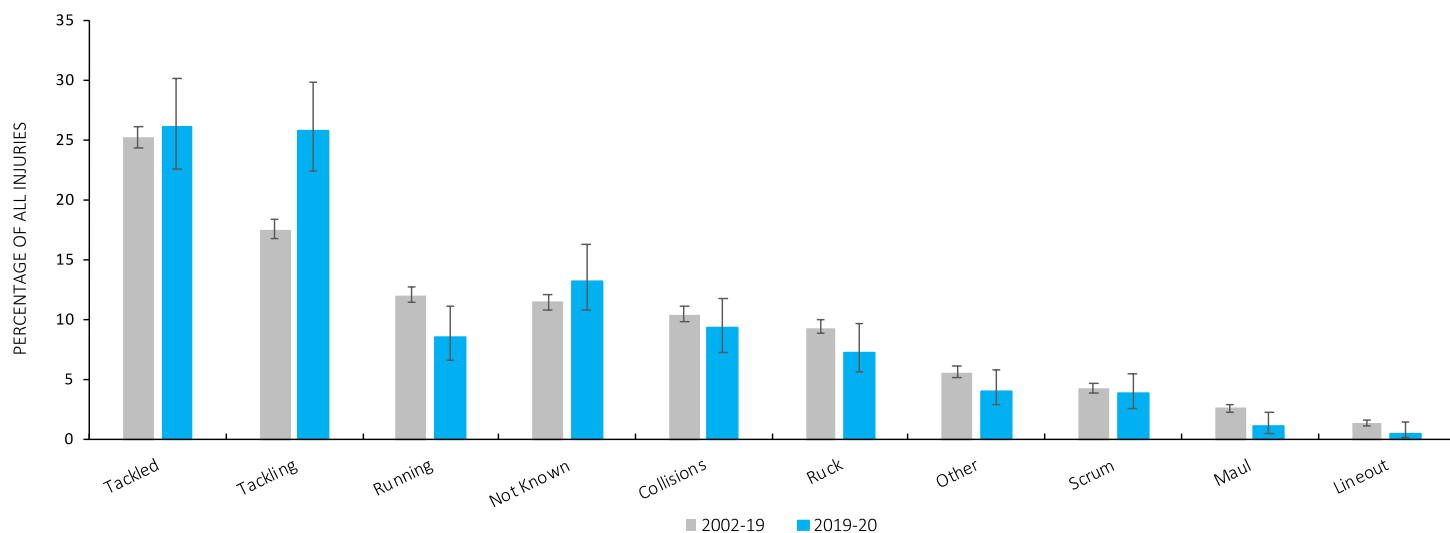


Figure 7: The percentage of all injuries attributed to each match injury event for the 2019-20 seasons compared with the surveillance period as a whole (2002-19). Error bars show 95% CIs.

In 2019-20, the incidence of injuries to the ball carrier and the tackler were similar (23.0 per 1000 hours vs 22.8 per 1000 hours: **Figure 8**). The mean severity of injury for the ball carrier and tackler were 37 and 34 days, respectively (**Figure 9**). The burden of injury to the ball carrier was 858 days absence per 1000 hours and 769 days absence per 1000 hours to the tackler (**Table S6**). The most common injury in the tackle to both the ball carrier and tackler was concussion, making up 39% of all injuries to the tackler and 17% to the ball carrier.

Figure 8: Incidence

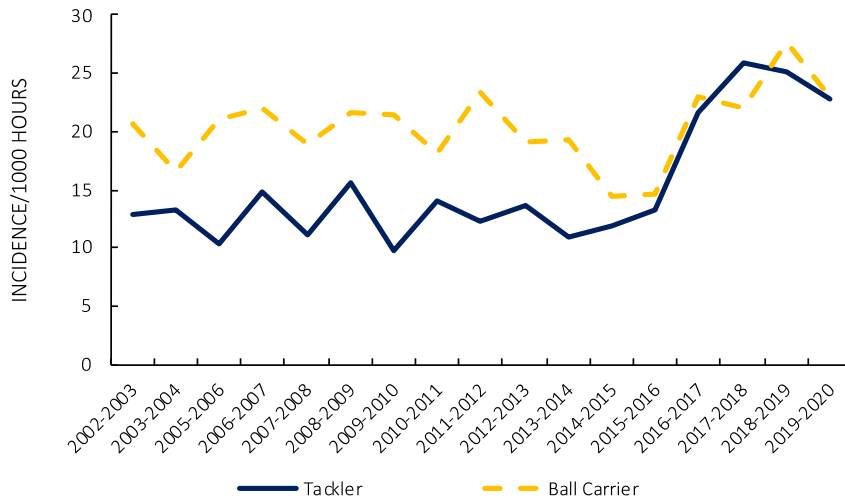


Figure 8: Incidence of tackle related injuries by season to tacklers (solid line) and ball carriers (dashed line).

Figure 9: Severity

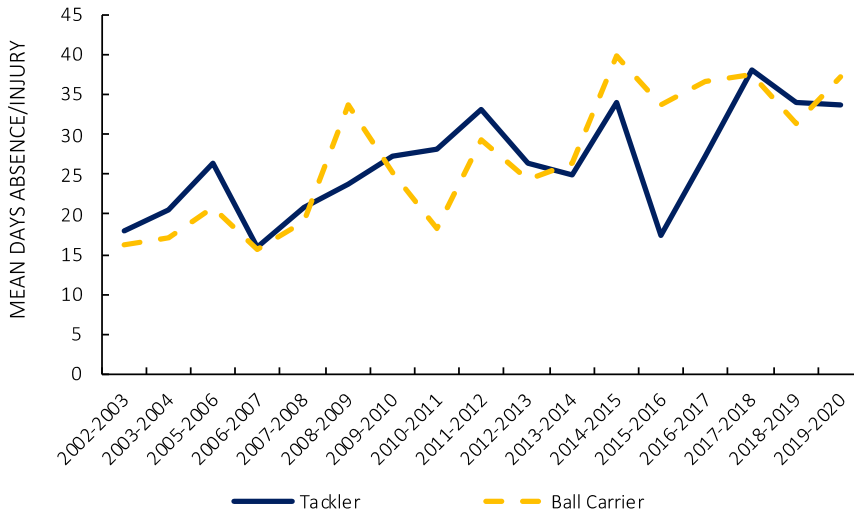
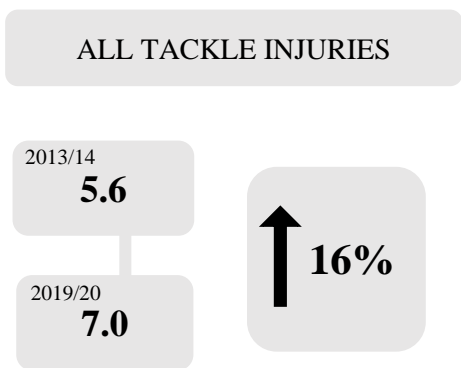


Figure 9: Mean severity of tackle related injuries by season to tacklers (solid line) and ball carriers (dashed line).

