Sport Collision Injury Collective
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To Chief Medical Officers (CMOs):

England	Professor Dame Sally Davies	CMOweb@dh.gsi.gov.uk
Scotland	Dr Catherine Calderwood	cmo@gov.scot
Wales	Dr Frank Atherton	pschiefmedicalofficer@wales.gsi.gov.uk
Northern Ireland	Dr Michael McBride	michael.mcbride@dhsspsni.gov.uk

Dear Professor Dame Sally Davies; Dr Catherine Calderwood; Dr Frank Atherton; Dr Michael McBride

RE: Open Letter: Preventing injuries in children playing school rugby

This letter is a response to your joint letter of 29th July 2016 and the report of your advisers. While we welcome your encouraging us to continue our research in this area we were nevertheless very disappointed to read your 'view' and were also dismayed that you should have come to your view without first giving us an opportunity to comment on the advice of the UK CMOs Physical Activity Expert Group (PAEG). We note that the PAEG have not provided any evidence in support of their advice in the form of data or references to published literature.

Our delay in responding is because in addition to writing the attached response to the PAEG's advice, we felt it necessary to write and publish a peer reviewed paper in response to the paper you cite as being in support of the conclusions of the PAEG, published in the British Journal of Sports Medicine (BJSM) and co-authored by Pollock AM, White AJ and Kirkwood G [1]. The paper by Tucker et al was co-authored by two employees of World Rugby and made a number of claims. Since its publication there has been extensive and extremely lengthy debate over the claims made by Tucker et al between ourselves and the many reviewers as well as the editors at the BJSM. We have updated the evidence and also conducted a fresh meta-analysis of rugby injury studies for narrower age bands. This analysis supports our previous conclusions that the risks of injury are high for all ages of school children.

We would like to draw your attention to the recent publication of seven new studies: two from the US (1, 2) and one each from Sweden (3), Ireland (4), England (5), New Zealand (6) and Australia (7); and three new systematic reviews and meta-analyses, two from Canada (8, 9) and one from China (10). The key findings are that: there are high rates of injury in the youth rugby union game with many injuries occurring during the tackle (4); youth rugby has a significantly higher rate of

[1] Pollock AM, White AJ, Kirkwood G. Evidence in support of the call to ban the tackle and harmful contact in school rugby: a response to World Rugby. British Journal of Sports Medicine. 2017; 51:1108-1113.

concussion than any other contact or collision team sport (8); the tackle is responsible for three quarters of concussions in the adult community game (5); in the US, rugby injury emergency department attendances are increasing, in particular head and face injuries (2); girls take longer to recover from concussion than boys (1); head impacts in under 11 year olds playing rugby league are of a similar severity to those sustained by college American football players (6); a history of concussion negatively impacts on a person's life chances across a range of social and educational measures (3); there is evidence that concussion is predictive of violent behaviour and subsequent injury in the year following the concussion in 13-14 year old Australian school children (7); head injury is associated with an increased risk of dementia and Alzheimer's disease (10); and strong evidence exists from youth ice-hockey that rule changes disallowing collision have a dramatic effect in lowering concussion risk (9).

In our response to the PAEG, we have sought to identify potential areas where we agree on the evidence and areas which we require the PAEG to clarify. We have covered these areas by posing 36 questions in our response, and have also set out the questions in a stand-alone file which we also attach.

We respectfully request you to ask your advisers to revisit their advice in light of our responses, and to provide the clarifications requested and to offer their view on the areas of agreement and disagreement.

In our view, open discussion is the best way to progress this matter, and so we would also ask you to send us a copy of your advisers' response and to consider convening a meeting of interested parties so that that any remaining differences of opinion in relation to the evidence can be identified and better understood.

In light of the accumulated evidence that the rate of injury including concussion in rugby is considerably higher than any other sport played in schools, and that the tackle is the main cause of these injuries, we continue to urge a cautionary approach and ask you having reappraised the evidence to advise the Ministers to withdraw the tackle and other forms of harmful contact, such as the scrum, ruck and maul, from school rugby, the main collision sport in the PE curriculum in the UK.

We look forward to hearing from you.

Yours sincerely,

Professor Allyson Pollock allyson.pollock@ncl.ac.uk

Professor Eric Anderson eric.anderson@winchester.ac.uk

Adam White adam.white@winchester.ac.uk

Graham Kirkwood graham.kirkwood@ncl.ac.uk

on behalf of the Sport Collision Injury Collective

Response to the UK CMOs Physical Activity Expert Group (PAEG)

This document sets out the response of Professor Allyson Pollock and Professor Eric Anderson, on behalf of the Sport Collision Injury Collective, to the undated response of the UK CMOs' Physical Activity Expert Group[2] to the Collective's open letter of 1st March 2016.

Our response is structured by reference to: 1) PAEG's overview of the evidence used in the open letter; 2) its response to each of the five concerns set out in the letter; 3) its general points; and 4) its summary.

