

Injury Report 2011: Cricket Australia



Cricket Australia conducts an annual ongoing injury survey recording injuries in contracted first class players (male). This report analyses injuries (defined as any injury or other medical condition that either: prevents a player from being fully available for selection in a major match; or 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) occurring prospectively at the state and national levels over the last decade, commencing in the 1998–99 season concluding in the 2010–11 season.

Notable findings

- A continuation of the long-term trends of similar injury incidence to the previous decade but steadily *increasing injury prevalence* were demonstrated.
- An entrenched feature of the cricket calendar is now greater variability in the type of cricket played and rapid transit back and forth between the various forms.
- Most injury categories have stayed relatively constant in prevalence (i.e. those which have increased in 2010–11 did so only marginally).
- The Australian team suffered ongoing high injury prevalence in 2010–11 of 15.5 per cent of players being injured, with the primary culprits being increasing absolute match schedule and workload, increasing workload variability (due to a rise in T20 cricket with no decline in Test cricket) and, to a lesser extent, a greater reliance on pace bowling (compared to spin bowling) in the Australian team. The first two factors (increased scheduling and variability) are now probably entrenched permanently and to combat will probably require paradigm shifts in rules of the game, player specialisation and player selection.
- The AMS (Athlete Management System) was used extensively by doctors and physios from all states again in season 2010–11, more so than in previous seasons.

Results

Injury exposure calculations

Since 1998–99 the Australian team has contracted 25 players annually prior to the start of any winter tours. The Australian squad for each subsequent season has been greater than 25 players, as it includes (from the date of their first match until the new round of contracts) any other player who tours with or

plays in the Australian team. State teams can contract up to 20 other players on regular contracts (outside their Australian contracted players) and up to 5 players on ‘rookie’ contracts. As with the Australian team, any other player who plays with the team in a major match during the season is designated as a squad member from that time on. To date, players who have been contracted to play Twenty–20 matches only for a state have been included as regular players according to the international definition.

Table 1 – Squad numbers per season

Squad	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
Australia	30	28	31	28	30	31	28	40	40	40
New South Wales	35	31	28	27	37	40	35	38	38	38
Queensland	28	27	30	30	31	32	32	33	28	32
South Australia	27	32	22	30	26	27	30	29	28	31
Tasmania	28	26	24	22	27	32	29	27	28	30
Victoria	31	31	29	27	36	31	25	26	32	33
Western Australia	30	29	30	30	37	34	32	34	32	35

Table 2 – Team matches under survey from 2000–01 to 2009–10

	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
Champions League T20									11	9
Domestic First Class	62	62	62	62	62	62	62	62	62	62
Domestic One Day	62	62	62	62	62	62	62	62	62	62
Domestic T20					14	26	32	34	34	40
International T20				1	3	1	11	6	10	12
One Day International	22	39	25	26	35	36	20	23	39	29
Test match	14	12	11	14	17	5	6	15	13	9
All matches	160	175	160	165	193	192	193	202	231	223

Table 2 shows that the number of matches under survey reached its highest level in season 2009–10, with 2010–11 being the second highest season. The format of the Sheffield Shield since 1998–99 has consistently been that each of 6 teams plays 10 matches each, one home and one away against each of the other teams (60 team matches), followed by a final (2 team matches) at the end of the season. The matches are all scheduled for 4 days, with the final being scheduled for 5 days. The major change in Shield scheduling in recent seasons has been to compact the match schedule (particularly prior to Christmas) to allow for a discrete ‘window’ for the Big Bash tournament. The average number of days between Shield games has therefore decreased (see Table 15).

Since 2000–01, the domestic limited overs (one day) competition has followed the same home and away format as the Sheffield Shield (although it will reduce for season 2011–12). The domestic T20 competition (currently the KFC Big Bash) commenced in season 2005–06 as a limited round of matches but has been expanded in each subsequent season. Season 2009–10 included a further expansion to the calendar as Champions League Twenty–20 matches were played for two Australian state teams. As seen from Table 3, in limited overs matches, the number of team days is generally the same as the number of team matches scheduled, with the exception of washed out games which count as zero days of exposure.