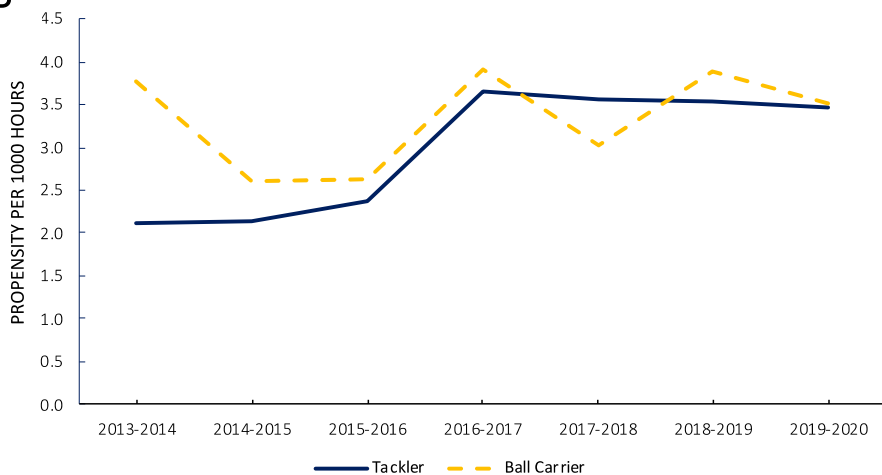
Data from OPTA (<https://optaprourugby.com/>) indicates that since the 2013-14 season, there has been an incremental increase in the number of tackles per match. In 2019-20 there were an average of 131 tackles per team per match, which is a 22% increase from the average of 102 in the 2013-14 season. Calculating the rate of injury per 1000 tackle events (propensity for injury) reveals that overall, there has been a 16% increase in the propensity of tackle related injuries from 2013-14 to 2019-20 (**Figure 10A**). Across the 2013-20 period there has been no overall increase in the propensity of tackle related injuries to the ball-carrier, however, there has been a 39% increase to the tackler (**Figure 10B**).

Figure 10: Propensity/ 1000 tackles

A



B



INJURIES LEADING TO RETIREMENT

The Injury Surveillance Steering Group would like to thank the Rugby Players Association (RPA) for its assistance with compiling data on players who retired as a result of injury or illness.

Since 2013-14 the injury surveillance report has published the number of players who have retired with injury or illness being cited as the reason for retirement. In 2019-20, 14 players were seen to retire as a result of injury (**Table 4: Number of retired players through injury and illness, 2013-20.**Table 4).

The injuries, which led to players retiring from the sport, were sustained at the following body locations in 2019-20:

LOWER LIMB	6
THORACIC AND LUMBER SPINE	0
TRUNK	0
UPPER LIMB	1
HEAD/NECK	7

Table 4: Number of retired players through injury and illness, 2013-20.

Season	Number retired through illness	Number retired through injury
2013-14	2	23
2014-15	1	11
2015-16	1	10
2016-17	0	19
2017-18	0	10
2018-19	1	9
2019-20	0	14

ARTIFICIAL TURF

In 2019-20, there were 608 injuries in matches played on natural grass pitches (6920 exposure hours) and 101 injuries in matches on artificial turf pitches (1120 exposure hours). In 2019-20 the incidence, severity and burden of match injuries was not different between surface types (**Table 5**). Aggregating seven seasons of match data revealed that match injury incidence is not different for natural grass and artificial turf (grass: 84 injuries per 1000 hours vs artificial: 85 injuries per 1000 hours). However, the mean severity of injuries on artificial turf is 6 days greater than natural grass, at 38 days per injury compared with 32 days. The burden of injury on artificial turf (3269 days absence per 1000 hours) is also significantly greater than that for natural grass (2682 days absence per 1000 hours) (**Table 5**).

Training on artificial turf accounted for 23% of on-pitch training exposure. In 2019-20, there were 418 training injuries on natural grass (81072 exposure hours) and 83 on artificial turf (23946 exposure hours). The incidence of training injury on natural grass was 5.2 injuries per 1000 hours, which is significantly greater than the 3.5 injuries per 1000 hours on artificial turf. There was no difference in the mean severity of training injuries between surface types, while the burden of injuries on grass was significantly greater than artificial turf. When aggregating five seasons worth of training data, for which training surface information is available, the incidence, severity and burden of injury are not significantly different between surface types (**Table 5**).

Table 5: Incidence, severity and burden of match and training injuries sustained on grass vs artificial turf.

		Grass		Artificial Turf	
		2013-20	2019-20	2013-20	2019-20
Match	Incidence (95%CI)	84 (82 - 87)	88 (81 - 95)	85 (79 - 91)	90 (74 - 110)
	Mean severity (95%CI)	32 (30 - 33)	37 (34 - 40)	38 (35 - 41)	42 (35 - 51)
	Burden (95%CI)	2682 (2599 - 2767)	3252 (3006 - 3524)	3269 (3053 - 3500)	3788 (3149 - 4651)
		2015-20	2019-20	2015-20	2019-20
Training	Incidence (95%CI)	4.2 (4.0 - 4.4)	5.2 (4.7 - 5.7)	3.6 (3.3 - 4.0)	3.5 (2.8 - 4.3)
	Mean severity (95%CI)	33 (30 - 37)	34 (31 - 38)	38 (30 - 47)	34 (28 - 43)
	Burden (95%CI)	139 (132 - 146)	176 (160 - 194)	136 (124 - 150)	119 (96 - 147)

TRAINING INJURY EVENT

As mentioned previously, the COVID19-induced changes to the 2019-20 season will have influenced the structure of training in the latter half of the season in comparison to previous seasons. The primary changes being: 1) the inclusion of a 10-week training period following the suspension of rugby and 2) the introduction of a schedule that included mid-week matches.