1. PAEG overview of the evidence used in Sport Collision Injury Collective letter

PAEG: *"The SCIC letter adopts a position that singles out rugby as a sport that carries both a high risk of injury and a risk of serious injury for under 18s. This letter is supported by published evidence of injury incidence, severity and cause. The letter asserts that compulsory contact rugby will encourage children to stop playing sport, and also exposes children to harmful contact. The letter does not list the educational, health, social or mental health benefits of participation and as a result is selective in its reporting of data. Evidence on the benefits of experiencing, learning, training and playing rugby, with appropriate supervision, safety and coaching, and physical activity were not included."*

Our response:

Rugby union and rugby league are the most commonly played collision sports offered in school as part of the physical education curriculum in England. (11) Collision sports involve athletes purposely hitting or colliding with each other or inanimate objects including the ground with great force and result in greater injury risk than other non-collision contact sports. (12) The high risk of injury in rugby is due to the collision elements of the game, mainly the tackle. (13-19) Comparisons between sports are difficult, however the collision sports rugby and ice-hockey have been found to have higher rates of concussion and general injury respectively than any other sport in children. (8, 20)

The PAEG has misstated the SCIC open letter as asserting that "compulsory contact rugby will encourage children to stop playing sport". What it did say was that "disillusionment with the game and interference with education, are the most common reasons for children giving up rugby" based on research by Lee and colleagues in the Borders of Scotland (21).

[2] The PAEG response was sent to the Chief Medical Officers of England, Scotland, Wales and Northern Ireland following their request for advice after having considered the open letter and the evidence enclosed, and sent to us under cover of a joint letter from the CMOs dated 29th July 2016.

Our focus on rugby is due to the high risk of injury in children playing rugby and the high risk of injury in rugby from the tackle in particular. We have worked on rugby injury since at least 2007, other researchers work on other sports, some on hockey, some on boxing and others on football. All are equally important and all deserve individual attention.

Our previous work has argued for a clear distinction to be drawn between the benefits arising from participation in physical activity to those specifically from sport. This distinction should be maintained as corporate sporting bodies which make the rules which most schools adopt are subject to commercial pressures. (22, 23) The conflation of the benefits of physical participation and exercise with the benefits of rugby, and attributing the obesity epidemic to a lack of participation in collision sports is misleading.

Our proposal is not to ban rugby outright from school, but to change the rules of play to a non-collision version of the game. We can see no reason why this should not be possible, our view is that collision sports such as rugby union and rugby league with high rates of injury have no place within an educational setting for children.

Q 1 We would ask that the PAEG provide evidence of the "educational, health, social or mental health benefits of participation" in rugby and the evidence on "the benefits of experiencing, learning, training and playing rugby, with appropriate supervision, safety and coaching, and physical activity".

Q 2 In particular could the PAEG provide us with evidence of how these "benefits" compare with other physical activities including non-collision rugby and other non-collision contact sports?

Q 3 Is it the position of the PAEG that collision rugby union and rugby league provide more beneficial health outcomes than other physical activities?

Q 4 Could the PAEG explain why they think we are selective in the reporting of data?

We note the PAEG concerns about the potential to increase inequalities in participation. With respect to females and school-age girls we would ask you to note that the House of Commons Culture, Media and Sport Committee report on Women and Sport in 2014 found that women were far more likely to take part in individual and non-competitive sports compared to team sports and to generally not belong to clubs. (24) Swimming, going to the gym, running/jogging and Zumba were the top four activities chosen by women. In their evidence to the committee the Youth Sport Trust said that 51% of secondary school-age girls were put off sport by their experiences of PE and school

sport. We would also ask you to note that girls take longer to recover from concussion than boys. (1)

Q 5 Could the PAEG explain how increasing female participation in school rugby would reduce the risks of injury and encourage physical activity in school girls?

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2. Specific responses to five points of evidence

2.1. SCIC Concern: "First, rugby is a high-impact collision sport. Studies show that the risks of injuries for those aged under 18 years are high and injuries are often serious."

PAEG response: *"The incidence of rugby injuries (per 1000 playing hours) is higher than other sports but the true incidence remains contentious. The letter stresses the rates are high but from their own work acknowledge that this is an imprecise estimate, due to the between and within study heterogeneity (I2 statistic 98.3%). Their meta-analysis was well-conducted and presented estimates with a prediction interval, but had statistical limitations. The width of the prediction interval indicated potential bias from different case definitions of injury, and more importantly publication bias. There is much uncertainty in their estimate. At present there is an absence of complete person-hours measures of exposure in children that includes, school, recreational, training, game and play based rugby that would permit comparison with other sports that involve physical contact."*

Our response:

We welcome the PAEG's agreement that the incidence of rugby injuries is higher than other sports, and that the meta-analysis was well-conducted. It is well established that the rates and risks of injury are high across all studies with variation in incidence. This is not contentious.

