

Association between community socioeconomic characteristics and access to youth flag football

Emily Kroshus,^{1,2} Aly J Sonnen,³ Sara PD Chrisman,^{4,5} Frederick P Rivara^{6,7,8}

¹Department of Pediatrics, University of Washington, Seattle, Washington, USA
²Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, Washington, USA

³University of Notre Dame, South Bend, Indiana, USA

⁴Division of Adolescent Medicine, University of Washington, Seattle, Washington, USA

⁵Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, USA
⁶Harborview Injury Prevention and Research Center, University of Washington, Seattle, Washington, USA

⁷Department of Pediatrics, University of Washington, Seattle, Washington, USA

⁸Center for Child Health, Behavior and Development, Seattle Children's Research Institute, Seattle, WA, USA

Correspondence to

Dr Emily Kroshus, Department of Pediatrics, University of Washington, Seattle, WA 98195, USA; ekroshus@u.washington.edu

Received 24 November 2017

Revised 22 December 2017

Accepted 27 December 2017

Published Online First

12 January 2018

ABSTRACT

Background The American Academy of Pediatrics has recommended that opportunities for non-tackling American football (e.g., flag football) be expanded, given concerns about the risks of brain trauma from tackle football. This study tested the hypothesis that flag football would be more accessible in communities characterised by higher socioeconomic status residents.

Methods In July 2017, the locations of community-based organisations offering youth flag and tackle football for youth between the ages of 6 and 13 in two US states (Georgia and Washington) were aggregated (n=440). Organisations were coded in terms of the availability of tackle and/or flag football teams for youth at each year of age between 6 and 13. Multivariate logistic regression analyses were used to assess the odds of a community-based football organisation offering flag football, by community socioeconomic and demographic characteristics.

Results In both states, communities with more educated residents were more likely to offer flag football for youth aged 6–12. For example, among 6 year-olds every 10% increase in the number of adult residents with a college education was associated with 1.51 times the odds of flag football availability (95% CI 1.22 to 1.86, P<0.001).

Conclusion These results suggest that youth living in communities characterised by low educational attainment are less likely than other youth to have the option of a lower contact alternative to tackle football. Relying on voluntary community-level adoption of lower contact alternatives to tackle football may result in inequitable access to such sport options. This may contribute to an inequitable burden of brain trauma from youth sport.

Every year in the USA, more than 2.8 million youth between the ages of 6 and 14 compete on an organised American football team.¹ Sport can help youth meet recommended levels of physical activity and it has the potential, with skilled coaching, to be a context for positive psychosocial development.² However, sport participation comes with risk, and concussions in particular are a growing area of concern in sports, such as football, that involve routine contact and collision.^{3,4} The majority of concussions in youth football occur from head-to-head contact and at the high school level, football players sustain an average of 774 head impacts during a single season.⁵ Studies of accelerometer-instrumented helmet data suggest that most youth football collisions are lower force than those sustained at the high school and collegiate level.⁶

However, even among youth football players not diagnosed with a concussion, changes in brain white matter have been observed over a single season of play⁷ and recent data indicate that the pathological findings of chronic traumatic encephalopathy can be seen in high school and college players.⁸ Among professional football players, those who played for more seasons and had more diagnosed concussions were more likely to experience memory changes⁹ and those who started playing tackle football before age 12 have differences in brain structure later in life compared with those who started later.¹⁰

Other youth sports including ice hockey and soccer have recently undertaken measures to limit head impact exposure for the youngest youth participants by outlawing body checking and heading, respectively.^{10–13} To date, most efforts to limit brain trauma in youth football have focused on voluntary rule changes that limit or remove contact from practices.¹⁴ Eliminating all contact practices can potentially reduce harmful impacts in youth football by around one-third.⁵ Another approach is removing tackling from the sport all together. The American Academy of Pediatrics (AAP) recently recommended that non-tackling leagues (e.g., flag football) be expanded.¹⁵ While flag football is not without concussion risk,¹⁶ among adults the most common injuries are to the fingers, thumb and wrist rather than to the head.¹⁷

At present, participation in tackle football or flag football is preference sensitive choice where reasonable and informed people can make different decisions in the context of their own priorities and values and based on the options that are available to them. Most paediatricians endorse limiting or eliminating tackling from practice and more than three-quarters state that they would not allow their son to play tackle football¹⁸ and there is increasing documentation of parent concern about concussion and its potential long-term consequences.^{19–21} However, decisions about tackle football participation must be viewed within an relative risk framework. In other words, when making sporting choices for their children, parents consider the risk and benefits of tackle football and available substitutes. On average, lower socioeconomic status youth participate in fewer organised recreational activities than their more affluent peers,²² a difference in part explained by less access to recreational facilities and the cost of participation.²³ Consequently, sport participation in lower resource communities tends to be in 'mainstream' team sports such as football and basketball as opposed to more 'niche' sports like tennis,²⁴ with participation in middle school and high school football is highest among black,



To cite: Kroshus E, Sonnen AJ, Chrisman SPD, et al. *Inj Prev* 2019;**25**:278–282.