In the 2019-20 season, more time was spent in *conditioning weights* and *conditioning non-weights* training than the 2011-19 average, however this was not more than the maximum time spent in these training types in any previous season. Less time was spent in *rugby skills contact* and *rugby skills non-contact* training in the 2019-20 season than the 2011-19 average, however this was within the range of the previous seasons (**Table 6**).

Table 6: Time (hours) spent in different training types.

	2011-19 Average (Min – Max)	2019-20 Total	2011-19		2019-20	
			Average hours per player		Average hours per player	
			Forwards	Backs	Forwards	Backs
Rugby skills contact	38837 (33000 – 49184)	31885	927	921	761	756
Rugby skills non-contact	52674 (41818 – 65714)	50514	1244	1268	1193	1216
Conditioning weights	55316 (36667 – 72500)	71274	1299	1341	1674	1728
Conditioning non-weights	14834 (9242 – 21250)	21009	346	362	490	513

In 2019-20, the incidence of injuries associated with rugby skills contact and rugby skills non-contact training was significantly higher than the 2002-19 period mean (Contact: 9.1/1000 hours vs 5.6/1000 hours; Non-contact: 2.7/1000 hours vs 1.5/1000 hours), while the incidence of conditioning weights training sessions was significantly lower (0.2 /1000 hours vs 0.8/1000 hours) (**Figure 10**). As highlighted in **Table 3**, the official 2019-20 preseason and 10-week training period allowed before competition resumed, were largely responsible for the increase in rugby skills-contact and rugby skills-non-contact training injury rates in 2019-20.

In 2019-20, the most commonly occurring injury in “full-contact” training sessions was concussion (14%). In “semi-contact” sessions, hamstring injuries were the most commonly occurring injuries (19%).

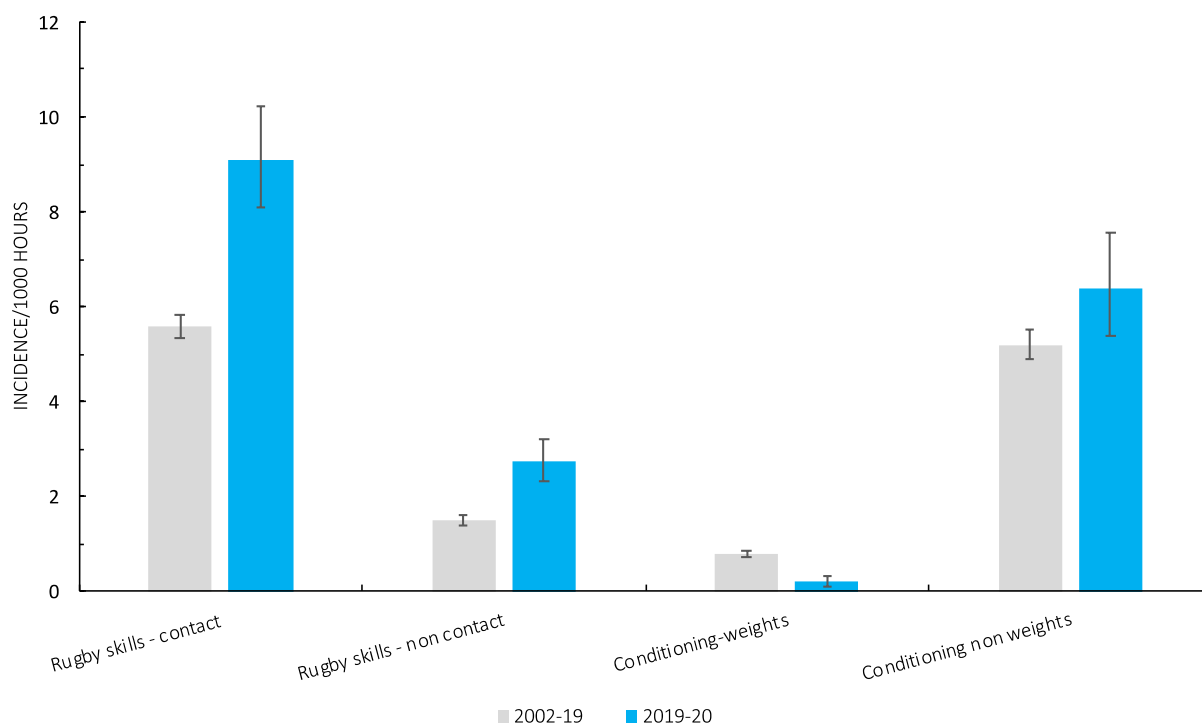


Figure 10: Incidence of training injury types for the 2019-20 seasons compared with the surveillance period as a whole (2002-19). Error bars show 95% CIs.

INJURY DIAGNOSIS

For the ninth successive season, concussion was the most common match injury (19.8 injuries per 1000 hours). AC joint injuries were the second most common match injuries (4.5 injuries per 1000 hours). For the fifth season in succession, concussion was the highest burden match injury and for the fourth successive season, hamstring the second highest burden.

MATCH INJURY

Figure 11: Most common



Figure 11: Ranking of the top 5 most common match injuries for each season with the associated incidence rates (injuries/1000 hours).

