

Appendix 3: Downs and Black checklist ¹ for the assessment of the methodologic quality of 18 studies included in the systematic review – Part 1 [8 studies ²⁻⁹]								
Checklist item	Regnier et al. 1989 [2]	Marcotte et al. 1993 [3]	Roberts et al. 1996 [4]	Watson et al. 1996 [5]	Trudel et al. 2000 [6]	Mattesi 2002 [7]	Cook et al. 2003 [8]	Brunelle et al. 2005 [9]
Reporting								
Is the hypothesis/aim/objective of the study clearly described?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Are the main outcomes to be measured clearly described in the Introduction or Methods section?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Are the characteristics of the participants included in the study clearly described?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Are the interventions of interest clearly described?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Are the distributions of principal confounders in each group of subjects to be compared clearly described?	No – authors did not report any principal confounders	No – authors did not report any principal confounders	No	No	No – authors did not report any principal confounders	No	No	No
Are the main findings of the study clearly described?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Does the study provide estimates of the random variability in the data for the main outcomes?	No	No – study did not provide estimates of random variability of data	No	No	Yes	Yes	Yes	Yes
Have all important adverse events that may be a consequence of the intervention been reported?	No	No – authors did not report any adverse events	No – authors did not report any adverse events	No – authors did not report any adverse events	No – authors did not report any adverse events	No – authors did not report any adverse events	No – authors did not report any adverse events	No, incomplete self-report
Have the characteristics of study participants lost to follow-up been described?	No – the study does not report on any study participants lost	No – the study does not report on any study participants lost	No – the study does not report on any study participants lost	No – the study does not report on any study participants lost	No – the study does not report on any study participants lost	Yes	No – the study does not report on any study participants lost	No – 46% of the teams did not report data
Have actual probability values been reported (e.g. 0.035 rather than <0.05) for the main outcomes except where the probability value is less than 0.001?	No	No	No	No	Yes	No	No, 95% confidence intervals are presented	Yes

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External validity								
Were the subjects asked to participate in the study representative of the entire population from which they were recruited?	Possibly, although not clearly stated	No, self selected	No, players were those who had not made a school team or were from schools without teams	Yes	Possibly, but only coaches enrolled	No – subjects chosen volunteered for study	Probably not, since many coaches did not allow their teams to participate and so participating teams may be different from those who did not participate	No – teams from one specific region of the province were studied
Were those subjects who were prepared to participate representative of the entire population from which they were recruited?	Probably	No	No	Yes	Uncertain	No – subjects chosen volunteered for study	Probably not, since many coaches did not allow their teams to participate and so participating teams may be different from those who did not participate	No – teams from one specific region of the province were studied
Were the staff, places, and facilities where the patients were treated, representative of the treatment the majority of patients receive?	Probably	Possibly	Yes	Yes	No – probably not	Not clear, perhaps the voluntary nature of the participants indicates they are different in some way from others	Probably not, since many coaches did not allow their teams to participate and so participating teams may be different from those who did not participate	Yes
Internal validity – bias								
Was an attempt made to blind study subjects to the intervention they have received?	No	No – retrospective study used	No blinding	No – retrospective study used	No – authors did not state if there was an attempt to blind	No – authors did not state if there was an attempt to blind	No – no blinding	No blinding
Was an attempt made to blind those measuring the main outcomes of the intervention?	No – authors did not report blinding	No – authors did not report blinding	No blinding	No – not blinded	No – authors did not report blinding	No – authors did not report blinding	No, but it is unlikely that referees were aware of the team assignment	No
If any of the results of the study were based on “Data dredging”, was this made clear?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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Checklist item	Regnier et al. 1989 [2]	Marcotte et al. 1993 [3]	Roberts et al. 1996 [4]	Watson et al. 1996 [5]	Trudel et al. 2000 [6]	Mattesi 2002 [7]	Cook et al. 2003 [8]	Brunelle et al. 2005 [9]
In trials and cohort studies, do the analyses adjust for different lengths of follow-up of patients, or in case-control studies, is the time period between the intervention and outcome the same for cases and controls?	Yes	Yes	Teams who proceeded to the regular part of the tournament were different than those who did not	Yes	Yes	Yes	Yes	Yes
Were the statistical tests used to assess the main outcomes appropriate?	Yes	NA – no statistical tests used	Yes	Yes, more possible	Yes	Yes	Yes	Yes
Was compliance with the intervention/s reliable?	Probably	Probably	Probably	Yes, probably although referee behaviour not specifically observed	N/A – potential contamination of data due to possible lack of coach compliance	Yes	Yes, but not all players participated	Not reported
Were the main outcome measures used accurate (valid and reliable)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Internal validity – confounding								
Were the participants in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited from the same population?	Yes	Yes	Yes, but probably differed in some systematic way since only certain teams proceeded to regular rules section	Yes, but at different times	No	Yes	Yes, but both groups may have differed from the whole population since they volunteered for the study	Yes
Were study subjects in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited over the same period of time?	Yes	Yes	No, sequential recruitment	No	Yes	Yes	Yes	Yes
Were study subjects randomized to intervention groups?	No – study not randomized	No – teams not randomized	No – teams not randomized	No – not randomized. Before-after assessment	No – not randomized	No – study did not state whether randomization occurred; voluntary group assignment	Yes	No – teams not randomized
Was the randomized intervention assignment concealed from both patients and health care staff until recruitment was complete and irrevocable?	No – study not randomized	No – not randomized	No – not randomized	No – study not randomized	No – not randomized	No – voluntary group assignment	No	Not randomized