Between-study variation in estimates of incidence may be due to differences in: injury definitions; who diagnoses and records the injuries and their level of medical qualification and expertise; study settings; the age of the participants; and the age grades used by the rugby playing authorities. The Freitag et al meta-analysis used only studies where injury definitions were consistent, minimising the effect of this source of heterogeneity. The PAEG are wrong therefore to cite "different case definitions of injury" as a potential bias contributing to the width of the prediction interval.

We agree that "at present there is an absence of complete person-hours measures of exposure in children that includes, school, recreational, training, game and play based rugby". However, the absence of these measures does not render comparisons with other sports impossible nor is it grounds for failing to take a cautionary approach by removing the tackle from school rugby union and rugby league.

In an ideal world we would like to see “complete person-hours measures of exposure in children that includes, school, recreational, training, game and play based rugby”, but to make this a precondition to permit comparison is unrealistic and unachievable. No other area of injury prevention sets the bar as high as this. The effect of doing so would have been to render interventions in transport or work related injuries impossible and subsequent large reductions in deaths and injuries would not have occurred.

In a systematic review in 2007, Spinks and McClure conclude that for children under 16 years, ice hockey appeared to have the highest rate of injuries and soccer the lowest. (20) They caution however that a wide range of injury rates exist for both these sports and did not attempt to rank the other sports, one of which was rugby. (20) In a meta-analysis of concussion rates in youth sports, rugby had a significantly higher rate of concussion than any other sport including ice-hockey and American football. (8)

Rugby Football Union employed medical experts agree that ‘rugby union has a relatively high risk of injury compared with other team sports’ (25), a view shared by experts from across the rugby injury research fraternity (8, 26-29). In two polls carried out by the British Medical Journal in 2015, 65% of doctors thought the rules of rugby should change to reduce the risk of concussion and 72% thought school rugby should be made safer. (30)

Freitag et al estimate that “28% of child and adolescent rugby players are likely to sustain an injury irrespective of need for medical attention or time loss from rugby activities and that about 12% are likely to sustain an injury severe enough to require at least 7 days’ absence from play”. These estimates are given with 95% confidence intervals (CIs) as 28.4% (15.2% to 49.1%) and 12.1% (7.2% to 19.8%). These CIs allow the reader to understand the uncertainty in the figures, so they can be 95% confident that the true estimate lies somewhere between these limits.

As outlined above, age is one of many factors contributing to between-study heterogeneity. Freitag et al conducted the meta-analysis using single injury definitions and calculated pooled injury rates across all ages. It is true that studies report an increasing rate of injuries sustained playing rugby with age, although the increase does not appear to be linear. (13, 15, 31) To answer the PAEG concern, we have reanalysed the studies included in the meta-analysis within smaller age ranges, the results are presented in in table 1 below. The four studies available for reanalysis of narrower age ranges show high rates of injury in all age groups, young and old. For under 14s and younger, 18.6% (12.8%, 26.6%) were likely to be injured in a season and 9.0% (2.3%, 31.5%) severely enough to be away from play for at least a week. For the under 15s and older 25.0% (21.6%, 28.9%) were likely to be injured in a season and 19.5% (4.1%, 67.6%) severely enough to be away from play for at least a week.

Q 6 The PAEG refers to “this is an imprecise estimate”, to Freitag et al’s “presented estimates” and to “uncertainty in their estimate”. Precisely which estimate or estimates are the PAEG referring to?

Q 7 Would the PAEG agree that the rates and risks of injury from rugby in all child age groups are high?

Q 8 Could the PAEG identify the “statistical limitations” they refer to? Are they other than those set out in the ‘Limitations’ section of the Freitag et al paper?

Q 9 Given we are not asking for the elimination of rugby, simply requesting the removal of the tackle and other forms of harmful contact from school rugby, do the PAEG subscribe to the cautionary approach?

Q 10 What do the PAEG mean by “more important… publication bias”? The Cochrane collaboration define publication bias as arising from the “publication or non-publication of research findings, depending on the nature and direction of the results”. (32) Can the PAEG provide us with studies we may have omitted if this is what they mean?

Q 11 Is the PAEG conflating the width of the prediction interval (a statistical term) with publication bias? The width of the prediction interval is a function of between-study heterogeneity, not evidence of publication bias.