Table 3 – Team days played under survey 2000–01 to 2009–10

	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
Champions League T20									11	9
Domestic T20					14	24	30	34	34	40
Domestic One Day	62	62	62	60	60	62	60	62	62	62
Domestic First Class	228	220	242	234	228	232	236	234	240	228
International T20				1	3	1	11	6	10	12
One Day International	21	39	25	24	35	36	20	23	39	27
Test match	61	51	50	58	78	22	28	72	58	41
Total	372	372	379	377	418	377	385	431	454	419

Table 4 – Overs bowled in matches each season

	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	10 Year Average
Champions League T20									210	175	192
Domestic T20					241	470	570	659	615	730	547
Domestic One Day	2,835	2,697	2,883	2,729	2,751	2,877	2,606	2,751	2,846	2,546	2,752
Domestic First Class	9,833	9,224	10,311	9,871	9,645	9,967	9,713	9,974	9,745	9,297	9,758
International T20				20	58	20	171	121	152	224	110
One Day International	980	1,700	1,094	1,057	1,577	1,488	805	959	1,657	1,226	1,254
Test match	2,243	2,073	2,000	2,159	2,756	890	1,136	2,833	2,116	1,419	1,962
Total	15,891	15,694	16,288	15,835	17,027	15,711	15,001	17,299	17,341	15,617	16,170

As per the international definitions¹⁰⁻¹³, hours of player exposure in matches is calculated by multiplying the number of team days of exposure by 6.5 for the average number of players on the field and then multiplied by the number of designated hours in a day's play. However, as envisaged in last year's report and subsequent publication²¹, this report will use a new unit of match injuries (per 1,000 days of play, Table 3) which more fairly compares T20 cricket to other forms of the game. This is used as the denominator for Table 6 in the injury incidence section.

Table 4 shows that workload in terms of number of overs bowled has stayed fairly steady in first class domestic cricket over the past 10 years. The overall number of overs bowled reached an all-time high in season 2009–10, but fell back during 2010–11 as there were more shortened matches in the Domestic first class season and fewer Test matches. T20 cricket itself has not substantially increased overall bowling workload. However, two 'knock-on' effects of T20 cricket have probably been highly significant (but are somewhat hard to measure) – increased variability in workloads and increased compression of first class fixtures to accommodate the T20 calendar (Table 15).



Table 5 – Player days of exposure available¹

	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
Champions League T20									361	234
Domestic T20					441	739	887	1,021	1,029	1,263
Domestic One Day	1,739	1,675	1,651	1,564	1,842	1,911	1,755	1,843	1,824	1,817
Domestic First Class	6,435	5,936	6,477	6,157	7,193	7,265	6,981	7,008	7,131	6,918
International T20				27	82	27	227	199	335	361
One Day International	608	1,061	685	640	960	1,056	536	743	1,302	984
Test match	1,707	1,352	1,374	1,562	2,095	572	736	2,169	1,933	1,419
Total	10,489	10,024	10,187	9,950	12,613	11,570	11,122	12,983	13,915	12,996

Player days per team per season are calculated by multiplying the size of the squads (for each match) by the number of days for matches (Table 5).

Injury incidence

Injury incidence results are detailed in Table 6–Table 10. Injury match incidence is calculated in Table 6 using the total number of injuries (both new and recurrent) as the numerator and the number of days of play (Table 3) as the denominator. Injury match incidence is probably a flawed way to examine injury risk, because the genesis of fast bowling injuries is often prior workload patterns²⁰. For example, in 2009–10, there were reportedly no bowling injuries from the Champions T20 League. However, the two teams involved (NSW and VIC), which needed to return to start first class cricket immediately, suffered a high prevalence of fast bowler injuries for the season, perhaps due to having the most compressed season(s) and unorthodox lead-in

(a T20 tournament rather than the traditional two and three day practice matches). In a similar fashion, the home summer ODI competition traditionally has the highest injury rate of the Australian calendar, yet we now understand that the reason for this is fatigue from the prior Test matches in the lead up to the ODI schedule. One day cricket played over an extended period (e.g. in World Cups) generally leads to fewer injuries than Test cricket.

Table 6 analyses match injury incidence by a new unit, injuries per 1,000 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 this, 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 1,000 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.

