
Change to injury profile of elite male cricketers in the T20 era

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1 Abstract

This report analyses injuries occurring prospectively in Australian cricket at the men's state and national levels over the last 9 years in particular, comparing this 9 year period ("T20 era") with the previous 9 years (starting 1996-97) to analyse long-term trends of injury. The number of Test, first class, ODI and List A matches was essentially unchanged from the pre-T20 era to the T20 era, but there was a 35% increase in the number of overall matches played, with the increase entirely being T20 matches. For match injury incidence (number of injuries during a match per squad per season) overall, there was an 18% higher chance of injury in the T20 era compared to the pre-T20 era. For match bowling injuries overall, there was a 28% higher risk in the T20 era. However, the only individual categories of injuries that increased in the T20 era were thigh and hamstring strains and other shoulder (not tendon) injuries. Overall injury prevalence increased in the T20 era as injured players missed more games – the major reason for this is that the games were scheduled more closely to fit the T20 games into the calendar. Injury prevalence for each position also increased significantly in the T20 era. The largest absolute increase was a 4.7% increase for fast bowlers. Batsmen, spin bowlers and wicketkeepers all had absolute increases of injury prevalence of approximately 3% in the T20 era, but coming off a low base in the T20 era their relative injury prevalence compared to pre-T20 era was much higher. For example, spin bowlers increased from 4.1% to 7.2% average injury prevalence in the T20 era whereas fast bowlers increased from 15.2% to 19.9%. Injuries that caused players to miss more playing time in the T20 era were shoulder injuries (non-tendon), wrist and hand fractures, side and abdominal strains, low-back stress fractures, thigh and hamstring strains and shin and foot stress fractures.

2 Introduction

The first major series of published studies on cricket injuries were made in the late 1980s and early 1990s, with the earliest attempts at recording larger series of injuries [1-4] and exploring risk factors for lumbar injuries in fast bowlers [5-11]. Cricket researchers published the first ever consensus international injury definitions for a sport in 2005, co-published in four major sports medicine journals [12-15], a process that was driven by the leadership that Australia had shown in developing a successful and ongoing injury surveillance system [16]. Other team sports such as football (soccer), in 2006 [17] and rugby union, in 2007 [18] also published consensus definitions. The international definitions have been a qualified success in that since their publication there have been subsequent publications of injury surveillance results from the West Indies [19], Australia [20-21], New Zealand.[22]

There have been some major changes to both the cricket calendar and the way that cricket injuries are managed and understood. These are:

(1) The explosion of T20 cricket as a major format of the game. T20 cricket had been played in England at domestic level prior to 2005, but subsequent to this time it has quickly become a very prominent form of the game in terms of number of matches, crowds and television ratings.

(2) The increased number of teams that an average player represents. Prior to 2005 an Australian player might represent his state and country with a minority of players occasionally playing county cricket in the off-season in England. In the T20 era many Australian players will play for four teams – state, country, Big Bash team and Indian Premier League (IPL) or English county/domestic T20 team. There are some players who are T20 specialists who can represent 5 or 6 teams in a single year. The implications are that it is more common for an injury sustained playing for one team to affect availability for another team.

3 Methods

3.1 Injury definitions

Methods for the survey have been described previously [12 14 16 20] but are summarised below.

The definition of a cricket injury (or 'relevant' injury for surveillance purposes) is:

Any injury or other medical condition that either:

- (1) prevents a player from being fully available for selection in a major match; or
- (2) during a major match, causes a player to be unable to bat, bowl or keep wicket when required by either the rules or the team's captain.

The major injury rates presented are injury incidence and injury prevalence:

- Injury incidence analyses the number of injuries occurring over a given time period.
- Injury match incidence considers only those injuries occurring during major matches. The preferred unit in this report is injuries per 1000 days of play, which was not the recommended unit in the 2005 definitions but is more suitable to compare the various formats in the era of T20 cricket, as detailed in a recent publication [21].
- Injury seasonal incidence considers the number of defined injuries occurring per squad per season. This can take into account gradual onset injuries, training injuries and match injuries in the one measurement. A 'squad' is defined as 25 players and a 'season' is defined as 60 days of scheduled match play.

Injury prevalence considers the average number of squad members not available for selection through injury for each match divided by the total number of squad members. Injury prevalence is expressed as a percentage, representing the percentage of players missing through injury on average for that team for the season in question. It is calculated using the numerator of 'missed player games', with a denominator of number of games multiplied by squad members. Player movement monitoring essentially requires that all players are defined in each match as either: (1) playing cricket (2) not playing cricket due to injury or illness (3) not playing cricket for another reason (e.g. non-selection with no lower grade game available).