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Was there adequate adjustment for confounding in the analyses from which the main findings were drawn?	No	No	No	No	No	No	No	No
Were losses of patients to follow-up taken into account?	No – study did not report any losses	No – study did not report any losses	No – study did not report any losses	No – study did not report any losses	No – study did not report any losses	Yes	No – study did not report any losses	No
Power								
Did the study have sufficient power to detect a clinically important effect where the probability value for a difference being due to chance is less than 5%?	Adequate (n=405, n=263)	Adequate (n=329, n=338)	Inadequate, since only 29 total injuries and 11 notable injuries in 273 players	Adequate (n=653 injury records, n=389 penalty records)	Inadequate (n=28)	Inadequate (n=3)	Inadequate (n=30, n=45)	Inadequate, only 76 injured players analyzed

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Appendix 3: Downs and Black checklist ¹ for the assessment of the methodologic quality of 18 studies included in systematic review – Part 2 [10 studies ¹⁰⁻¹⁹]										
Checklist item	Macpherson et al. 2006 [10]	Hagel et al. 2006 [11]	Gee et al. 2007 [12]	Lauer 2009 [13]	Smith et al. 2009 [14]	Emery et al. 2009 [15]	Emery et al. 2010 [16]	Kukaswadia et al. 2010 [17]	Cusimano et al. 2011 [18]	Emery et al. 2011 [19]
Reporting										
Is the hypothesis/aim/objective of the study clearly described?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Are the main outcomes to be measured clearly described in the Introduction or Methods section?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Are the characteristics of the participants included in the study clearly described?	Yes	Yes	Yes, indirectly	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Are the interventions of interest clearly described?	Yes	Yes	No, not clear if timing was with event or with the timing of the legal charge	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Are the distributions of principal confounders in each group of subjects to be compared clearly described?	Partially	No – authors did not report any principal confounders	No – authors did not report any principal confounders	Yes	No – authors did not report any principal confounders	No – authors did not report any principal confounders	Yes	Partially	No – authors did not report any principal confounders	No – authors did not report any principal confounders
Are the main findings of the study clearly described?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Does the study provide estimates of the random variability in the data for the main outcomes?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Have all important adverse events that may be a consequence of the intervention been reported?	No – authors did not report other adverse events such as decreased numbers of players making it to varsity scholarships or professional leagues	No – authors did not report other adverse events	No, for example, injuries are not described	Likely not – authors did not report any adverse events	No – authors did not report other adverse events	No – authors did not report other adverse events	Yes	No – authors did not report other adverse events	No – authors did not report other adverse events	No – authors did not report other adverse events
Have the characteristics of study participants lost to follow-up been described?	No – study did not report on any participants lost	No – study did not report on any participants lost	No – study did not report on any participants lost	No – study did not report on any participants lost; one was considered unsuitable for the program and was not included	No – study did not report on any participants lost	No – study did not report on any participants lost	Yes	No – study did not report on any participants lost	No – study did not report on any participants lost	No – study did not report on any participants lost

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Appendix 3: Part 2 continued										
Checklist item	Macpherson et al. 2006 [10]	Hagel et al. 2006 [11]	Gee et al. 2007 [12]	Lauer 2009 [13]	Smith et al. 2009 [14]	Emery et al. 2009 [15]	Emery et al. 2010 [16]	Kukaswadia et al. 2010 [17]	Cusimano et al. 2011 [18]	Emery et al. 2011 [19]
Have actual probability values been reported (e.g. 0.035 rather than <0.05) for the main outcomes except where the probability value is less than 0.001?	No, but 95% confidence intervals are reported	No, but 95% confidence intervals are reported	Yes	No	No	Yes	No, but 95% confidence intervals are reported	No, but 95% confidence intervals are reported	Yes	No, but 95% confidence intervals are reported
External validity										
Were the subjects asked to participate in the study representative of the entire population from which they were recruited?	Yes, probably, since it is unlikely that injured players differ significantly from jurisdiction to jurisdiction	Yes, probably; however, players were from a single province	Yes – only NHL players participated in study, although it is conceivable that players were called from or sent to non-NHL teams during the study period	No – three male youth ice hockey players were identified as aggressive players for the study	Probably, but players in Fair Play may differ from those not in fair play	Yes	Yes	Yes	Yes, probably, however players are from a single province	Yes
Were those subjects who were prepared to participate representative of the entire population from which they were recruited?	Yes, probably	Yes	Yes, probably	No – only three male youth ice hockey players were identified as aggressive players for the study	Yes, probably	No – low levels of participation in bodychecking cohort may have introduced selection bias	Yes	Yes, probably	Yes, probably	Yes, probably
Were the staff, places, and facilities where the patients were treated, representative of the treatment the majority of patients receive?	Yes	Yes	Yes	Yes	Yes, probably	No – two teams in bodychecking league had access to additional medical professionals that may have resulted in greater accuracy of injury detail and follow-up	Yes	Yes	Yes	Yes
Internal validity – bias										
Was an attempt made to blind study subjects to the intervention they have received?	No – not applicable, retrospective study design	No – not applicable, retrospective study design	No – not applicable, retrospective study design	No – not blinded	No – not a randomized study however subjects not aware they would be part of a study	No – authors did not state if there was an attempt to blind	No – authors did not state if there was an attempt to blind	No – not applicable, retrospective study design	No – not applicable, retrospective study design	No – not applicable, retrospective study design
Was an attempt made to blind those measuring the main outcomes of the intervention?	No – not applicable	No – not applicable	No – all players likely aware of legal charge	No	No – authors did not blind	Yes	No – authors did not blind	No – not applicable	No – not applicable	No – not applicable