Table 6 – Injury match incidence (new and recurrent injuries/1,000 days of play)

	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	10 year average
Champions League T20									0.0	222.2	100.0
Domestic T20					71.4	208.3	200.0	117.6	117.6	400.0	204.5
Domestic One Day	96.8	161.3	290.3	183.3	283.3	209.7	233.3	306.5	451.6	322.6	254.1
Domestic First Class	175.4	95.5	90.9	94.0	57.0	112.1	156.8	149.6	95.8	149.1	117.6
International T20 *				0.0	3,333.3	0.0	5,555.6	0.0	100.0	166.7	214.3
One Day International	142.9	359.0	160.0	291.7	85.7	222.2	200.0	173.9	256.4	370.4	231.8
Test match	114.8	58.8	240.0	34.5	89.7	90.9	142.9	83.3	51.7	122.0	98.3
All matches	150.5	129.0	147.8	111.4	100.5	143.2	182.8	157.8	152.0	207.6	148.7

* Sample size for International T20 each year is very small hence wildly varying results.

Table 7 – Bowling match incidence (new and recurrent match injuries/1,000 overs bowled)

	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Average
Champions League T20									0.0	11.4	5.2
Domestic T20					0.0	2.1	1.8	3.0	0.0	6.9	2.7
Domestic One Day	1.1	1.9	2.1	1.5	1.1	1.4	2.7	3.6	3.9	4.3	2.3
Domestic First Class	1.5	1.5	0.9	1.0	0.2	1.1	2.2	2.3	1.2	2.3	1.4
International T20				0.0	0.0	0.0	5.8	0.0	6.6	4.5	3.9
One Day International	0.0	1.8	0.0	1.9	0.6	2.0	0.0	1.0	3.6	4.1	1.7
Test match	1.8	1.4	3.5	0.0	0.7	1.1	0.0	0.7	0.5	1.4	1.1
All matches	1.4	1.6	1.4	1.0	0.5	1.3	2.0	2.2	1.8	2.9	1.6

Table 8 – Injury seasonal incidence by team (injuries/team/season)

	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	10 year average
Australia	15.5	29.3	14.0	14.8	16.2	26.2	25.0	14.9	13.4	21.7	18.8
New South Wales	18.5	10.2	18.8	5.8	8.9	15.0	9.2	20.8	19.3	22.7	14.9
Queensland	25.3	15.7	20.4	17.9	15.0	20.6	36.3	19.1	8.6	26.3	20.5
South Australia	17.6	19.0	18.8	9.7	17.3	12.7	17.5	17.4	20.3	20.7	17.1
Tasmania	16.9	20.5	13.2	19.7	21.7	14.8	11.6	11.8	16.9	12.0	15.9
Victoria	20.5	21.1	17.7	13.4	15.9	20.4	29.0	20.5	17.8	15.4	19.2
Western Australia	16.6	21.0	14.2	23.6	11.9	12.4	16.3	17.0	6.6	23.1	16.3
All teams	18.3	19.8	16.4	15.0	15.1	17.4	20.2	17.3	14.8	20.4	17.5

Table 9 – Injury seasonal recurrence rates (recurrent injuries/all injuries)

	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Average
Recurrence rates	8.5%	7.3%	10.0%	3.0%	7.1%	8.9%	17.3%	15.8%	7.6%	12.4%	9.0%



Seasonal incidence (Table 8 and Table 10) is calculated by the number of injuries multiplied by 1,500 (for a squad of 25 players over 60 days), divided by the number of player days of exposure (Table 5). This has reached a new peak in 2010-11 but, unlike prevalence, this may reflect year to year bounce as there is not a gradual upward trend over seasons.

Table 9 reveals that the injury recurrence rates stabilised in 2009-10 after increasing over the prior two seasons.

Table 10 reveals that seasonal incidence by body part has generally been consistent over the past eight seasons. Some injury categories have fallen slightly in incidence in recent seasons including shoulder tendon injuries and wrist and hand fractures although most categories have stayed fairly constant.