Figure 12: Highest burden

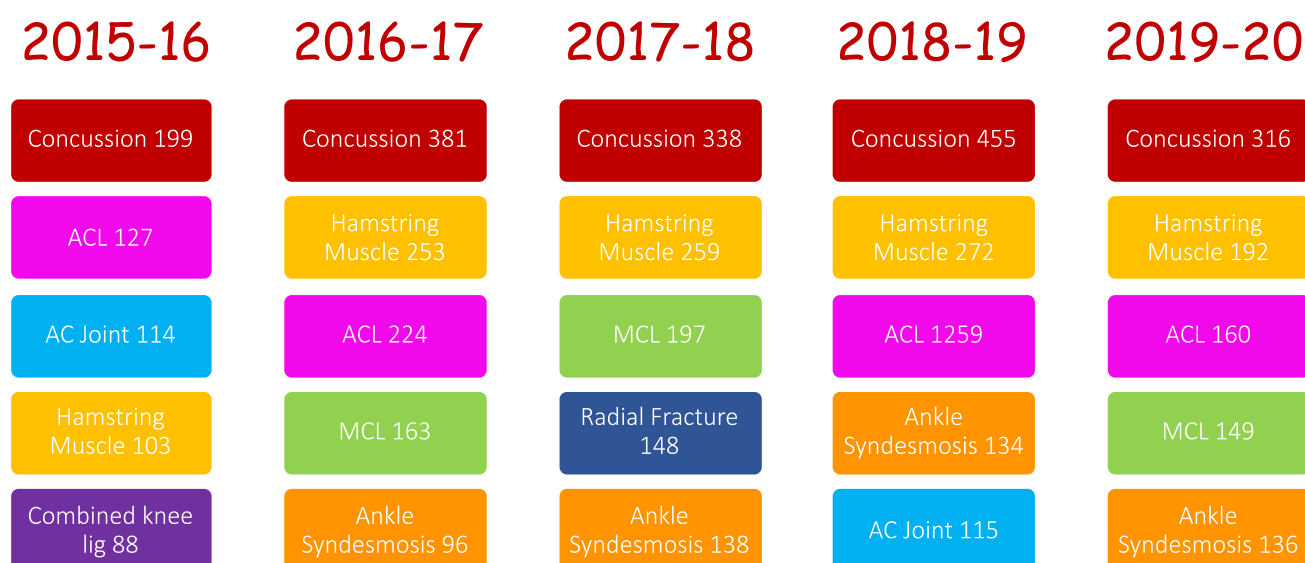


Figure 12: Ranking of the top 5 highest burden match injuries for each season with the associated days absence per 1000 hours.

TRAINING INJURY

Hamstring and calf muscle injuries were both the most common and highest burden training injuries in the 2019-20 season. For the fourth successive season, concussion was third most common training injury (0.19 injuries per 1000 hours).

Figure 13: Most common



Figure 13: Ranking of the top 5 most common training injuries for each season with the associated incidence rates (injuries/1000 hours).

Figure 14: Highest burden



Figure 14: Ranking of the top 5 highest burden training injuries for each season with the associated days absence per 1000 hours.

ENGLAND SENIOR MEN'S SIDE

Match Injuries

The England Senior Mens' 2019-20 season included the 2019 Rugby World Cup and 2020 Six Nations Competition. Sixteen matches were played, with 37 recorded injuries. The incidence of match injuries for the England Senior side in 2019-20 was 112 injuries per 1000 hours compared with 123 injuries per 1000 hours for the 2002-19 period mean (

Table S7 S7). The incidence of match injuries is lower than the previous World Cup years' incidence of 163 injuries per 1000 hours (**Table S7**).

The mean severity of match injuries was 27 days absence, which is the second highest recorded mean severity of the surveillance period and higher than the mean for the surveillance period as a whole (20 days). The increased mean severity reflects an increase in the proportion of >84day injuries in comparison to the 2002-19 period mean (11% vs 4%) (**Table S8**). It has been confirmed that the rehabilitation time for two of the four injuries in the >84day severity category was lengthened as a result of the disruptions to the season. As such, these two injuries exhibit a higher severity than they would have if recovered under normal season conditions. The recovery time of the other two injuries in this category was not influenced by the suspension of the season. The overall burden of match injury was 3156 days absence per 1000 hours, which is higher than the 2002-19 period mean burden of 2460 days absence per 1000 hours and is a reflection of the higher mean severity (**Table S7**).

Training Injuries

In 2019-20, the incidence of training injuries was 5.5 injuries per 1000 hours, which is similar to the 2002-19 period mean of 5.3 injuries per 1000 hours. For injuries in rugby skills sessions (contact, semi-contact and non-contact combined), the incidence was 9.7 injuries per 1000 hours, which is higher than that of the 2002-19 period mean (6.7 injuries per 1000 hours). Injuries in strength and conditioning (1.4 injuries per 1000 hours) were lower than the 2002-19 period mean (3.9 injuries per 1000 hours) (**Table S9**).

The burden for rugby skills injuries (193 days absence per 1000 hours) decreased from recent seasons and is similar to the 2002-19 period mean (144 days absence per 1000 hours). The burden for strength and conditioning sessions (165 days absence per 1000 hours) was substantially higher than the surveillance period average (60 days absence per 1000 hours) and reflects a severe injury that carried a severity of 439 days (**Table S9**). It has been confirmed that the recovery time of this injury was relatively unaffected by the COVID19-induced disruptions to the season and the injury would have carried a similar severity if rehabilitated under more normal season circumstances.

NB: The relatively small number of senior England training sessions and training injuries included in the study each season means that the training injury risk for England should be interpreted with caution. The small sample size means that any differences in risk are much more likely to have arisen "by chance" rather than to be the result of a "true" difference, reflected in the wide 95% confidence intervals.

RFU INJURY SURVEILLANCE PROJECT METHODS

Written informed consent was obtained from 733 registered Premiership squad players for the 2019-20 season, there were no players that formally refused consent. A total of 402 team games were included in the analyses for the 2019-20 season. The COVID19-induced disruptions to the 2019-20 season resulted in the structure in of the season being unlike any previous season. These changes included a 12-week suspension of all normal training activity and match play, an 11-week training period following the suspension of normal training activity and the introduction of a congested match schedule in the post-suspension period of the season. Despite these changes, analysis of the 2019-20 season data suggests that it is comparable with previous seasons data. Where differences were observed between the 2019-20 season data and 2002-19 period mean, further analysis has been done to identify if the circumstances of the 2019-20 season may provide explanation for these differences. In addition, results of an in-depth analysis of the 2019-20 season data have been compiled and accompany this report.

Injuries from consented 1st team squad (including academy players that trained regularly with the 1st team) players sustained in training and in all matches in the Gallagher Premiership, European Competitions (Champions and Challenge Cup) and Premiership Cup were included. Injuries sustained while players represented England were reported and analysed separately.

