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Time to add a new priority target for child injury prevention? The case for an excess burden associated with sport and exercise injury: population-based study

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ABSTRACT

Objective: To determine the population-level burden of sports injuries compared with that for road traffic injury for children aged <15 years in Victoria, Australia.

Design: Retrospective observational study.

Setting: Analysis of routinely collected data relating to non-fatal hospital-treated sports injury and road traffic injury cases for children aged <15 years in Victoria, Australia, over 2004–2010, inclusive.

Participants: 75 413 non-fatal hospital-treated sports injury and road traffic injury cases in children aged <15 years. Data included: all Victorian public and private hospital hospitalisations, using the International Statistical Classification of Diseases and Health Related Problems, 10th Revision, Australian Modification (ICD-10-AM) activity codes to identify sports-related cases and ICD-10-AM cause and location codes to identify road traffic injuries; and injury presentations to 38 Victorian public hospital emergency departments, using a combination of activity, cause and location codes.

Main outcome measures: Trends in injury frequency and rate were analysed by log-linear Poisson regression and the population-level injury burden was assessed in terms of years lived with disability (YLD), hospital bed-days and direct hospital costs.

Results: Over the 7-year period, the annual frequency of non-fatal hospital-treated sports injury increased significantly by 29% (from N=7405 to N=9923; p<0.001) but the frequency of non-fatal hospital-treated road traffic injury decreased by 26% (from N=1841 to N=1334; p<0.001). Sports injury accounted for a larger population health burden than did road traffic injury on all measures: 3-fold the number of YLDs (7324.8 vs 2453.9); 1.9-fold the number of bed-days (26 233 vs 13 886) and 2.6-fold the direct hospital costs ($A5.9 millions vs $A2.2 millions).

Conclusions: The significant 7-year increase in the frequency of hospital-treated sports injury and the substantially higher injury population-health burden (direct hospital costs, bed-day usage and YLD impacts) for sports injury compared with road traffic injury for children aged <15 years indicates an urgent need to prioritise sports injury prevention in this age group.

Strengths and limitations of this study

- This study capitalises on the availability of the International Statistical Classification of Diseases and Health Related Problems (ICD), 10th Revision, Australian Modification, external cause chapter activity codes, which allow for sports injuries to be specifically identified in routine data collections coded to the ICD.
- This whole-of-population study reports data from the complete capture of all public and private hospitalisation discharges in Victoria, Australia over a 7-year period.
- It was not possible to calculate participation-adjusted injury rates due to the lack of annual population-level figures for child participation in sport.
- There is some potential for under-reporting of sports and road traffic injury cases in the two data sets due to completeness and accuracy of the ICD coding.

INTRODUCTION

Injury, particularly due to road trauma and transport accidents, is a recognised global health problem.[1] In the past, injuries have been regarded as random events and often considered inevitable. More recently a better understanding of the nature of injuries has developed, and unintentional and intentional injuries are now viewed as largely preventable events.[2] As a result of the growing acceptance of injuries as a preventable public health problem, there has been increasing demand for effective injury prevention policy worldwide.[2]

Measurement of the health burden of injuries for understanding the magnitude and impact of the problem is the crucial first step in the planning and development of health policy. Non-fatal health outcomes from diseases and injuries are increasingly recognised as being critical in the promotion and monitoring of individual and population health.[3] When non-fatal disability resulting from injuries is taken into consideration along with the mortality burden, injuries are shown to be an even more important health problem. The overall magnitude of the burden associated with injury is explained by the fact that injuries affect many young people, resulting in a large number of years lost because of premature death or a large number of years lived with disability (YLD). In the most recent Global Burden of Disease estimates, the contribution of non-fatal disability to the injury burden was highest in those aged 10–14 years.[1] Children are particularly vulnerable to certain types of injury and the injuries they sustain can have long-term effects on their health and development with associated economic costs for the entire healthcare system.[2,3]

Road trauma is well recognised as a leading cause of injury burden,[2] however, road safety initiatives, such as speeding controls, the enforcement of restraint use and public education campaigns, have led to significant reductions in severe and fatal road traffic injuries in some countries.[4,5] It is also clear that other contexts of injury, including sports and active recreation and leisure (hereafter referred to as sports injury), contribute to injury burden. There is increasing recognition of the significant impact of sports injury on public health, and that the problem is increasing as more of the population are encouraged to take up physically active lifestyles.[6] Population-level strategies for injury prevention have proven successful in improving road safety, but are yet to be applied to the sports sector.