Table 1

Injury Definition	Comparison (studies used)	Effect Size	Probability of Injury Over Season	I-squared	Estimated Predictive Interval[a]
irrespective of the need for medical attention or time-loss from rugby activities	All ages (1, 2, 3, 6, 9)[b]	26.7 (13.2, 54.1)	28.4% (15.2%, 49.1%)	99.6%	(1.65, 433.26)
	U14s and younger (2, 3)	16.5 (11.0, 24.8)	18.6% (12.8%, 26.6%)	82.6%	N/A
	U15s and older (2, 3)	23.0 (19.4, 27.2)	25.0% (21.6%, 28.9%)	46.2%	N/A
	U14s (2, 3)	16.4 (10.9, 24.9)	18.6% (12.7%, 26.7%)	79.6%	N/A
	U15s and U16s (2, 3)	21.6 (15.3, 30.5)	23.7% (17.4%, 31.7%)	81.0%	N/A
requiring at least 7 days absence from games	All ages (3, 4, 5, 7, 8, 9, 10, 11) [b]	10.3 (6.0, 17.7)	12.1% (7.2%, 19.8%)	98.3%	(1.49, 70.82)
	U14s and younger (3, 7, 11)	7.5 (1.9, 30.2)	9.0% (2.3%, 31.5%)	94.2%	(0, $3.35x10^8$)
	U15s and older (3, 11)	17.3 (3.3, 90.1)	19.5% (4.1%, 67.6%)	97.6%	N/A
	U14s (3, 11)	10.9 (1.7, 69.2)	12.8% (2.1%, 57.9%)	94.3%	N/A
	U15s (3, 11)	20.9 (3.1, 141.2)	23.0% (3.8%, 82.9%)	96.4%	N/A
	U16s (3, 11)	14.9 (3.7, 60.1)	17.0% (4.5%, 52.8%)	92.1%	N/A

a - this is only possible where there are more than two studies

b – as calculated in Freitag et al 2015 meta-analysis

1 - (33), 2 - (34), 3 - (35), 4 - (36), 5 - (37), 6 - (38), 7 - (39), 8 - (40), 9 - (41), 10 - (42), 11 - (43)

2.2. Concern: "Second, many secondary schools in the United Kingdom deliver contact rugby as a compulsory part of the physical education curriculum from age eleven."

PAEG response: *"We agree that PE is a compulsory part of the National Curriculum however rugby is not stated as a compulsory part of the PE offer (KS3, KS4).*

Indeed the greatest risk of injury at school is not from participation in sport but in other areas of school life. The HSE RIDDOR data (2005) reported the contribution of games (of which rugby would be one contributing sport) to the proportion of reported non-fatal injuries for primary and secondary school students were 14% to 31%. This contribution is at most one third (at secondary school age) of the injuries within school time and playground injuries were twice as prevalent as games injuries (HSE 2005). Injuries at secondary schools in outdoor PE (which will include other sports than rugby) are less frequent than injuries in inside sport, playground and classrooms. Not all sports injuries to pupils are reportable under RIDDOR, as organised sports activities can lead to sports injuries that are not connected with how schools manage the risks from the activity. The HSE advise schools if an accident that results in an injury arises because of the normal rough and tumble of a game, the accident and resulting injury would not be reportable. Clearly schools, teachers and coaches have a duty of care for children at all times. Rugby has been taught for many years in schools and teachers are very aware of the importance of adequate coaching, contact free games and gradual introduction of contact when appropriate. We would support initiatives to improve the training and coaching of key skills i.e. correct body position and movement techniques for tackling, rucking, mauling etc.

Sport contributes significantly to physical activity in children but does begin to decline from 12 years of age. Participation is also differential by inequalities (IMD) and sport contributed proportionately less with increasing deprivation. Reducing opportunity for children to play rugby in schools would potentially increase these inequalities in participation."

Our response:

In a survey of 124 comprehensive schools in England which played boys rugby, researchers found 83% of the schools made the sport compulsory. (44) In 21% of schools disciplinary action would be taken if a student refused to play rugby, 12% of schools would take disciplinary action against parents who refused to consent to their child playing the game. Teachers were asked of their perceptions of which of the sporting activities they provided were high risk, 60% said rugby, 30% trampolining and 18% football.

A 2015 survey of predominantly private schools in England showed that for 77% of the 116 schools, collision rugby is a compulsory school sport. (45) The Children's Commissioner for Wales, Sally Holland, states that in her view children should be given a choice of sport and no individual sport should be made compulsory. (46) Physical Education is part of the national curriculum in England, Scotland, Wales and Northern Ireland, it is not clear whether individual sports are compulsory at the individual school level.

Q 12 Would the PAEG agree that no single sport should be compulsory in school and that government should commission a survey of all schools to ascertain what choice of physical activities and sports children have?

We agree that schools, teachers and coaches have a duty of care for children at all times.

We agree that rugby has been taught in schools for many years. Initial teacher education has transformed from being primarily a four year Bachelor of Education programme to an undergraduate degree followed by a one year post-graduate certificate in education. Trainee teachers are not required as part of their training to learn about specific sports, but to 'demonstrate good subject and curriculum knowledge'. (47) Unlike other activities (such as, trampolining or swimming) where specific regulations govern training and provision, teaching tackling in rugby requires no training at all. A training audit conducted in October 2015 from 24 Oxfordshire Rugby Football Schools Union affiliated schools found that only 39% of current PE teachers in schools had any rugby coaching qualifications and only 32% had completed a concussion education module (for state schools this was 14%, nine state schools had no teacher with concussion training). (48) Similarly, even in targeted schools for the Rugby Football Union as part of the All Schools initiative, 31% of schools had received no coaching development training. (49)

Q 13 What evidence does the PAEG have that teachers understand the rules of contact and are properly trained in "initiatives to improve the training and coaching of key skills i.e. correct body position and movement techniques for tackling, rucking, mauling etc."?