Table 10 – Injury seasonal incidence by body area and injury type

Injury type	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
Fractured facial bones	0.3	0.0	0.1	0.2	0.2	0.1	0.1	0.3	0.1	0.1
Other head and facial injuries	1.0	0.2	0.1	0.2	0.1	0.3	0.1	0.1	0.0	0.1
Neck injuries	0.0	0.0	0.0	0.0	0.2	0.4	0.0	0.0	0.0	0.1
Shoulder tendon injuries	0.9	1.1	0.0	0.2	0.9	0.6	0.5	0.2	0.3	0.3
Other shoulder injuries	0.7	0.3	0.4	0.9	0.8	0.5	1.5	0.3	0.3	0.3
Arm/forearm fractures	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0
Other elbow/arm injuries	0.0	1.1	0.1	0.2	0.6	0.3	0.9	0.3	0.2	0.7
Wrist and hand fractures	1.7	1.1	1.0	1.2	0.8	0.5	1.3	0.9	1.3	2.5
Other wrist/hand injuries	0.1	0.6	0.7	1.2	0.4	0.5	0.4	0.9	0.6	1.3
Side and abdominal strains	1.8	0.5	1.1	1.4	0.6	1.7	1.7	1.4	1.8	1.2
Other trunk injuries	0.4	0.2	0.4	0.0	0.6	0.6	0.1	0.1	0.3	0.3
Lumbar stress fractures	0.7	1.4	0.8	0.2	0.4	1.0	0.3	0.6	0.6	1.2
Other lumbar injuries	0.9	2.1	1.8	1.1	1.7	1.0	1.6	1.2	1.1	1.7
Groin and hip injuries	0.9	3.2	1.4	0.8	1.2	1.6	1.1	0.9	0.6	1.6
Thigh and hamstring strains	2.6	1.9	2.9	2.6	1.3	2.1	4.4	4.8	2.9	2.5
Buttock and other thigh injuries	0.1	0.2	0.7	0.0	0.0	0.8	0.5	0.4	0.4	0.5
Knee cartilage injuries	1.4	0.6	0.4	0.9	1.8	0.9	0.7	0.4	1.2	0.8
Other knee injuries	0.6	0.5	0.3	0.0	0.6	0.4	0.3	0.3	0.5	0.2
Shin and foot stress fractures	0.3	0.8	0.3	0.6	0.1	0.5	0.5	0.9	0.1	0.6
Ankle and foot sprains	1.1	1.0	1.6	0.8	0.5	1.0	1.2	1.1	0.4	1.2
Other shin, foot and ankle injuries	2.0	1.8	1.6	1.8	0.6	1.4	1.3	1.2	0.9	2.4
Heat-related illness	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Medical illness	0.9	1.1	0.5	1.1	1.5	1.2	1.3	0.3	0.2	0.7
Total	18.3	19.8	16.4	15.0	15.1	17.4	20.2	16.8	14.1	20.4



Injury prevalence

Injury prevalence rates follow a similar pattern to injury incidence, but although incidence has stayed constant over the past few seasons, prevalence has gradually increased. The disparity between the two can be partially attributed to the increased number of matches, with the 'average' injury artificially becoming more severe over recent years because there are more matches to miss (injury prevalence = injury incidence x average injury severity). Injury prevalence rates (Table 11–Table 13) in season 2009–10 were slightly higher

than the long-term average, which is an expected outcome given the steadily increasing amount of match exposure at domestic level. The Australian team had a prevalence rate that was higher in 2010–11 than in any previous seasons.

Pace bowlers remain the position most susceptible to missing time through injury (Table 12). In season 2009–10, 24 per cent of fast bowlers were missing (on average) through injury at any given time. It continues to be a priority to further research possible risk factors for pace bowlers in order to control their injury rates.

Table 11 – Comparison of injury prevalence between teams

	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	Average
Australia	6.7%	8.1%	11.8%	5.6%	7.7%	10.0%	11.0%	15.8%	15.5%	18.2%	11.0%
New South Wales	5.4%	6.7%	15.1%	3.1%	5.7%	5.8%	6.4%	8.1%	17.7%	20.3%	9.4%
Queensland	16.6%	8.8%	14.5%	15.1%	7.3%	12.3%	18.5%	12.0%	8.8%	19.9%	13.4%
South Australia	14.5%	9.4%	10.1%	2.1%	9.0%	7.9%	4.9%	9.2%	15.6%	11.0%	9.4%
Tasmania	8.8%	8.7%	3.3%	12.1%	21.7%	9.4%	9.5%	9.6%	10.8%	8.9%	10.3%
Victoria	12.6%	9.9%	13.7%	7.5%	11.7%	18.1%	19.6%	9.9%	12.7%	11.6%	12.7%
Western Australia	6.9%	10.5%	9.1%	11.9%	9.2%	9.6%	11.1%	8.7%	3.3%	18.8%	9.9%
Average	9.7%	8.7%	11.4%	8.1%	9.7%	10.3%	11.4%	11.1%	12.8%	15.9%	10.9%