To date, sports injury prevention has not been a priority because of the lack of high-quality evidence about the size of the problem and its public health burden.[7] Obtaining accurate burden estimates for sports injury has been problematic to date, due to limitations in the specific identification of sports injuries in most routine hospital data collection and coding. This study capitalises on the availability of the International Statistical Classification of Diseases and Health Related Problems, 10th Revision (ICD-10), Australian Modification (ICD-10-AM) codes which allow for sports injuries to be specifically identified. Owing to the lack of good population-wide figures about the incidence and costs, it has not previously been possible to compare the health burden of sports injuries against more recognised high-priority injury issues such as road trauma. Extracting data relating to these codes provides current data on the public health burden of sports injuries for the first time. This paper therefore compares the public health burden of sport and road traffic injury, for children aged <15 years over a 7-year period in Victoria, Australia.

METHODS

Data sources

Routinely collected data for the calendar years 2004–2010, inclusive, were extracted by the Victorian Injury Surveillance Unit (VISU), the repository for de-identified injury surveillance data in Victoria, Australia, relating to: (1) all hospitalisations to public and private hospitals from the Victorian Admitted Episodes Dataset (VAED), coded to the ICD-10-AM,[8] which since 2002 has included 200 'activity codes' for identifying specific types of sport/leisure activity in which the person was participating at the time of injury[9] and (2) emergency department (ED) presentations (non-admissions only) to all Victorian public hospitals with 24 h EDs (n=38) from the Victorian Emergency Minimum Dataset (VEMD). The VEMD injury surveillance items are based on the National Injury Surveillance Data Dictionary (NISDD).[10]

Case selection was restricted to people aged <15 years and data were extracted for the following two major non-fatal injury categories. Road traffic injury data included: (1) hospitalisations, when the cause was transport (ICD-10-AM external cause code: V00-V99) and the fourth character indicated the incident was 'traffic related' (ie, occurred on a road/street/highway) and (2) ED presentations, where the cause was transport (cause codes: 1–8) and the location was road/street/highway (place of occurrence=10). Sports injury data included: (1) hospitalisations with an activity when injured coded as sport (ICD-10-AM activity code: U50-U71) and (2) ED presentations if the activity was coded to sport (activity=S).

For both injury categories, the annual frequency of hospital-treated injury was identified by summing the total of the identified VAED and VEMD cases. Trends in injury frequency and rate were determined using a log-linear Poisson regression model using SAS V.9.2. A trend was considered to be statistically significant if the p value of the slope of the regression model was <0.05.

Measures of the burden of injury

YLD[11] is a measure of 'threat-of-disability' which can be applied to ICD-10 injury diagnoses. The methods described in the Australian and Victorian burden of injury studies were used to calculate YLDs[12,13] and the number of incident cases was multiplied by the average duration of the injury (to remission or death) and a weight factor that reflects the severity of the injury on a scale from 0 (optimum health status) to 1 (death). Australian cohort life expectancies for 1996 were used to calculate the YLD and age weighting was applied.

The National Hospital Costs Data Collection (NHCDC)[14] is based on the principles of Casemix costing approach to the classification of patient care where each hospital admission is assigned an Australian Refined Diagnosis-Related Group (AR-DRG). The AR-DRGs provide a clinically meaningful way of relating the types of patients treated in a hospital to the resources required by the hospital. The NHCDC contains component costs per DRG and enables DRG Cost Weights and average costs for DRGs (national and state/territory specific) for acute inpatients to be produced. The types of component costs included are ward medical, ward nursing, non-clinical salaries, pathology, imaging, allied health, pharmacy, critical care, operating rooms, ED, ward supplies and other overheads, specialist procedure suites, on-costs, prostheses, and depreciation. For this study, the year-specific average Victorian cost per AR-DRG was applied to each admission. The year-specific average cost reported in the NHCDC[14] for the ED component of a hospital admission was applied to each ED presentation. Hospital bed-days were calculated for admitted cases only, by calculating the number of days between the patient's separation and admission dates.

For the calculation of injury frequency and YLD hospitalisation analysis, readmissions and transfers within and between hospitals were excluded to avoid overcounting of incident injuries. For the calculations of direct hospital costs and hospital bed-days, all readmissions and transfers within and between hospitals were included to get a true estimate of the burden of injury.