Q 14 What evidence does the PAEG have that schools are fulfilling their duty of care and undertaking injury monitoring and audits?

Q 15 Could the PAEG set out the actual data from the HSE RIDDOR 2005 reported and interpreted in their statement above? We have contacted the Health and Safety Executive but they are unable to reconcile these numbers with their records due to the age of the data. Current data are not detailed enough to breakdown to the level that was previously available.

2.3. Concern: "Third, the majority of all injuries occur during contact or collision, such as the tackle and the scrum. These injuries which include fractures, ligamentous tears, dislocated shoulders,

spinal injuries and head injuries can have short-term, life-long, and life-ending consequences for children."

PAEG response: *"We agree that serious injuries can occur during contact or collision. We welcome the RFU's CRISP (Community Rugby Injury Surveillance Project) initiative which is now monitoring injuries at community level, and show* (sic) *the implementation of a rugby based injury surveillance system. The CRISP 20154-2015* (sic) *Report states that the majority of community rugby injuries are sustained in the lower limb, particularly to the knee, ankle and thigh, and the majority of upper limb injuries occur in the shoulder, (p 3)."*

Our response:

In a systematic review of concussion in youth rugby (14), one study was identified for rugby union with data on concussion and phase of play (50). Of the 94 concussions reported, (87.2%) were associated with being tackled, tackling and rucks. (50)

Q 16 Could the PAEG clarify why they choose the following form of words, that "…serious injuries **can** occur during contact or collision" when it is the case that injuries, including serious injuries, are **most likely** to occur during contact or collision.

The CRISP project only collects injury data from the adult community game; there is a similar project which collects data from the adult professional game. There are no similar injury surveillance initiatives in the youth game, the only school rugby injury data available from England which we could find are from a small surveillance project which took place during the 2006/07 and 2007/08 seasons. (51, 52)

Q 17 Does the PAEG agree that there is a need for comprehensive routine school based injury surveillance including sport injury?

Q 18 Would the PAEG agree that successful injury surveillance relies on making good use of the data collected and that data collection without audit and dissemination may have negative consequences in relation to collection of data? (53) Feedback of data maintains data collector morale and high quality data collection. (53)

Q 19 Does the PAEG agree that all the data collected by the Rugby Unions on school rugby injury are not currently in the public domain and should be published?

The statistics the PAEG cite with respect to body site are interesting but are not sufficient in understanding the seriousness of injuries, especially in the youth and school context. Serious injuries can occur at any body site, whether lower limb, upper body or head.

Q 20 Could the PAEG explain why they do not acknowledge the types of injury and consequences?

Q 21 In providing these clarifications, could the PAEG consider and respond to the following recently published pieces of research on rugby injury and on concussion:

Archbold 2015: A study of 825 adolescent rugby players from 28 Ulster grammar school first XV rugby squads over the course of the 2014-2015 season recorded 426 injuries requiring at least a day away from play with a match injury incidence of 29.06 injuries per 1000 player-hours. (4) Injuries to the head or face accounted for 23.9% of all injuries and concussion was the most common specific diagnosis made accounting for 19% of all injuries. The tackle and other collision situations contributed 63.4% of injuries.

King 2016: In rugby league, children under 11 years old have been found to endure high magnitude head impacts during rugby of a level of severity similar to that experienced by college American footballers. (6)

Pfister 2016: A meta-analysis across all sports in under 18 year olds has found rugby to have a significantly higher rate of concussion than any other team sport with 4.18 (95% CI 2.50, 5.86) concussions per 1000 athlete exposures. (8) The rate of concussions in rugby were significantly higher than any other team collision sport including hockey, American football and lacrosse.

Roberts 2016: In a study of English community rugby over six seasons involving between 46 and 76 clubs per season, time-loss head injuries requiring at least eight days away from play were recorded as 2.43 injuries per 1000 player match hours, with a higher incidence for amateur players (2.78; 95% CI, 2.37-3.20) than recreational players (2.20; 95% CI, 1.86-2.53). (5) Concussion was the most common time-loss head injury, recording 1.46 concussions per 1000 player match hours. Tackles accounted for 64% of head injuries and 74% of concussions. They found a higher risk of injuries associated with the tackle than any other contact event. The researchers hypothesise that concussion incidence in the community game is likely to be underreported due to a lack of player awareness and unwillingness among players to report symptoms and caution that these estimates should be treated as minimum estimates.