Match and training injury data, and training exposure data, were provided by all 12 Premiership clubs in 2019-20. A complete set of data were collected from all 12 Premiership clubs and the England senior side. Medical personnel at each Premiership club and the England senior team reported the details of injuries and illnesses sustained by a player at their club/team that were included in the study group together with the details of the associated injury event using an online medical record keeping system, "Rugby Squad" (The Sports Office UK Ltd). Strength and conditioning staff recorded the squad's weekly training schedules and exposure on a password protected online system, "Elitehub". Team match days were also recorded by strength and conditioning staff. Injury and illness diagnoses were recorded using the Orchard Sports Injury Classification System (OSICS) version 10.1. This sports-specific injury classification system allows detailed diagnoses to be reported and injuries to be grouped by body part and injury pathology.

The definitions and data collection methods utilised in this study are aligned with the World Rugby Consensus statement on injury definitions and data collection procedures for studies of injuries in Rugby Union.

In the instance that a player retries from injury within the same season that their injury was sustained, this injury is included in all incidence calculations and excluded from all severity and burden calculations.

A number of quality control processes are embedded within the PRISP data collection process to ensure the validity and integrity of the data being presented within this report. All match exposures are crosschecked against fixture lists for each club at the end of the season to ensure match exposure is correct. During each match in the Gallagher Premiership and Premiership Cup, a match report card is

completed by an official, which notes the reasons for substitutions (i.e., tactical, injury, blood substitution, head injury assessment etc.). These report cards are cross-referenced against match injuries entered into the PRISP database to ensure that all injuries sustained are captured.

Furthermore, concussions reported in the PRISP database are crosschecked with the CSx (concussion management mobile application) data to ensure all concussions are logged correctly. Finally, before the PRISP data is analysed, all injuries are checked for duplicates and inconsistencies and final approval of the included injuries is sought from the medical lead in each club.

PROJECT DEFINITIONS

Time-loss injury

A time-loss injury was defined as ‘any injury that prevents a player from taking a full part in all training activities typically planned for that day and/or match play for more than 24 hours from midnight at the end of the day the injury was sustained’. For example, if a player was injured during a match on Saturday and he was able to take a full part in training on Monday, the incident would not be classed as an injury. If the player’s training was restricted on Monday due to the injury received on Saturday, the incident would be classed as a time-loss injury and reported.

Injury severity

Injury severity was measured as time (days) lost from competition and practice and defined as the number of days from the date of the injury to the date that the player was deemed to have regained full fitness not including the day of injury or the day of return. A player was deemed to have regained full fitness when he was ‘able to take a part in training activities (typically planned for that day) and was available for match selection.’

Recurrent injury

An injury of the same type and at the same site as an index (original) injury and which occurs after a player’s return to full participation from the index (original) injury. Manual calculation of within season injury recurrence was completed using player registration codes and OSICS codes (to two digits).

Injury incidence and days absence

The likelihood of sustaining an injury during match play or training is reported as the injury incidence. The injury incidence is the number of injuries expressed per 1,000 player-hours of match exposure (or training exposure).

Burden

The burden of injury is a measure that combines the frequency and severity of injuries. Burden is measured as the day’s absence per 1,000 player-hours of exposure.

Illness

Any illness (classified using the Orchard sports injury classification system – OSICS 10.1) for which the player sought consultation at his club that prevented the player from participating in training or match play for a period greater than 24 hours after the onset of symptoms.

Statistical significance

A result is considered to be statistically significant if the probability that it has arisen by chance is less than 5% or 1 in 20. In this report, statistical analysis has been performed for the match and training injury incidence and days absence.

Median severity

The median severity is the middle value when all of the severity values are lined up in order numerically.

CURRENT PUBLICATIONS

Further detailed information on injury risk in this cohort of players can be obtained from the following peer reviewed publications that have been produced as part of the Premiership injury surveillance project:

Publications

- West, S., Starling, L., Kemp, S. P. T., Williams, S., Cross, M., Taylor, A., Brooks, J. and Stokes, K.. Trends in match injury risk in professional male rugby union: a 16-season review of 10851 match injuries in the English Premiership (2002-2019): The Professional Rugby Injury Surveillance Project. *British Journal of Sports Medicine*. DOI: 10.1136/bjsports-2020-102529
- West, S., Williams, S., Cazzola, D., Cross, M., Kemp, S. and Stokes, K. Training load and injury risk in elite Rugby Union: The largest investigation to date. *International Journal of Sports Medicine*. DOI: 10.1055/a-1300-2703
- West, S., Williams, S., Kemp, S. P. T., Eager, R., Cross, M. and Stokes, K. Training Load, Injury Burden, and Team Success in Professional Rugby Union: Risk Versus Reward. *Journal of Athletic Training*. 55 (9): 960-966.
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- Williams, S., Trewartha, G., Kemp, S.P.T., Brooks, J.H.M., Fuller. C. W., Taylor. A.E., Cross, M.J., and Stokes, K.A. 2017. How much rugby is too much? A seven-season prospective cohort study of match exposure and injury risk in professional rugby union players. *Sports Medicine*. 47 (11): 2395-2402. DOI: 10.1007/s40279-017-0721-3
- Tucker, R., Raftery, M., Kemp, S.P.T., Brown, J., Fuller, G.W., Hester, B., Cross, M.J. and Quarrie, K. (2017). Risk factors for head injury events in professional rugby union: a video analysis of 464 head injury events to inform proposed injury prevention strategies. *British Journal of Sports Medicine*. 51, (15): 1152-1157.
- Tucker, R., Raftery, M., Fuller, G.W., Hester, B., Kemp, S.P.T., and Cross, M.J (2017). A video analysis of head injuries satisfying the criteria for a head injury assessment in professional Rugby Union: a prospective cohort study. *British Journal of Sports Medicine*. 51: 1147-1151.
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Table S1: Match injury incidence, severity and burden 2002-20.