RESULTS

Over the 7-year period, there were 5.4 times as many hospital-treated child sports injury cases (N=63 573) than road traffic injury cases (N=11 840). The average annual rate of hospital-treated child sports injuries was 918.7/100 000 population (687.3/100 000 ED presentations and 231.4/100 000 hospitalisations), compared with an average rate of hospital-treated road traffic injuries of 171.6/100 000 population (111.2/100 000 ED presentations and 60.4/100 000 hospitalisations). It is important to note that the sports injury definition was based on activity codes, while the road traffic injury case definition was based on a combination of cause and location coding so the two categories are not mutually exclusive. However, only 5% of cases (N=3689) are covered in both the sports and road traffic analyses, with >80% of these overlapping cases associated with cycling.

Table 1 summarises the frequency, YLDs, direct hospital costs and hospital bed-days for sports and road traffic hospital-treated injury in children in Victoria over the 7-year period. On every measure, sports injury was associated with a significantly higher burden than road traffic injury.

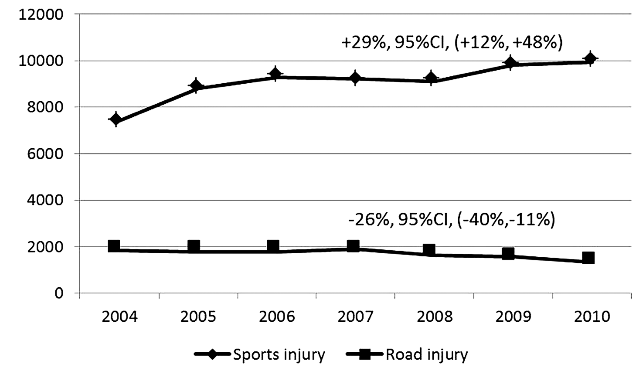

Figure 1 Trends in frequency of hospital-treated sports-related and road traffic-related injury in children aged <15 years.

Figure 1 and table 2 show the trends in the frequency of hospital-treated sports injury compared with road traffic injury. Over the 7 years, the annual frequency of hospital-treated sports injury increased significantly from 7405 in 2004 to 9923 in 2010, an estimated annual increase of 4% (95% CI 1.6% to 5.7%) and an overall increase of 29% (p<0.001; 95% CI 12% to 48%). In contrast, the trend in hospital-treated road traffic injury frequency declined significantly (1841 in 2004 to 1334 in 2010)—equating to a significant decrease of 26% (p=0.001; 95% CI −40% to −11%) over the same period. According to the Australian Bureau of Statistics, the population of children aged <15 years increased overall by 5% over the study period (966 658 in 2004 to 1 017 271 in 2010).[15]

DISCUSSION

This study clearly demonstrates that hospital-treated sports injuries accumulate an overall higher morbidity health burden than does hospital-treated road traffic injury for children aged <15 years. Currently road traffic injury prevention is a well-recognised and resourced

Table 1 Comparison of the public health burden of hospital-treated injury in children aged <15 years—sports-related and road traffic-related injury, Victoria 2004–2010

Burden measure	Sports injury	Road traffic injury	Ratio of sport : road
Frequency			
Emergency department presentations	47 596	7670	6.2
Hospitalisations	15 977	4170	3.8
All hospital-treated injury	63 573	11 840	5.4
Number of years lost to disability			
Mean per case	0.12	0.21	0.6
Total	7324.82	2453.88	3.0
Direct hospital costs ($A)	58 933 122	22 467 146	2.6
Number of hospitalised bed-days			
Mean per case	0.41	1.17	0.4
Total	26 233	13 886	1.9

Table 2 Trend in the frequency and rate of sports-related and road traffic-related hospital-treated injury for children aged <15 years in Victoria 2004–2010