Sabesan 2016: An analysis of data from the US National Electronic Injury Surveillance System of emergency department attendances for rugby related injury from 2004 to 2013 found an increasing trend in rugby injuries among all age groups. (2) Facial and head injuries made up more than a third of attendances, up 10% over the ten years. Women were more often injured in the head than men. Seven percent of all injuries were concussions.

Miller 2016: A study of 294 paediatric sports-related concussion patients in the USA found girls were around three or four times more likely to experience postconcussive symptoms lasting more than 28 days than boys (1), a particular concern given the significant growth in women and girls rugby (54).

Sariaslan 2016: A study of a birth cohort from Sweden of over a million individuals under the age of 26 years which identified 104290 who had suffered a traumatic brain injury in the past found that mild TBI (concussion) had a significant negative effect on a person's life chances, when compared with their unaffected siblings. (3) This was true for all measures: receipt of disability pension, psychiatric inpatient admissions or outpatient visits, premature mortality, low educational achievement and receipt of state welfare payments ($p<0.05$ for all).

Li 2017: In a systematic review and meta-analysis of 32 studies, representing 2,013,197 individuals, prior head injury significantly increased the risks of any dementia, relative risk (RR) = 1.63 (95% confidence interval 1.34 to 1.99) and Alzheimer's disease, RR = 1.51 (1.26 to 1.80). (10)

Emery 2017: There is strong evidence from a systematic review and meta-analysis from Canada that rule changes disallowing body-checking in youth ice-hockey, where a player deliberately makes contact with an opposing player to separate them from the ice-puck, has led to a 67% reduction, incidence rate ratio 0.33 (95% CI 0.25, 0.45), in concussion risk. (9) The evidence for other strategies to reduce concussion risk in sports including protective equipment (helmets, headgear and mouthguards), training and fair play rules is either weak or conflicting.

Buckley 2017: In a study of Australian 13-14 year olds in school, concussion was found to be predictive of violent behaviour and subsequent injury in the year following the concussion. (7) Children exhibiting violent behaviour in year 9 were 2.34 (95% CI 1.07, 5.16) times more likely to have had a concussion in year 8 than non-violent children. Similarly children who had received a violent injury in year 9 were 2.96 (95% CI 1.33, 6.58) times more likely to have had a concussion in year 8 than non-injured children. Both these odds ratios are adjusted for sex, alcohol use, truancy, unauthorised driving and passenger risk (travelling with drink driver or dangerous driver).

2.4. Concern: "Fourth, head injury and concussion is a common injury and repeat concussion is more likely when a player has a history of a previous concussion. A link has been found between repeat concussions and cognitive impairment and an association with depression, memory loss and diminished verbal abilities, as well as longer term problems. Children take longer to recover to normal levels on measures of memory, reaction speed and post-concussive symptoms than adults."

PAEG response: "*Concussion has wide ranging effects on the developing brain and body. There are rare cases of second impact syndrome and therefore player, coach and teacher education on concussion has been significantly increased. Following this increase in awareness there has been a large increase in head injury reporting from school children as they and their parents are concerned about concussions. It seems that before the sustained programme of education and awareness in rugby concussions were under reported, and it may be now that true concussion is over-reported, making it currently difficult to ascertain where the true incidence lies. Rest and recovery strategies are internationally accepted by the world wide governing body (World Rugby) following advice from the International Head Injury Board working across all sports. In addition, education on recognising, removing, recovering and returning to play following concussion is far better understood and is actively part of the RFU's approach to risk reduction and management (i.e. Head Case).*"

Our response:

Q 22 Do the PAEG agree that head injury and concussion are common; that there is an association between repeat concussions and cognitive impairment, depression, memory loss, diminished verbal abilities and other longer term problems; and that children take longer to recover to normal levels on measures of memory, reaction speed and post-concussive symptoms than adults?

In the 2014-15 professional season in England there were 13.4 concussions recorded per 1000 player-hours for matches up from 5.1 per 1000 player-hours in 2011-12 (55) The concussion incidence was 2.63 per 1000 player-hours in community match rugby in 2014-15 compared to 1.37 per 1000 player-hours in 2011-12 (5). It may well be the case that the significant increase in the incidence of reported match concussion in the adult professional game "most likely reflects the continued increase in concussion awareness and behavioural changes among players, medical staff, coaches and match officials as a result of RFU, Premiership Rugby, RPA and World Rugby education initiatives and the recent media focus on this injury" along with a "widening of definition of the operational definition of concussion in the elite adult game". (55) However, in the community adult game there is still likely to be underreporting of concussion "through a lack of player awareness and/or unwillingness of players to report symptoms to club staff". (5) Equivalent surveillance

projects do not exist in the school or child club rugby settings so any statement regarding over-reporting is unsubstantiated.