In order to promote consistency, the starting date for the Australian cricket year has been designated as the start of whichever series was being played after May 1st for every season under consideration.

The methods used for Cricket Australia injury surveillance conform to the Code of Ethics of the World Medical Association (Declaration of Helsinki) and the latest National Health and Medical Research Council (NHMRC) guidelines for research. They have been approved by the Cricket Australia Sports Science Sports Medicine Advisory Group as the relevant institutional review board. As injury surveillance is non-interventional and the methods preserve confidentiality of the players, it is characterised as 'low or negligible risk' (statement available at:

http://www.nhmrc.gov.au/files_nhmrc/file/publications/synopses/e72-jul09.pdf

accessed December 9, 2013).

3.2 Statistical calculations

Data presented in this report is categorised into pre-T20 era 9 year averages and T20-era 9 year averages. The two eras are statistically compared to give relative risks (RR) of injuries between eras. The 95% CI of the RR are calculated using Taylor Series expansions [29].

4 Results

Table 1 – Schedule and overs comparison of eras

Average annual:		Team matches		Team days played		Overs bowled	
		Pre Era	T20 Era	Pre Era	T20 Era	Pre Era	T20 Era
Domestic	Champions League T20		9.4		9.4		89
	Domestic T20		42.4		42.0		782
	Domestic One Day	52.4	56.9	52.0	56.4	2510	2533
	Domestic First Class	62.0	62.0	231.8	233.1	9821	9707
International	International T20	0.1	8.6	0.1	8.4	3	151
	One Day International	27.0	27.4	26.7	27.1	1204	1154
	Test match	12.0	11.3	51.3	50.9	1945	1917
Totals		153.6	213.9	361.9	423.2	15483	16334

Table 1 shows that workload in terms of number of overs bowled has stayed fairly steady in first class domestic cricket over the past 18 years. The two ‘knock-on’ effects of T20 cricket have probably been highly significant (but are somewhat harder to measure) – increased variability in workloads and increased compression of first class fixtures to accommodate the T20 calendar.

4.1 Injury incidence

Injury incidence results are detailed in Table 2. For overall match incidence and for the various games formats, there were few significant differences (at 95% CI level) between the pre-T20 and T20 eras, although there were trends towards more injuries in the T20 era. For matches injuries overall, there was a 1.18 relative risk in the T20 era (95% CI 1.03-1.35). Domestic one day matches (RR 1.61, 95% CI 1.20-2.17) was the one match format with a significantly increased risk of injuries. For domestic first class matches (RR 1.13, 95% CI 0.94-1.37) there was a trend towards more bowling injuries in the T20 era. Of course T20 matches themselves could not be compared between eras.

Table 2 – Incidence comparison of eras

Average annual:		Match incidence (inj /1000 days of play)		Bowling incidence (inj / 1000 overs)	
		Pre Era	T20 Era	Pre Era	T20 Era
Domestic	Champions League T20		127.7		2.5
	Domestic T20		166.7		2.0
	Domestic One Day	177.4	285.4	1.9	2.8
	Domestic First Class	106.4	120.6	1.2	1.6
International	International T20		189.2		3.7
	One Day International	270.8	245.9	1.6	2.2
	Test match	123.4	102.6	1.8	1.1
Totals		131.1	154.5	1.4	1.8

For overall bowling match incidence and for the various games formats, there was some significant difference (at 95% CI level) between the pre-T20 and T20 eras. For match bowling injuries overall, there was a 1.28 relative risk in the T20 era (significant, 95% CI 1.05-1.54). For domestic one day matches (RR 1.46, 95% CI 0.94-2.17) and domestic first class matches (RR 1.35, 95% CI 1.03-1.74) there was a trend towards more bowling injuries in the T20 era, but for Test cricket there was a trend towards fewer bowling match injuries in the T20 era (RR 0.60, 95% CI 0.37-1.06).

Table 2 analyses match injury incidence by the unit of injuries per 1000 days of play. These units were not recommended by the international definitions, but enable a more direct comparison between T20 cricket and the other forms. From Table 2, it can be seen that Domestic T20 matches have a similar bowling injury incidence than other forms of domestic cricket in terms of injuries per day of play as well as injuries per 1000 overs bowled. The international and Champions League T20 figures follow a similar trend although are not yet as accurate due to the small sample size.

Seasonal incidence (Table 3) is calculated by number of injuries multiplied by 1500 (for a squad of 25 players over 60 days), divided by the number of player days of exposure. In the T20 era there was a significant increase in seasonal injuries for all teams RR 1.13 (95% CI 1.04-1.22).