Table 12 – Injury prevalence by player position

	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11	Average
Batsman	4.7%	3.9%	6.7%	9.8%	6.3%	5.5%	7.7%	6.6%	6.8%	10.2%	6.9%
Keeper	0.6%	0.8%	3.9%	3.2%	2.9%	0.5%	1.7%	3.0%	8.6%	8.2%	3.6%
Pace Bowler	19.4%	16.5%	18.2%	9.3%	14.4%	18.6%	19.1%	17.9%	21.5%	24.9%	18.2%
Spinner	1.1%	3.6%	7.1%	4.2%	8.8%	4.1%	10.7%	5.3%	4.6%	10.8%	5.9%

Table 13 – Comparison of injury prevalence by body area

Body region	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
Fractured facial bones	0.2%	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%	0.2%	0.1%	0.0%
Other head and facial injuries	0.1%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
Neck injuries	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%
Shoulder tendon injuries	1.4%	0.6%	0.1%	0.1%	0.8%	0.7%	0.4%	0.5%	0.5%	0.0%
Other shoulder injuries	0.6%	0.1%	0.5%	0.8%	1.0%	0.5%	1.1%	0.2%	0.3%	0.5%
Arm/forearm fractures	0.0%	0.0%	0.0%	0.1%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%
Other elbow/arm injuries	0.0%	0.5%	0.0%	0.1%	0.2%	0.0%	0.4%	0.6%	0.7%	0.6%
Wrist and hand fractures	0.9%	0.6%	0.8%	0.7%	0.6%	0.2%	0.5%	0.2%	0.8%	1.4%
Other wrist/hand injuries	0.0%	0.2%	0.1%	0.7%	0.1%	0.1%	0.6%	0.1%	0.3%	0.5%
Side and abdominal strains	0.7%	0.1%	0.7%	0.8%	0.3%	0.6%	0.8%	0.8%	0.9%	1.3%
Other trunk injuries	0.1%	0.0%	0.1%	0.0%	0.3%	0.1%	0.0%	0.0%	0.9%	0.1%
Lumbar stress fractures	1.1%	1.8%	2.1%	0.2%	0.9%	1.6%	0.8%	0.8%	1.8%	2.7%
Other lumbar injuries	0.3%	0.6%	0.8%	1.0%	1.1%	0.6%	0.5%	1.3%	1.0%	1.2%
Groin and hip injuries	0.8%	0.7%	0.8%	0.3%	0.6%	1.0%	0.7%	0.4%	0.3%	1.2%
Thigh and hamstring strains	0.7%	0.8%	0.7%	0.7%	0.3%	1.1%	1.6%	1.8%	1.5%	1.1%
Buttock and other thigh injuries	0.0%	0.0%	0.4%	0.0%	0.0%	0.8%	0.1%	0.4%	0.1%	0.1%
Knee cartilage injuries	1.2%	1.1%	0.5%	0.5%	1.7%	1.0%	0.6%	0.3%	1.3%	1.5%
Other knee injuries	0.1%	0.1%	0.2%	0.0%	0.6%	0.3%	0.4%	0.5%	1.5%	0.4%
Shin and foot stress fractures	0.2%	0.5%	0.0%	0.5%	0.2%	0.4%	0.4%	1.0%	0.2%	1.0%
Ankle and foot sprains	0.5%	0.3%	1.5%	0.2%	0.5%	0.6%	1.6%	0.5%	0.3%	0.7%
Other shin, foot and ankle injuries	0.8%	0.5%	1.4%	0.6%	0.2%	0.4%	0.5%	0.8%	0.3%	1.3%
Heat-related illness	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Medical illness	0.2%	0.2%	0.5%	0.6%	0.3%	0.2%	0.3%	0.1%	0.2%	0.3%
Total	9.7%	8.7%	11.4%	8.1%	9.7%	10.3%	11.4%	10.4%	12.8%	15.9%