Consensus statements on concussion including definitions of concussion diagnosis and return to play guidelines have existed since the first conference in Vienna 2001 to the most recent, the 5th such conference, in Berlin in 2016, but there is concern over how well these guidelines are adhered to. (56, 57) In a systematic review, Fraas and Burchiel concluded that despite there being several concussion education and prevention programmes in existence across various country Rugby Unions, there was little evidence available to support their effectiveness (58).

Q 23 Would the PAEG agree that rates of match play concussion have been recorded as rising in both the professional and community adult rugby union game?

Q 24 Could the PAEG explain what they mean by "over-reporting" when referring to concussion incidence in rugby?

Q 25 Could the PAEG provide any evidence they have to support their suggestions of over-reporting of concussion, particularly in the child games?

Q 26 Do the PAEG agree that primary prevention of head injury and concussion is crucial and that the current focus of Rugby Unions on secondary prevention and management of injury is limited?

Q 27 Could the PAEG clarify whether concussion education (i.e. Headcase) (59) is an optional online module in schools and if so, how it is being evaluated? According to data reported at the England Rugby Football Schools Union Development Subcommittee in January 2016, only 400 teachers had so far completed Headcase training.

2.5. Concern: "Fifth, studies show that injuries from rugby can result in significant time loss from school. Rugby injury, disillusionment with the game and interference with education, are the most common reasons for children giving up rugby."

PAEG response: *"Injuries among 10-19 year olds occur most frequently in school, public places, sports and roads. All injuries will have some impact on schooling but we are unsure what data*

supports this assertion. We were unable to find any coherent body of research to support the assertion that Rugby injury, disillusionment with the game and interference with education *caused children to give up rugby. We did find research on reasons to stop playing sport and become less active for teenagers, which might be connected to negative experience of PE at school, lack of a range of choices for physical activity and peer pressure."*

Our response:

The data we use in support of time loss from school and reasons for giving up sport are contained in four studies:

1) In an analysis of data from nine Edinburgh schools over the course of a season, it was found that 16% (n=23) of school rugby match and 32% (n=12) of school rugby training injuries resulted in time away from school, with an average of 2.2 days lost; lower limb fractures alone resulted in an average of 5.5 days off school (60)

2) Another study of school rugby in Edinburgh schools found that 8 out of the 37 injuries recorded (21.6%) required time off school and a small number (n=3) required significant time off (over three days) (40).

3) In a study which followed up rugby injuries four years after they occurred in a Scottish Borders rugby playing district, 19% of the reasons given by under 20 year old players for stopping playing were connected to rugby injury and a further 20% were connected to disillusionment with the game. (21)

4) A report published by the Rugby Football Union cited evidence that the numbers playing rugby "reduce dramatically" at 18 years and that injuries contributed to and initiated players dropping out of the game. (61) They found injury and fear of injury were high on the list of concerns of 16-24 year olds. (61)

Q 28 Could the PAEG specify the research they found "on reasons to stop playing sport and become less active for teenagers"?

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3. General points to views and conclusions

RE: "the absence of a comprehensive system for injury surveillance and primary prevention.

PAEG response: *"This assertion appears unfair as recent Home Nation rugby football unions initiatives are focusing on prevention and monitoring. Routine assessment and recording of injuries caused by sport at Emergency Departments is sporadic and varies in quality. The Committee's A&E and Paediatric medicine specialists felt that this type of recording was unlikely to change or improve in the future, as it was not a clinical priority. One of the few examples of injury surveillance, from Oxfordshire, showed that rugby was not the largest contributor to injuries in the under 20s who play sport. From approximately 21,000 attendances by under 20s, 11,662 were for sport related injuries (70% male). Of these sport related injuries, the main sports were football (28.8% of sport injuries recorded), rugby union (9.6%) and horse-riding (4.6%). For males only the main sports were football (37.9%), rugby union (12.7%) and rugby league (3.9%). For 10-14 year old males, the most frequently sport injured group, football was responsible for 35.7% of injuries, rugby union 17.6% and rugby league 6.1% (Key sport injury figures from Oxford University Hospitals NHS Trust data collected between 01 Jan 2012 and 30 Mar 2014)."*

Our response: We deal in turn with the three points made in this response.

As we have already discussed there are no child specific rugby injury surveillance projects currently active in England. We are aware of one PhD project at University of Bath surveying rugby injuries in schools but results are as yet unpublished. The last published work from the English schools game that we are aware of was based on data collected during the 2006/07 and 2007/08 seasons. (51, 52)

In a survey of 154 comprehensive schools in England, 47% said they did not make any use of their data. (44) Only one school published their injury data while 10% used their data internally, for example to influence risk assessments. (44)

There is currently a major upgrade of the emergency care dataset taking place which will be implemented in A&E departments across England from October 2017 and that when completed this will include an enhanced injury minimum dataset which will include specific sport where involved in injury (see ECDS - https://www.england.nhs.uk/ourwork/tsd/ec-data-set/)

Q 29 Could the PAEG please identify the Home Rugby Nations initiatives on primary prevention and monitoring they are referring to and if any of them apply to school children?