	2004	2005	2006	2007	2008	2009	2010	Percentage of annual change (95% CI)	Percentage change over whole period (95% CI)
Sports injury									
ED presentations	5045	6361	6898	6859	6887	7762	7784	6.0 (3.2 to 8.4)***	50.0 (25.0 to 76.0)***
Hospital admissions	2360	2453	2383	2376	2219	2047	2139	−2.5 (−4.1 to −1.1)**	−16.0 (−25.0 to −7.0)**
All hospital-treated (per 100 000)	766.0	909.4	952.5	938.7	915.3	973.6	975.5	2.8 (0.6 to 5.0)*	22.0 (4.0 to 41.0)*
Road traffic injury									
ED presentations	1238	1168	1146	1215	1005	1023	875	−4.8 (−7.4 to −2.5)***	−29.0 (−42.0 to −16.0)***
Hospital admissions	603	621	631	666	633	557	459	−3.3 (−7.3 to 0.6)	−21.0 (−41.0 to 4.0)
All hospital-treated (per 100 000)	190.4	184.6	182.4	191.2	164.6	156.8	131.1	−5.1 (−8.0 to −2.4)***	−31.0 (−44.0 to −16.0)***

*0.01<p<0.05; **0.001<p≤0.01; ***p≤0.001.
ED, Emergency Department.

public health issue, but sports injury prevention is not.[7] Participation in sport and physical activity is now widely accepted as essential for the prevention of non-communicable diseases and for overall health.[6 16] Sports injuries, which may prevent people from reaping the health benefits of participating in sport and physical activity, are therefore a population health issue. These findings clearly show that sports injury should also be a priority for government health agencies and necessitate the setting of sports injury prevention policy.

Over the 7-year period, 2004–2010, inclusive, in children aged <15 years the frequency of hospital-treated sports injury increased significantly (by 29%) whereas the frequency of hospital-treated road traffic injury cases among children decreased significantly (by 26%). Sports-related hospital-treated injuries were more than five times more common than road traffic injury. Moreover, the population rate for sports injury increased significantly over the 7-year period, while the population rate for road traffic injury decreased significantly. Sports injury also accounted for a much larger healthcare burden than did road traffic injury, accounting for 3-fold the number of YLDs, 1.9-fold the number of bed-days and 2.6-fold the direct hospital costs. These findings demonstrate that the burden of sports-related injury for children aged <15 years is considerable and has significantly increased over time.

A strength of this study was the complete capture of hospitalisations at the population level, as all public and private hospitals in Victoria contribute to the VAED. The ED presentation data are also comprehensive as the VEMD covers all public hospitals with 24 h services, including all paediatric hospitals.

There were, however, several limitations to this study. First, although the hospitalisation data were comprehensive, there is still potential for under-reporting of sports and road traffic injury cases in the two data sets. Despite the VAED coding being completed by specialist coders, there are issues with the completeness and accuracy of external cause coding (used to identify road traffic injury cases in this study)[17 18] and also with activity coding (used to identify sports injury cases).[19 20] Data quality issues relating to completeness and accuracy of coded data have also been identified with the VEMD[21] and could impact on the identification of road and sports cases in this study. Additionally, the VEMD does not capture data from the smaller and often rural hospitals that do not have 24 h ED services.

As the total population of children <15 years was used as the denominator for this study, our rate estimates do not provide information about relative exposure risks. It was not possible to calculate participation-adjusted injury rates due to the lack of annual population-level figures for child participation in sport. Nonetheless, the fact that the population of <15 year olds increased by 5% over the 7-year period, compared with the 29% increase in sports injury cases is highly suggestive that increased sports injury frequency and rates are not solely due to changing demographics. Given the limitations in the routinely collected sports injury data, it was not possible to determine if the cases arose through highly competitive or high-intensity sport, informal sport or more recreational forms of these activities. To effectively target prevention strategies to groups at high risk for sports and recreational injuries without discouraging participation, participation rates and exposure data need to be collected.

The treatment costs reported here are estimates only as they are based on average costs per DRG in the case of admissions, and average costs per ED presentation. Ideally specific costs per admission and ED presentation would have been used but this information is not available in either of the VISU-held hospital-treated data sets. There has been some criticism on the construction of disability-adjusted life years (DALYs) around the social choices for age, weights and severity scores of disabilities,[22 23] and little research on the effect of injury on quality of life in children. While we have applied DALYs as one measure of different burden associated with sports and road traffic injury, the full applicability of DALYs for children aged <15 years requires further investigation.

Our findings differ from some previous studies examining trends in sports injury treated in hospital settings for children, mainly due to case-selection differences.

A previous Australian study reported a constant rate of sports/leisure hospitalisation over a 5-year period with children aged <15 years having the second highest rate per 100 000 population.[24] However, that study was based solely on hospitalisations and did not include ED data. Recent US-based trends in ED presentations for overall sports and recreational musculoskeletal injuries reportedly declined by 12.4% over the past 10 years in children aged 5–15 years.[25] That study did not include hospitalisation data nor were statistical trend analyses reported.