Changes to demographics and season schedule over time

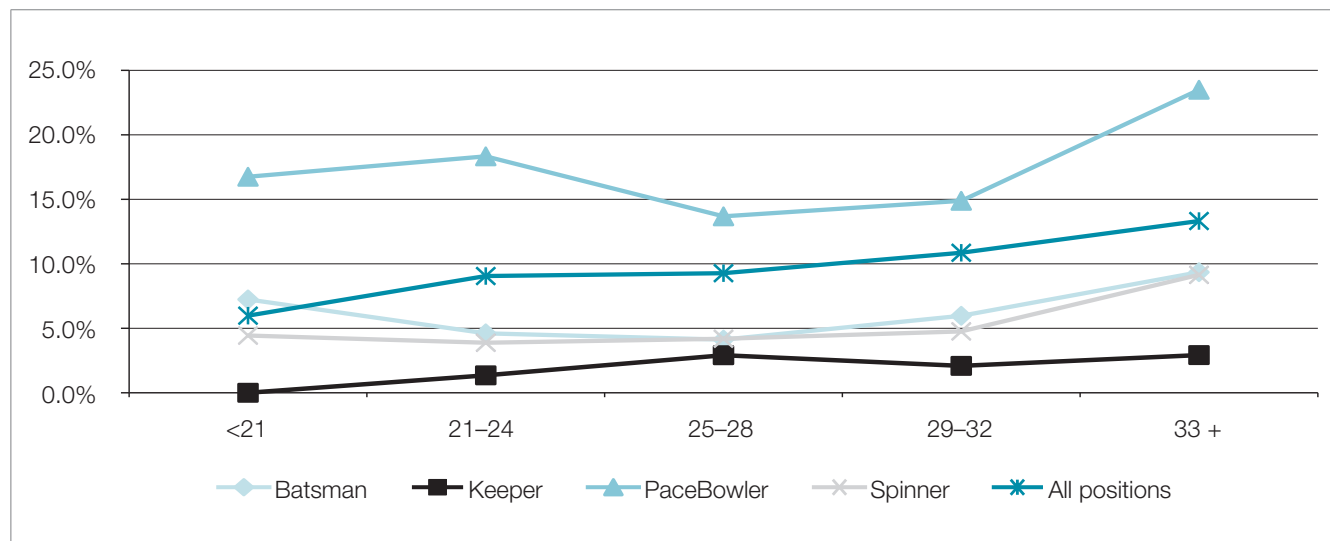
Table 15 attempts to illustrate one of the major scheduling effects of the development of the T20 competition and its effects on first class cricket. This table uses NSW as an example, but is almost certainly representative of all major

Australian cricket teams. It shows that the median number of days between Shield games has dropped from a high of 16 days between games in 1999–2000 to 6.5 days between games in 2010–11. Median was chosen rather than mean because there is a very high number of days break between the Shield games either side of the window for the Big Bash.

Table 14 – Compaction of NSW Shield games by season

Season	96–97	97–98	98–99	99–00	00–01	01–02	02–03	03–04	04–05	05–06	06–07	07–08	08–09	09–10	10–11
Median days b/w Shield games	10	15	11	16	10	10	7	10	8.5	8	8.5	9	10	8	6.5
No of games with <10 day break	4	4	4	3	3	3	6	4	5	6	5	5	4	5	8

Figure 1 – Injury prevalence by position by age in first class cricketers



Fast bowler injury prevalence is high, particularly early in their careers (due to stress fractures, Figure 1) and late in their careers (due to degenerative changes, Figure 1). The NSW squad in recent years, used again as an example in Table 16 (although perhaps an exaggerated one) has a mix of young and ageing bowlers, with few in the middle ground of late 20s which is the time when bowlers are least injury prone. As can

be seen from Table 15 in the decade from 95–96 to 04–05 there were no matches played by fast bowlers under 21 in the NSW fixtures.

From Table 16 and Figure 1 it can be seen that the demographic changes to the NSW squad, for example, have probably contributed to the NSW team having higher injury prevalence than the historical levels (Table 12).

Table 15 – Matches played by NSW pace bowlers by season (comparison of age brackets)

Age	95–96	96–97	97–98	98–99	99–00	00–01	01–02	02–03	03–04	04–05	05–06	06–07	07–08	08–09	09–10	10–11
<21											5	8	9	1	18	22
21–24	20	18	28	29	30	32	40	39	2	5	34	29	5	30	34	36
25–28	27	27	36	36	27	43	38	41	56	43	21	46	27	42	26	22
29–32	15	18	5	5	2	6	14	14	20	38	28	33	61	48	38	19
33+				6	3				1	1	3		17		17	30
Total	62	63	69	76	62	81	92	94	79	87	91	116	119	121	133	129

Proportion of games affected by injury to one or both teams

Table 16 – Percentage of teams in first class games suffering an injury over the past 13 seasons

	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
Matches with an injury	35	22	26	19	18	21	27	30	23	31
Matches with no injury	41	52	47	57	61	46	41	47	52	40
Percentage of games affected by injury	46.1%	29.7%	35.6%	25.0%	22.8%	31.3%	39.7%	39.0%	30.7%	43.7%

To give further evidence to the point of view that will shortly be argued regarding the necessity of substitutes in cricket, Table 17 reveals that a high percentage of matches in the past decade, but particularly in 2010–11, have been affected

by injury. The traditional viewpoint that substitutes are not necessary in cricket because the game has a low injury rate can be discounted, as 44 per cent of games in 2010–11 were affected by injury to one or both teams.