Season	Exposure	Number of match injuries	Incidence/1000 hrs (95% CI)	Injuries per club per match	Mean severity (days) (95%CI)	Burden/1000 hrs (95% CI)	Median Severity	Burden/1000 hrs
2002-03	7480	748	100 (92-107)	2.0	16 (15-17)	1556 (1444-1667)	5	31
2003-04	7420	653	88 (82-95)	1.8	20 (19-22)	1773 (1637-1909)	7	35
2005-06	6427	482	75 (68-82)	1.5	21 (19-23)	1591 (1449-1733)	10	32
2006-07	8389	755	90 (84-97)	1.8	21 (20-23)	1879 (1745-2013)	7	38
2007-08	7952	660	83 (77-89)	1.7	19 (18-21)	1613 (1490-1736)	8	32
2008-09	7690	769	100 (93-107)	2.0	23 (21-25)	2285 (2123-2446)	8	46
2009-10	7950	636	80 (73-86)	1.6	22 (20-24)	1722 (1588-1856)	8	34
2010-11	8022	746	93 (86-99)	1.9	21 (20-23)	1917 (1779-2054)	8	38
2011-12	7980	655	82 (76-88)	1.6	27 (25-29)	2222 (2052-2392)	9	44
2012-13	8100	588	73 (67-79)	1.5	25(23-27)	1784 (1645-1936)	11	35
2013-14	8160	739	91 (85-98)	1.8	26 (24-28)	2247 (2091-2415)	9	46
2014-15	8200	645	79 (73-85)	1.6	29 (27-31)	2369 (2193-2560)	9	47
2015-16	7162	447	62 (57-68)	1.2	29 (26-32)	1808 (1648-1984)	10	36
2016-17	8100	778	96 (90-103)	1.9	33 (31-35)	3150 (2936-3379)	11	63
2017-18	7800	717	92 (86-99)	1.8	37 (34-40)	3401 (3161-3659)	14	66
2018-19	8120	823	103 (96-110)	2.0	34 (32-36)	3479 (3249-3725)	14	69
2019-20	8040	709	88 (82-95)	1.8	38 (35-41)	3334 (2706-4108)	11	67
MEAN (2002-19)	7810	678	85 (65-108)	1.7	25 (23-27)	2125 (1718-2628)	9	43

Table S2: Match injury incidence by severity grouping 2002-20.

Season	Incidence/1000hrs (95%CI)				
	2-7 days	8-28 days	29-84 days	>84 days	All injuries
2002-03	57	30	9	3	100
2003-04	45	26	14	4	88
2005-06	29	29	13	3	75
2006-07	47	28	11	5	90
2007-08	39	30	10	4	83
2008-09	48	31	14	6	100
2009-10	36	29	10	4	80
2010-11	44	32	11	5	93
2011-12	34	28	13	7	82
2012-13	26	30	13	4	73
2013-14	38	33	14	6	91
2014-15	33	25	12	9	79
2015-16	23	24	11	5	62
2016-17	36	33	20	10	96
2017-18	28	32	19	12	92
2018-19	32	39	22	10	103
2019-20	31	30	15	11	88
MEAN (2002-19)	37 (36-38)	30 (29-31)	14 (13-14)	6 (5-7)	87 (85-88)

Table S3: Training injury incidence, severity and burden 2002-20.

Season	Exposure	Total number of training injuries	Proportion of all injuries (%)	Incidence/1000 hrs	Injuries per club	Mean severity (days)	Median severity (days)	Burden/1000 hrs
2002-03	56786	159	18	2.8	13	21	7	59
2003-04	144667	217	25	1.5	18	22	8	33
2005-06	109730	203	30	1.9	17	19	9	36
2006-07	112973	209	22	1.9	17	17	8	32
2007-08	107797	318	33	3.0	27	17	9	51
2008-09	105306	258	25	2.5	22	22	9	55
2009-10	121633	298	32	2.5	25	20	9	50
2010-11	119298	340	31	2.9	28	21	9	61
2011-12	139956	323	33	2.5	27	22	10	55
2012-13	129019	335	36	2.6	28	29	12	75
2013-14	131900	414	36	2.9	35	25	12	73
2014-15	140263	325	34	2.3	27	28	12	64
2015-16	159398	304	40	1.9	25	30	17	57
2016-17	147983	429	36	2.9	36	33	14	96
2017-18	152533	438	38	2.9	37	37	14	106
2018-19	183280	528	39	2.9	44	32	15	93
2019-20	182049	551	44	3.0	46	35	18	105
MEAN (2002-19)	132034	332	32	2.5	28	25	11	65