Table 3- Injury seasonal incidence by body area & injury type

Region	Injury type	Pre era	T20 era	Significant change
Head & neck	Fractured facial bones	0.1	0.2	
	Other head and facial injuries	0.2	0.1	
	Neck injuries	0.1	0.1	
Shoulder	Shoulder tendon injuries	0.6	0.5	
	Other shoulder injuries	0.4	0.7	1.66 95% CI 1.02-2.68
Arm/elbow	Arm/forearm fractures	0.1	0.0	
	Other elbow/arm injuries	0.3	0.4	
Wrist/hand	Wrist and hand fractures	1.1	1.2	
	Other wrist/hand injuries	0.6	0.8	
Trunk	Side and abdominal strains	1.3	1.6	
	Other trunk injuries	0.2	0.4	
Lumbar spine	Lumbar stress fractures	0.6	0.9	
	Other lumbar injuries	1.3	1.3	
Groin/hip/thigh	Groin and hip injuries	1.2	1.3	
	Thigh and hamstring strains	2.6	3.7	1.44, 95% CI 1.18-1.76
	Buttock and other thigh injuries	0.2	0.4	
Knee	Knee cartilage injuries	0.9	0.9	
	Other knee injuries	0.7	0.5	
Shin/foot/ankle	Shin and foot stress fractures	0.4	0.6	
	Ankle and foot sprains	1.0	0.8	
	Other shin, foot and ankle injuries	1.4	1.6	
Medical	Heat-related illness	0.1	0.0	
	Medical illness	1.0	0.8	
Total				

Of the individual injury categories, only thigh and hamstring strains (RR 1.44, 95% CI 1.18-1.76) and other shoulder (not tendon) injuries (RR 1.66 95% CI 1.02-2.68) have increased significantly in incidence in the T20 era.

4.2 Injury prevalence

Injury prevalence rates (Tables 4 and 5) has generally increased over the T20 era of cricket.

Table 4 – Injury prevalence by player position 2005-06 to 2013-14

	Pre Era	T20 era	Relative risk T20:preT20	95% CIs
Batsman	4.4%	7.2%	1.64	1.53-1.75
Keeper	2.0%	5.1%	2.57	2.10-3.14
Pace Bowler	15.2%	19.9%	1.31	1.27-1.36
Spinner	4.1%	7.2%	1.77	1.60-1.97

Although pace bowlers remain the most susceptible to injury by far, they have actually had a smaller relative increase in injury prevalence in the T20 era compared to the other positions (i.e. batsmen, spin bowlers and wicketkeepers have had relatively greater increase in missed time in T20 era than pace bowlers).

As per Table 5, many injury categories which led to more missed playing time in the T20 era. Of these only hamstring and shoulder instability injuries have been shown to have a statistically significant increase in actual incidence. The increased prevalence of the other injuries is therefore due mainly to increased severity (greater number of matches missed per injury). The greater number of matches in the T20 era has led to an injury of a given time period missing a greater number of games as there are more games in this given time period, on average.

The notable injury categories which led to less missed playing time in the T20 era were medical illnesses and arm/forearm fractures.

Table 5 – Injury prevalence categories significant changes between eras

Region	Body region	Pre era	T20 era	Relative risk T20:pre	95% Cis
Head & neck	Fractured facial bones	0.1%	0.1%	1.24	0.87-1.79
	Other head and facial injuries	0.0%	0.0%	1.50	0.75-3.00
	Neck injuries	0.0%	0.0%	0.39	0.19-0.79
Shoulder	Shoulder tendon injuries	0.5%	0.5%	1.09	0.96-1.23
	Other shoulder injuries	0.4%	0.6%	1.55	1.35-1.78
Arm/elbow	Arm/forearm fractures	0.1%	0.0%	0.38	0.24-0.62
	Other elbow/arm injuries	0.2%	0.3%	2.16	1.77-2.63
Wrist/hand	Wrist and hand fractures	0.5%	0.7%	1.35	1.21-1.52
	Other wrist/hand injuries	0.2%	0.3%	1.27	1.05-1.52
Trunk	Side and abdominal strains	0.6%	0.9%	1.48	1.33-1.65
	Other trunk injuries	0.1%	0.2%	2.34	1.78-3.08
Lumbar spine	Lumbar stress fractures	1.0%	1.7%	1.69	1.56-1.84
	Other lumbar injuries	0.7%	0.8%	1.09	0.99-1.21
Groin/hip/thigh	Groin and hip injuries	0.6%	0.7%	1.16	1.03-1.30
	Thigh and hamstring strains	0.8%	1.6%	2.08	1.90-2.27
	Other thigh/buttock injuries	0.0%	0.2%	6.25	4.33-9.03
Knee	Knee cartilage injuries	0.7%	0.9%	1.20	1.09-1.33
	Other knee injuries	0.4%	0.6%	1.46	1.28-1.67
Shin/foot/ankle	Shin and foot stress fractures	0.3%	0.6%	1.75	1.52-2.00
	Ankle and foot sprains	0.5%	0.6%	1.15	1.01-1.30
	Other shin, calf, foot and ankle injuries	0.6%	0.8%	1.25	1.13-1.40
Medical	Heat-related illness	0.0%	0.0%	0.00	
	Medical illness	0.4%	0.2%	0.55	0.47-0.66
Total					