Analysis of specific injuries

Lumbar stress fractures

Table 17 – Key indicators for lumbar stress fractures in the last 10 seasons

	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
Number reported	5	9	6	1	3	8	2	5	4	10
Incidence	0.7	1.4	0.8	0.2	0.4	1.0	0.3	0.6	0.6	1.2
Prevalence	1.1%	1.8%	2.1%	0.2%	0.9%	1.6%	0.8%	0.8%	1.8%	2.7%

Lumbar stress fractures are generally gradual onset injuries, most often occurring to the pars interarticularis part of the L4 and L5 vertebra and on the non-bowling side. They are also more common in younger bowlers and are prone to recurrence. These injuries extract the greatest toll on cricketers in terms of missed playing time per injury. Whereas cricket fast bowlers have perhaps the highest incidence of lumbar stress fracture of any type of athlete, the rate of these injuries in non-bowlers (batsmen and wicket-keepers) appears to be no higher than in the general population.

Studies have previously associated a 'mixed' action with the development of lumbar spine injuries, particularly stress fractures^{22–24}. There is still no published data to show that coaching intervention can prospectively lower the lumbar stress fracture risk for a player, although it is assumed that this is the case.

Many more contracted fast bowlers in Australian cricket have suffered lumbar stress fractures as juniors prior to joining the first class pool of players. There appears to be neither a long-term reduction nor increase in the incidence over the last decade at first class level, although junior figures are unknown. It is presumed that biomechanical intervention has been helpful for fast bowlers but has not been able to eliminate lumbar stress fractures. Although not measured specifically by this survey, the biggest contribution of modern medical management has been that very few Australian bowlers are forced into retirement due to chronic back injuries. This was not the case in the past and is still not the case today in parts of the world (e.g. Indian subcontinent). Because stress fractures lead to a long layoff period for fast bowlers, further study is required to determine whether more aggressive management could still deliver the good long-term results we currently achieve.

Side strains

Table 18 – Key indicators for side strains in the last 10 seasons

	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
Number reported	13	3	8	9	5	13	13	13	16	10
Incidence	1.8	0.5	1.1	1.4	0.6	1.7	1.7	1.4	1.8	1.2
Prevalence	0.7%	0.1%	0.7%	0.8%	0.3%	0.6%	0.8%	0.8%	0.9%	1.3%

Side strains are a classic cricket fast bowling injury. 'Side strains' appear to be a unique type of muscle strain²⁵²⁶. They are only reported in cricket bowlers and javelin throwers, who use a somewhat similar technique. Side strains also affect the non-bowling side of the body and

are generally acute onset injuries. They may have a related entity ('side impingement') that is distinct and which has a more insidious onset. Side strains are more common early in the season (pre-Christmas) and are somewhat less prone to recurrence than other injuries. By legend, they have been

seen as a 'rite of passage' injury, in that a genuinely fast bowler should suffer one side strain in his career. However, they can be recurrent and occasional side strains lead

to chronic pain (where they are sometimes, with the use of nuclear medicine, re-diagnosed as stress fractures of the ribs).

Thigh and hamstring strains

Table 19 – Key indicators for thigh and hamstring strains in the last 10 seasons

	2001–02	2002–03	2003–04	2004–05	2005–06	2006–07	2007–08	2008–09	2009–10	2010–11
Number reported	18	12	21	17	11	16	33	43	25	12
Incidence	2.6	1.9	2.9	2.6	1.3	2.1	4.4	4.8	2.9	2.5
Prevalence	0.7%	0.8%	0.7%	0.7%	0.3%	1.1%	1.6%	1.8%	1.5%	1.1%

Hamstring, quadriceps, calf and adductor strains all affect cricketers, as they do many other types of running athletes. According to the international survey definitions, hamstring strains are grouped with quadriceps strains to form a category of 'thigh and hamstring strains', of which the majority are hamstring strains. Again it is bowlers who are most prone to injury, but occasionally they occur in batsmen either whilst running between the wickets or fielding. All muscle strains can affect both sides of the body, but the mechanics of bowling leads to a predisposition for muscles strains to affect a particular side, in bowling. In the non-bowling side, shortly before delivery the leg undergoes acceleration, whereas the bowling leg undergoes deceleration. Hence hamstring injuries are more likely on the non-bowling side, whereas quadriceps injuries are more likely on the bowling side. Recent research has found that a past history of lumbar spine stress fracture is a risk for lower limb muscle strains, particularly calf strains, in fast bowlers²⁷.