In the absence of a prioritised approach to sports injury prevention, the reasons for the increasing trends in sports injuries are unknown, but are likely to be multifaceted. Contributing factors could include increased participation (eg, in response to efforts to increase physical activity to reduce obesity), sports delivery factors (eg, facility design and condition) or increased awareness of injury management; they are unlikely to be the result of an increasing population. It is unlikely that the overall increase in sports injuries is related to changes in hospital admission practices, as the absolute number of sports injury-related hospitalisations significantly decreased between 2004 and 2010. However, the significant increase in ED presentations and the overall increase in hospital-treated sports injury may have resulted from increased injury rates and/or from changes in public and healthcare professional awareness of sports injury assessment and management.

Overall, despite these limitations in case ascertainment and cost analysis, this paper provides powerful data that compare trends in injury rates and the magnitude of the burden for sports injury and road traffic injury for children aged <15 years. Sports injury is clearly a significant public health burden and based on this data and the previous literature[24 26] will continue to increase if not addressed. Government health agencies need to recognise sports injury as a priority health issue and implement a public health approach to sports injury prevention.[7] In order to do this, they will need to: make a dedicated investment in surveillance and data systems to inform injury prevention activities; and work strategically with other government agencies and key stakeholders to effectively implement and evaluate interventions.[27]

In conclusion, the significance of sports injury, while increasingly recognised in absolute terms, has not previously been considered relative to other leading causes of injury burden. This lack of understanding has inhibited resource allocation to prevention efforts and not stimulated the political and organisational will that are necessary for change. This study demonstrates that the population-level magnitude of the burden of sports injuries in children aged <15 years is higher than that for road traffic injury on measures of incidence, health impact and hospital utilisation and costs. This is not to negate the importance of preventing road traffic injuries,[2] but rather argues for the need for government and other agencies to also prioritise sports injury prevention for the health of our children.

Road traffic injury prevention is an issue that affects everyone in society and so prevention approaches based on legislation, changing the physical environment and mass education have been most effective. Despite sports participation having clear benefits for health, it is much more of a personal choice activity and to date there has been more of a focus on individual behaviour change strategies in sports injury prevention. Given the increasing trends reported in this paper, it is perhaps now time to consider the application of more structural, political and population-focused prevention measures to this important public health issue.

This study clearly demonstrates the importance of sports injuries as a public health problem, particularly for children for whom sports injuries can have long-term effects on performance, participation, physical and cognitive development and health. The fact that there has been a significant reduction in hospital-treated road traffic injury, but a significant increase in hospital-treated sports injury burden over the past 7 years shows that public health efforts to address the former have been highly effective and that it is now time to identify, implement and support similar injury prevention policies and programmes for sports injury in children.

Contributors CFF conceived the study, contributed to the analysis plan and led the paper writing. AWS had major responsibility for the writing of the Introduction and Discussion sections. AC undertook the data analysis, developed the analysis plan and contributed to the writing of the paper, especially the Methods and Results section.

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REFERENCES

1. Murray C, Vos T, Lozano R, *et al*. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2012;380:2197–223.
2. World Health Organization. *World report on child injury prevention.* Switzerland: World Health Organization, 2008. http://www.who.int/violence_injury_prevention/child/injury/world_report/en/ (accessed 19 Aug 2013).
3. Vos T, Flaxman AD, Naghavi M, *et al*. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2012;380:2163–96.