Table S4: Incidence, severity and burden of match concussions 2002-20

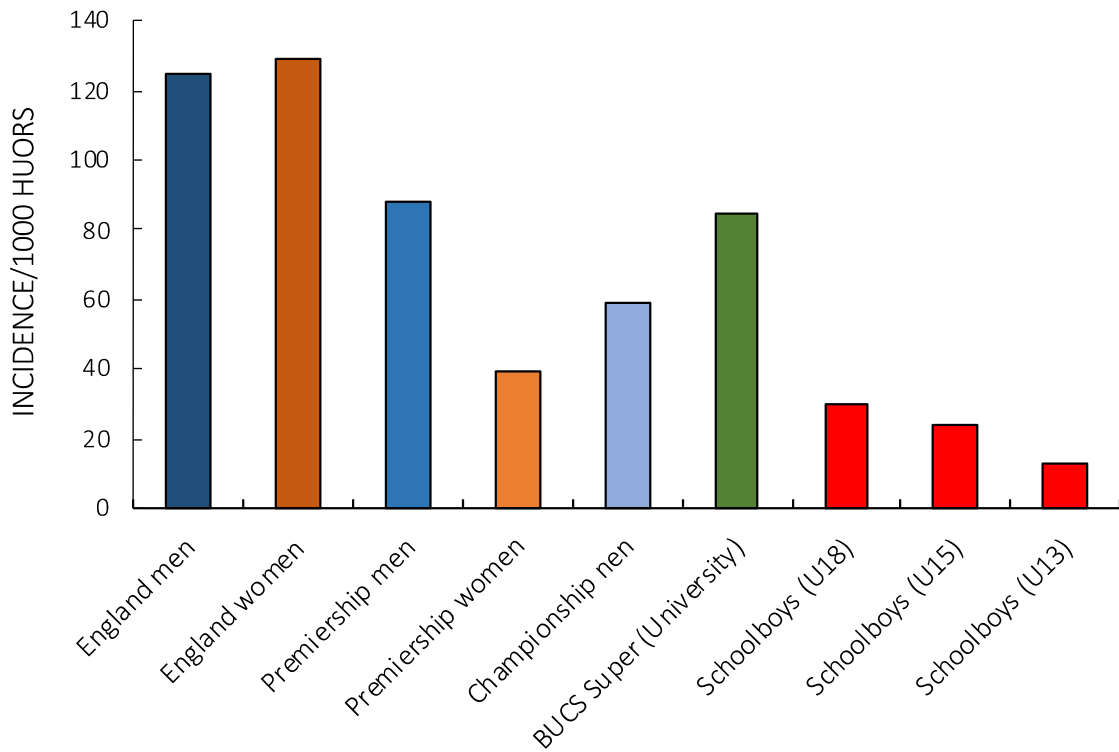
Season	Exposure	Total number of concussion	Incidence/1000 hrs	Injuries per club	Mean severity (days)	Median Severity (days)	Burden/1000 hrs
2002-03	7480	42	5.6	3	10	6	56
2003-04	7420	24	3.3	2	9	8	30
2005-06	6427	20	3.1	2	20	8	62
2006-07	8389	37	4.4	3	12	7	53
2007-08	7952	37	4.6	3	8	7	37
2008-09	7690	38	4.9	3	12	8	59
2009-10	7950	31	3.9	3	7	6	27
2010-11	8022	38	4.7	3	10	7	47
2011-12	7980	41	5.1	3	12	8	61
2012-13	8100	54	6.7	5	13	9	87
2013-14	8160	86	10.5	7	11	8	116
2014-15	8200	110	13.4	9	12	7	161
2015-16	7162	113	15.8	9	13	8	205
2016-17	8100	169	20.9	14	18	8	376
2017-18	7800	140	17.9	12	19	9	339
2018-19	8120	166	20.4	14	22	10	455
2019-20	8040	159	19.8	13	16	8	317
MEAN (2002-19)	7810	72	9.0	6	13	8	136

Table S5: Proportion of concussion by severity grouping.

Season	Proportion (%)			
	2-7 days	8-28 days	29-84 days	>84 days
2010-11	57	41	3	0
2011-12	49	49	8	0
2012-13	42	68	11	3
2013-14	49	105	11	0
2014-15	55	35	6	3
2015-16	46	45	8	1
2016-17	40	49	7	4
2017-18	39	47	10	4
2018-19	37	48	9	6
2019-20	42	48	8	3
MEAN (2010-19)	43	46	8	3

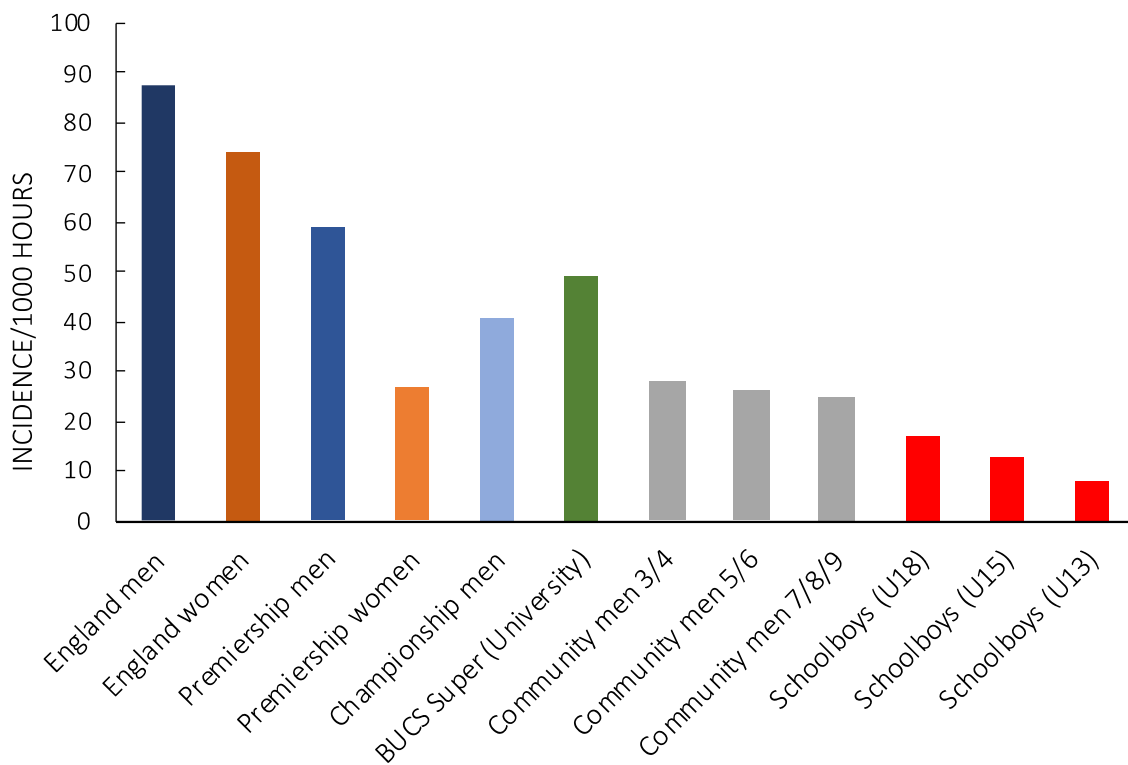
Table S6: Incidence, severity and burden of tackle related injuries to the ball carrier and tackler.

Season	Ball Carrier			Tackler		
	Incidence/1000 hours	Mean severity	Burden/1000 hours	Incidence/1000 hours	Mean severity	Burden/1000 hours
2002-03	21	1	334	13	18	230
2003-04	17	17	281	13	21	274
2005-06	21	21	439	10	27	272
2006-07	22	16	347	15	16	234
2007-08	19	19	359	11	21	233
2008-09	22	34	731	16	24	370
2009-10	21	25	537	10	27	267
2010-11	18	18	334	14	28	399
2011-12	23	29	688	12	33	406
2012-13	19	24	465	14	26	361
2013-14	19	16	511	11	25	274
2014-15	15	40	580	12	34	406
2015-16	15	34	495	13	17	231
2016-17	23	37	845	22	27	590
2017-18	22	38	830	26	38	989
2018-19	28	32	874	25	34	855
2019-20	23	37	858	23	34	769
MEAN (2002-19)	20	25	541	15	26	399



FigureS1: Incidence of 24-hour time loss match injury across men's and women's rugby union participation in England for 2019-20.