5 Discussion

The number of Test, first class, ODI and List A matches was essentially unchanged from the pre-T20 era to the T20 era, but there was a 35% increase in the number of overall matches played, with the increase entirely being T20 matches. There was only a minimal effect on overall number of overs bowled, however, with T20 giving rise to far fewer overs than the longer forms of the game. The challenges to bowlers were of rapid changes in weekly workloads and an increase in overall number of fixtures rather than an increase in annual workloads.

The T20 era was generally associated with increased risk of injury. For match injury incidence (number of injuries per squad per season) overall, there was a 1.18 relative risk in the T20 era (95% CI 1.03-1.35) compared to the pre-T20 era. For match bowling injuries overall, there was a 1.28 relative risk in the T20 era (significant, 95% CI 1.05-1.54). In the T20 era there was also a significant increase in seasonal injuries for all teams combined RR 1.13 (95% CI 1.04-1.22). Of the individual injury categories, only thigh and hamstring strains (RR 1.44, 95% CI 1.18-1.76) and other shoulder (not tendon) injuries (RR 1.66 95% CI 1.02-2.68) increased significantly in incidence in the T20 era.

Injury prevalence (percentage of players missing through injury) increased far more than injury incidence in the T20 era, meaning that average severity (number of games missed per individual injury) increased. The major reason for more games being missed in the T20 era is simply that the games were scheduled in closer proximity to each other to fit the T20 games into the calendar. The injury prevalence overall significantly increased for the T20 era (RR 1.41 95% CI 1.37-1.45). The injury prevalence for every position increased significantly in the T20 era. In absolute terms it increased most for fast bowlers from 15.2% to 19.9% (a 4.7% increase). However in relative terms the increase for fast bowlers was the least of all positions. Batsmen, spin bowlers and wicketkeepers all had absolute increases of injury prevalence of approximately 3% in the T20 era but coming off a low base in the T20 era their relative injury prevalence compared to pre-T20 era was much higher. For example, spin bowlers increased from 4.1% to 7.2% average injury prevalence in the T20 era.

The notable injury categories which led to more missed playing time in the T20 era were: Other (non-tendon) shoulder injuries RR 1.55 95% CI (1.35-1.78), Wrist and hand fractures RR 1.35 95% CI (1.21-1.52), Side and abdominal strains RR 1.48 95% CI (1.33-1.65), Lumbar stress fractures RR 1.69 95% CI (1.56-1.84), Thigh and hamstring strains RR 2.08 95% CI (1.90-2.27) and Shin and foot stress fractures RR 1.75 95% CI (1.52-2.00).

The notable injury categories which led to less missed playing time in the T20 era were: Medical illness RR 0.55 95% CI (0.47-0.66) and Arm/forearm fractures RR 0.38 95% CI (0.24-0.62).

Bowling workload has been documented as a risk factor for overuse injury in cricket [23 30-32]. Acute high one-off workloads [30], overs or sessions per week [31 32] and workload variability[23] have all been associated with increased risk of bowling injury, with low weekly workloads also documented as a risk factor[31]. Although our understanding of high (and low) workloads in bowlers as risk factors is gradually improving, the ability to avoid high and low match workloads and particularly sudden upgrades of workloads is diminishing, as T20 matches and first class matches are

scheduled more closely to each other on an annual basis. In athletics, it would be considered a grave training error for a runner to upgrade from running 10km per week to 100km per week [33], yet this is the equivalent of the rapid workload upgrade now expected of some fast bowlers. It has been shown in cricket that sudden upgrades in workload are associated with increased injury risk[23] although it is harder to adequately prepare players in the fashion which is 'low risk'. That is, maintaining a constant moderate workload (not too high and not too low) to both condition but not overload. Sadly the modern schedule encourages the two extremes (unloading in T20 and overloading in first class cricket) for fast bowlers who want to play in all forms of the game.

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