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Appendix 3: Part 2 continued										
Checklist item	Macpherson et al. 2006 [10]	Hagel et al. 2006 [11]	Gee et al. 2007 [12]	Lauer 2009 [13]	Smith et al. 2009 [14]	Emery et al. 2009 [15]	Emery et al. 2010 [16]	Kukaswadia et al. 2010 [17]	Cusimano et al. 2011 [18]	Emery et al. 2011 [19]
If any of the results of the study were based on "Data dredging", was this made clear?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
In trials and cohort studies, do the analyses adjust for different lengths of follow-up of patients, or in case-control studies, is the time period between the intervention and outcome the same for cases and controls?	Yes	Yes	Yes, likely, although not stated specifically	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Were the statistical tests used to assess the main outcomes appropriate	Yes	Yes	Yes	NA – there were no statistical tests used	NA – there were no statistical tests used	Yes	Yes	Yes	Yes	Yes
Was compliance with the intervention/s reliable?	Yes, probably, since rules were likely implemented uniformly across the provinces	Yes	Yes	Yes	Yes, likely	Yes	Yes	Yes	Yes, likely	Yes
Were the main outcome measures used accurate (valid and reliable)?	Yes	Yes	Yes, probably, although it is possible that referees changed their behaviour as well after the event	Yes	Yes, probably rules applied equally	Yes	Yes	Yes	Yes	Yes
Internal validity – confounding										
Were the participants in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited from the same population?	Yes	Yes	Yes	No controls	Yes	Yes	Yes, different provinces in Canada	Not clear	Yes	Yes
Were study subjects in different intervention groups (trials and cohort studies) or were the cases and controls (case-control studies) recruited over the same period of time?	Yes	Yes	No, but likely insignificant differences	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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Checklist item	Macpherson et al. 2006 [10]	Hagel et al. 2006 [11]	Gee et al. 2007 [12]	Lauer 2009 [13]	Smith et al. 2009 [14]	Emery et al. 2009 [15]	Emery et al. 2010 [16]	Kukaswadia et al. 2010 [17]	Cusimano et al. 2011 [18]	Emery et al. 2011 [19]
Were study subjects randomized to intervention groups?	No – cohorts were children in different provinces	No – not randomized	NA – no randomization	No – subjects not randomized	No – subjects not randomized	No – not randomized	No – not randomized	No – cohort study	No – not randomized	No – not randomized
Was the randomized intervention assignment concealed from both patients and health care staff until recruitment was complete and irrevocable?	No – study not randomized	No – study not randomized	No – not randomized nor concealed	No – study not randomized	No – study did not state whether concealing occurred	No – study not randomized	No – study not randomized	No – not applicable	No – study not randomized	No – study not randomized
Was there adequate adjustment for confounding in the analyses from which the main findings were drawn?	No	Yes	No, referee behaviour not assessed	NA – no quantitative analysis was performed	No	Yes	Yes	No	No	No
Were losses of patients to follow-up taken into account?	No – study did not report any losses	No – study did not report any losses	No – study did not report any losses	No – study did not report any losses	No – study did not report any losses	No – study did not report any losses	Yes	No – study did not report any losses	No – study did not report any losses	No – study did not report any losses
Power										
Did the study have sufficient power to detect a clinically important effect where the probability value for a difference being due to chance is less than 5%?	Adequate (n=4736)	Adequate (n=233)	Adequate	No (n=3)	Adequate (large sample size)	Adequate (n=283)	Adequate (n=2154)	Adequate (n=2708); however, the numbers of injury per year were substantially fewer	Adequate (n=8552)	Adequate (n=1971)
Note: NA = not applicable, NHL = National Hockey League. Citations of the included studies appear on the next page.										

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