FigureS2: Incidence of 24-hour time loss match injury across men's and women's rugby union participation in England for 2019-20.



FigureS3: Incidence of 7-day time loss match injury across men's and women's rugby union participation in England for 2019-20

Table S7: England match injury incidence, severity and burden 2002-20. *Asterisk indicate world cup year.

Season	Total number of injuries	Incidence/1000 hours (95%CI)	Injuries per match	Mean severity	Burden/1000 hours (95%CI)	Days absence per match
2002-03	53	221 (169-289)	4.4	19	4264 (4010-4533)	85
2003-04	83	207 (167-256)	4.1	11	2371 (2225-2527)	47
2005-06	30	136 (95-195)	2.7	10	1391 (1243-1556)	28
2006-07	30	136 (95-195)	2.7	28	3836 (3586-4104)	77
2007-08	55	162 (119-205)	3.2	24	3876 (2852-4901)	78
2008-09	23	96 (57-135)	1.9	8	813 (480-1145)	16
2009-10	23	88 (52-125)	1.8	19	1712 (1012-2411)	34
2010-11	14	78 (37-119)	1.5	23	1789 (852-2726)	36
2011-12*	16	62 (31-92)	1.2	29	1754 (894-2613)	35
2012-13	31	111 (78-158)	2.2	24	2618 (1841-3722)	52
2013-14	19	86 (55-135)	1.7	20	1509 (963-2366)	34
2014-15	27	113 (78-165)	2.3	23	2604 (1786-3797)	52
2015-16*	39	163 (119-223)	3.3	13	2043(1492-2795)	41
2016-17	27	113 (78-165)	2.3	16	1774 (1217- 2587)	35
2017-18	23	105 (70-158)	2.1	30	3131 (2081-4712)	62
2018-19	23	89 (59-134)	1.8	19	1664 (1106-2504)	39
2019-20*	37	112 (84-160)	2.3	27	3156 (2630-3787)	63
MEAN (2002-19)	32	123 (113-133)	2.5	20	2460 (2062-2936)	47

Table S8: Proportion of England match and training injuries by severity grouping 2002-20. *Asterisk indicate world cup year.

Season	Proportion (%)							
	Match				Training			
	2-7 days	8-28 days	29-84 days	>84 days	2-7 days	8-28 days	29-84 days	>84 days
2002-03	72	15	11	2	64	29	0	7
2003-04	61	30	7	1	51	40	9	0
2005-06	70	20	0	10	93	0	7	0
2006-07	34	47	6	13	53	27	20	0
2007-08	55	27	16	2	50	46	4	0
2008-09	48	30	17	4	53	40	0	7
2009-10	39	52	9	0	61	17	17	6
2010-11	29	43	21	7	86	14	0	0
2011-12*	63	6	19	13	44	39	11	6
2012-13	35	35	26	3	17	50	17	17
2013-14	58	21	21	0	51	37	10	2
2014-15	70	15	11	4	63	19	13	6
2015-16*	59	39	2	0	67	29	4	0
2016-17	70	15	11	4	36	9	45	9
2017-18	48	26	17	9	42	17	25	17
2018-19	61	9	30	0	42	26	21	11
2019-20*	38	41	11	11	44	31	15	10
MEAN (2002-19)	57	27	12	4	55	30	11	4

Table S9: England training injury incidence, severity and burden 2002-20. *Asterisk indicate world cup year.

Season	Incidence/1000 hours (95%CI)	RUGBY SKILLS		STRENGTH AND CONDITIONING		
		Mean severity	Burden/1000 hrs (95%CI)	Incidence/1000 hours (95%CI)	Mean severity	Burden/1000 hrs (95%CI)
2002-03	4.5 (2.6-8.0)	15	69 (60-80)	4.0 (1.0-15.9)	4	16 (8-32)
2003-04	7.6 (5.3-11.0)	12	89 (80-99)	6.3 (3.8-10.3)	13	79 (68-90)
2005-06	0.6 (0.1-4.0)	4	2 (1-6)	-	-	-
2006-07	9.8 (5.9-16.3)	15	149 (131-169)	-	-	-
2007-08	7.3 (4.5-10.1)	9	74 (46-103)	2.5 (0.5-4.6)	12	34 (7-61)
2008-09	6.5 (3.0-10.0)	20	135(62-209)	12.1 (4.2-20.0)	18	233 (81-385)
2009-10	5.3 (3.4-8.3)	8	46 (30-73)	4.0 (2.0-8.6)	6	26 (12-55)
2010-11	1.7 (0.8-3.5)	7	12 (6-26)	4.4 (1.8-10.5)	5	22 (9-53)
2011-12*	3.2 (1.4-5.1)	22	70 (31-110)	2.8 (0.4-5.3)	18	51 (6-95)
2012-13	3.7 (1.6-9.0)	20	58 (24-134)	1.1 (0.2-7.8)	9	10 (1-71)
2013-14	7.9 (4.7-13.3)	11	87 (52-147)	3.9 (1.3-12.1)	14	57 (18-177)
2014-15	3.3 (1.6-6.9)	25	85 (50-145)	2.3 (0.6-9.2)	2	3 (1-80)
2015-16*	15.7 (11.6-21.3)	9	135 (99-183)	7.3 (4.7-11.3)	8	55 (36-85)
2016-17	7.7 (4.1-14.3)	44	337 (181-626)	0.8 (0.1-5.7)	17	13 (2-93)
2017-18	12.2 (7.8-19.1)	47	579 (369-908)	1.8 (0.8-4.3)	32	57 (24-137)
2018-19	9.9 (6.0-16.4)	38	371 (224-615)	1.9 (0.7-5.1)	19	36 (14-96)
2019-20*	9.7 (6.9-13.6)	20	193 (103-362)	1.4 (0.6-3.4)	117	165 (21-858)
MEAN (2002-19)	6.7 (5.9-7.6)	19	144 (68-307)	3.9 (3.1-4.9)	20	60 (39-93)