Q 30 Could the PAEG inform us of any injury surveillance projects in child and school rugby which have taken place since the 2006/07 and 2007/08 seasons and provide us with the publications?

Finally, the PAEG do not provide a source or reference for the "Oxfordshire data" they cite apart from "Key sport injury figures from Oxford University Hospitals NHS Trust data collected between 01 Jan 2012 and 30 Mar 2014". To our knowledge these data have only ever been analysed and presented in this format by two of the authors (Kirkwood and Pollock) at the Royal Society of Medicine, "Tackling school sports injury" meeting on 14 Sep 2015 in London.

Q 31 Could the PAEG please note and rectify the figures which as presented by them understate the contribution of rugby to sport injuries in younger age groups? We provide the correct data below.

PAEG "*One of the few examples of injury surveillance, from Oxfordshire, showed that rugby was not the largest contributor to injuries in the under 20s who play sport. From approximately 21,000 attendances by under 20s, 11,662 were for sport related injuries (70% male).*"

Correction: There were 11676 injuries to all ages from sport out of a total of 63877 all causes, so 18.3% of all injuries to all ages were sport related. For the under 20s there were 5533 sport related injuries out of a total of 20883 all causes, so for this age group 26.5% of all injuries were sport related. Of these 68.0% were in males. Sport injuries are highest in 10-14 year old boys, accounting for 1569 (48.0%) out of 3270 injury attendances.

PAEG "Of these sport related injuries, the main sports were football (28.8% of sport injuries recorded), rugby union (9.6%) and horse-riding (4.6%). For males only the main sports were football (37.9%), rugby union (12.7%) and rugby league (3.9%)."

Correction: For the under 20s (both sexes) the main sports are Football (28.2%), Rugby Union (11.1%) and Trampoline (6.7%). For under 20 year olds males only the main sports are Football (37.7%), Rugby Union (15.5%) and Rugby League (5.0%).

PAEG: "For 10-14 year old males, the most frequently sport injured group, football was responsible for 35.7% of injuries, rugby union 17.6% and rugby league 6.1%"

These are correct.

RE: "Also under the United Nations Convention on the Rights of the Child (Article 19), governments have a duty to protect children from risks of injury: "States Parties shall take all appropriate legislative, administrative, social and educational measures to protect the child from all forms of physical or mental violence, injury or abuse, neglect or negligent treatment…". As a party to the Convention, the UK must ensure the safety of children."

PAEG response*: "We feel this assertion lies outside of the scope of the Expert Committee however not allowing children to play or be active will be detrimental to their emotional, social, mental and physical health."*

Our response: This is an international legal obligation of the United Kingdom; it is not an assertion. We agree wholeheartedly that not allowing children to play or to be active will be detrimental to their emotional, social, mental and physical health, and we have never suggested otherwise.

Q 32 Is the PAEG aware of the concerns raised by the United Nations (UN) Convention on the Rights of the Child, fifth periodic report which also affect the sporting and educational contexts, and how children are currently involved in policies relevant to play and leisure? (62) The committee notes that "Children's views are not systematically heard in policymaking on issues that affect them", and the need to "Fully involve children in planning, designing and monitoring the implementation of play policies and activities relevant to play and leisure, at the community, local and national levels".

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4. Summary

PAEG: *"The Committee are confident that there is selection bias in the evidence used by the SCIC to present their case. Their position based on such evidence is not supported by the Committee. The Committee reject the call to ban tackling, do not feel rugby participation poses an unacceptable risk of harm and could not support any actions that would increase inequalities in participation.*

We think the benefits of experiencing, learning, training and playing rugby, with appropriate supervision, safety and coaching, considerably outweigh the risks of injury."

SCIC response:

Q 33 We would appreciate being informed of the selection bias referred to and of the evidence we have excluded.

We note that the PAEG do not support what they call our "position", and "reject the call to ban tackling". Our request to the Ministers to remove the tackle and other forms of harmful contact from school rugby was not made to the CMOs, it was made to the ministers, and we made it on the basis of our judgment of the evidence. Our request to the CMOs was – and is – to advise in accordance with the evidence.

Q 34 Would the PAEG agree that their feelings about unacceptable risks are a separate and personal matter?

Q 35 Could the PAEG respond to our concerns about the government's plan for school sport in England and provide evidence for the claim that "reducing the opportunity for children to play rugby in school will potentially reduce access to sport participation more widely, thus increasing disadvantage".

Q 36 Would the PAEG agree that consideration should be given to which sports and other physical activities offered at school are likely to encourage lifelong participation and decrease disadvantage including disability and disadvantage which arises from injuries?

Professor Allyson Pollock

Professor Eric Anderson

Adam White

Graham Kirkwood

13 July 2017

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