4. Du W, Finch C, Hayen A, *et al*. Trends in hospitalisation rates for road traffic injuries in child motor vehicle passengers in New South Wales, July 1998–June 2005. *Med J Aust* 2007;187:515–18.
5. World Health Organization. *Global status report on road safety 2013: supporting a decade of action*. Switzerland: World Health Organization, 2013.
6. Finch C, Owen N. Injury prevention and the promotion of physical activity: What is the nexus? *J Sci Med Sport* 2001;4:77–87.
7. Finch C. Getting sports injury prevention on to public health agendas—addressing the shortfalls in current information sources. *Br J Sports Med* 2012;46:70–4.
8. National Centre for Classification in Health. *The international statistical classification of diseases and related health problems, 10th revision, Australian modification (ICD-10-AM)*. Sydney: University of Sydney, 1998.
9. Soo I, Lam MK, Rust J, *et al*. Do we have enough information? How ICD-10-AM activity codes measure up. *Health Inf Manag* 2009;38:22–34.
10. Australian Institute of Health and Welfare (AIHW). *Injury surveillance National Minimum Data Set. National Health Data Dictionary*. Version 12. Canberra: Australian Institute of Health and Welfare, 2003. http://www.aihw.gov.au/publication-detail/?id=6442467501 (accessed 4 Jun 2013).
11. Murray C, Lopez A. *The global burden of disease: a comprehensive assessment of mortality and disability from diseases, injuries, and risk factors in 1990 and projected to 2020*. Boston: Harvard School of Public Health on behalf of the World Health Organization and the World Bank, 1996.
12. Mathers C, Vos T, Stevenson C. *The burden of disease and injury in Australia*. AIHW cat. no. PHE 17. Canberra: Australian Institute of Health and Welfare, 1999. http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id6442459196 (accessed 19 Aug 2013).
13. Vos T, Begg S. *Victorian burden of disease study: morbidity*. Melbourne: Victorian Government Department of Human Services, 1999. http://docs.health.vic.gov.au/docs/doc/Victorian-Burden-of-Disease-Study:-Morbidity (accessed 19 Aug 2013).
14. Australian Government Department of Health and Ageing. National hospital cost data collection. Hospital Reference Manual Round 11 (2006–2007), 2007. http://www.health.gov.au/internet/main/publishing.nsf/Content/health-casemix-data-collections-about (accessed 11 Nov 2012).
15. Australian Bureau of Statistics. Regional population growth, Australia. http://www.abs.gov.au/Ausstats/abs@.nsf/mf/3218.0 (accessed 8 May 2014).
16. Bull F, Bauman A, Bellew B, *et al*. *Getting Australia Active II: an update of evidence on physical activity for health*. Melbourne, Australia: National Public Health Partnership, 2004. http://www.nphp.gov.au/publications/documents/gaa_2_body_ver1.pdf (accessed 8 May 2014).
17. McKenzie K, Enraght-Moony E, Harding L, *et al*. Coding external causes of injuries: problems and solutions. *Accid Anal Prev* 2008;40:714–18.
18. McKenzie K, Enraght-Moony E, Waller G, *et al*. Causes of injuries resulting in hospitalisation in Australia: assessing coder agreement on external causes. *Inj Prev* 2009;15:188–96.
19. Finch C, Boufous S. Do inadequacies in ICD-10-AM activity coded data lead to underestimates of the population frequency of sports/leisure injuries? *Inj Prev* 2008;14:202–4.
20. Cassell E, Kerr E, Clapperton A. Adult sports injury hospitalisations in 16 sports: the football codes, other team ball sports, team bat and stick sports and racquet sports. *Hazard, Victorian Injury Surveillance Unit* 2012; Edn 74. http://www.monash.edu.au/miri/research/research-areas/home-sport-and-leisure-safety/visu/hazard/haz74.pdf (accessed 3 Jun 2013).
21. Hadorn D. The role of public values in setting health care priorities. *Soc Sci Med* 1991;32:773–81.
22. Polinder S, Haagsma J, Lyons R, *et al*. Measuring the population burden of fatal and nonfatal injury. *Epidemiol Rev* 2012;34:17–31.
23. Lyons R, Kendrick D, Towner E, *et al*. Measuring the population burden of injuries—implications for global and national estimates: a multi-centre prospective UK longitudinal study. *PLoS Med* 2011;8:e1001140.
24. Finch C, Mitchell R, Boufous S. Trends in hospitalised sport/leisure injuries in New South Wales, Australia—implications for the targetting of population-focussed preventive sports medicine efforts. *J Sci Med Sport* 2011;14:15–21.
25. Lykissas M, Eismann E, Parikh S. Trends in pediatric sports-related and recreation-related injuries in the United States in the last decade. *J Ped Orth* 2013;33:803–10.
26. Finch C, Clapperton A, McCrory P. Increasing incidence of sports related concussion hospitalizations in Victoria, Australia. *Med J Aust* 2013;198:427–30.
27. Finch C, Hayen A. Governmental health agencies need to assume leadership in injury prevention. *Inj Prev* 2006;12:2–3.