Medical illness

Because cricket is often played in hot weather conditions it might be expected that dehydration was a common condition. This would be particularly expected in cricket played in Asian countries where not only are heat and humidity extreme, but gastrointestinal illness is also common and could be a contributory factor towards dehydration. Cricket is also in the minority of sports which do not readily allow for substitution due to injury or illness (with the exception of fielding). Despite these theoretical concerns, in practice it appears that most dehydration is mild to moderate and is successfully treated by oral rehydration. In competitive cricket and/or in very hot conditions, it is sensible preparation to have

intravenous rehydration facilities available nearby, should they be medically indicated (in line with WADA/ICC guidelines).

In terms of specific rates of heat illness in elite cricket, almost no cases reach the threshold of forcing a player to miss a game or be unable to bat or bowl due to the condition.

Recommendations

- **Traditional workload preparation for fast bowlers to play first class cricket needs to be preserved as much as possible.**
- **More radical solutions to counter the effects of the modern schedule should be contemplated.**

Factors which would have been considered 'radical' in the past but which can be placed on the table for debate include: (1) allowing medical staff to be involved in team selection, to the extent of advising on rotation or that a minimum number of bowlers be selected; (2) formally encouraging more bowler-friendly pitches for Australian matches to minimise the likelihood of long stints of bowling on 'dead' tracks; (3) investigating whether fielding rotation policies could decrease the overall workload of fast bowlers on days in the field.

- **Further research is required to determine other risk factors for injury such as increased (or decreased) gym training or running and workload restrictions of teenage fast bowlers, to determine whether they are contributory factors to the increase in injury prevalence now being observed.**
- **Substitute player(s) should be allowed in first class cricket.**

Arguments for this include:

*** The high rate of injury in first class games**

In > 30 per cent of first class games a team will have at least one player suffer an injury that either prevents continued participation in the game or causes him to miss the following game.

*** Increasing fast bowler injury prevalence**

Fast bowlers are clearly not coping with the new make-up of the cricket calendar, which is here to stay given the eight year forward planning of the Future Tours Program and the popularity of the T20 tournaments.

*** Risk of injuries worsening if players push through pain**

Serious injuries do occasionally occur in cricket and the expectation that a player should always push through pain for the benefit of the team could in rare cases be catastrophic.

*** Risk of players being lost to Test cricket as T20 is a full-time career option**

Because of the lucrative contracts being offered by T20 franchises, it is an increasing option for players to 'retire' from first class cricket to become T20 specialists. If the rules of first class cricket remain as arduous as they currently are, T20 cricket will be seen by more players as 'money for jam' and the talent pool for Test cricket will diminish (along with perhaps the popularity of this form of the game).

*** Benefits for amateur cricket – 12th man can become more involved**

Allowing the 12th man, plus perhaps other substitutes, to be fully involved in the game as specialist players would encourage more amateur players to enjoy cricket. No other team sport in the world makes a player suffer the indignity of being a substitute with no prospect for meaningful participation in the game.

*** Redress balance of first class game in favour of bowlers**

The changes to modern first class cricket have been criticised for swinging the balance of the game too far in favour of batsmen, such as improvements in protective equipment and bat size, covering of wickets and shortening of the boundary dimensions. Fast bowlers suffer far too high an injury burden in cricket and rule changes should occasionally also favour the bowlers and swing the balance back into a fairer contest between bat and ball.

*** Give Australia a competitive advantage**

Other than by lobbying the ICC, Australia does not have the option to change the rules of Test cricket. We do have the

option to change the rules for the Sheffield Shield. The major argument against doing this is that Sheffield Shield cricket would not replicate Test cricket as much with a substitute player. A major argument in favour is that if Australian cricket unilaterally introduces a substitute rule, it is highly likely that there would be a favourable impact on injuries to the pool of Australian fast bowlers. If there are fewer injuries in our squad bowlers, we have greater choice in selection for the national team, which would help provide a competitive advantage.

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References, as indicated within the article, are available at sma.org.au/publications/sport-health/