Hispanic and low socioeconomic status youth.²⁵ Family and peer socialisation plays an important role in sport selection as well. Football is part of the cultural fabric of many communities in the USA,²⁶ something that would likely influence the risk-benefit appraisal of participation.

Relative risk calculations about sport choice are also dependent on risk perceptions. Consequently, differences in decisions about tackle football participation may also be a function of differences in parent health literacy. Health literacy, as conceptualised using a multidimensional framework,²⁷ reflects the ability to access, understand, appraise and apply health-related information, and it is often patterned by socioeconomic status. Black/African American and Hispanic/Latino parents tend to be less aware of concussion than parents of other racial/ethnic backgrounds.²⁰ Differences in parent health literacy could theoretically help shape the sport options in a given community. If enough parents choose not to enrol their child in tackle football, youth football organisations might respond by offering flag football as a lower contact alternative. Differential change by community socioeconomic status may also happen through more direct mechanisms if more health literate parents advocate for community-level changes related to safety. Either of these mechanisms could theoretically result in more options for lower contact or flag football in communities with more educated parents, which often means more affluent communities that contain a lower proportion of racial and ethnic minority residents.

Although flag football participation has increased in recent years,²⁸ we do not know among whom participation has increased. A concern with risk-reducing interventions is that when they are unequally implemented they may end up exacerbating inequalities.²⁹ The goal of our study was to learn more about the distribution of flag football as an option for football participation in communities located in two geographically and demographically disparate US states: Washington and Georgia.³⁰ We tested the hypothesis that in both states flag football would be more available in communities with more educated parents while also assessing whether other correlated community demographic characteristics (poverty, racial/ethnic composition and rurality) independently predicted flag football availability beyond education. As concern about the threat of repetitive brain trauma from tackle football continues to grow, understanding who has access to acceptable alternative activities is important for understanding whether current youth sport policy may be contributing to health inequities.

METHODS

Sample and procedure

A database of all community-based organisations offering youth flag and/or tackle football clubs in two US states (Washington and Georgia) was assembled in July 2017 using publicly available information listed online. Washington was selected because it is where the research team is located and the sample was purposively expanded to include a state located in a region of the country in which football has cultural hegemony³¹; based on that criteria, Georgia was selected using a random number generator drawing from the subset of US states located in the US Census South Atlantic region.³⁰ At the youth level (e.g., prior to high school) community-based organisations, rather than schools, are typically the sponsor for organised football. The search began by identifying superordinate 'parent' organisations or administrative units in which community-based football organisations were members: USA Football, Pop Warner, NFL Flag Football, Boys' and Girls' Clubs, Parks & Recreation,

YMCA and i9 Sports. These parent organisations in some cases have searchable online tools to identify community-based football organisations (e.g., USA Football's Find a League tool), and in the absence of such tools they provide information about branches or leagues (subunits of community-based organisations that compete against each other) which themselves have web sites that list teams. Additional searches using terms 'youth football', 'youth tackle football' and 'youth flag football' for both Washington and Georgia were used to identify community-based organisations not participating under those parent organisations. Community-based organisations were included in the sample if they offered flag and/or tackle football for youth between the ages of 6 and 13. Community-based organisations missing information online were contacted by email, with one follow-up email sent if there was no initial response. Research activities were classified as not human subjects by the Seattle Children's Hospital Institutional Review Board.

Measures

Flag and tackle availability by age

Football participation options for a given community-based organisation were recorded by year of age for children ages 6–13 years. Different parent organisations and community-based organisation employ different terminology and groupings for age and in some cases weight-based teams. Thus, we recorded for every year of age whether there was a tackle option (yes or no) and whether there was a flag option (yes or no), meaning that for every community-based organisation there was a binary record for three categories: only flag football, flag and tackle, and only tackle. This was subsequently dichotomised by age into a variable reflecting any flag football or no flag football.

Cost

We recorded the cost of enrolment and whether the community-based organisation offered financial need-based scholarships to offset the cost of participation.

Community socioeconomic characteristics

Zip codes of the communities in which football organisations were located were merged with community-level demographic data from the 2015 American Community Survey (ACS) 5-year estimates, the 2010 US Census and the Rural-Urban Commuting Areas (RUCA) database.³² ACS data were used to determine the percentage of families with a child below the age of 18 living below the federal poverty line, racial and ethnic composition of the community, and educational attainment. Information about Hispanic ethnicity was obtained from the 2010 US Census. RUCA codes³² were used to classify communities into two groups: urban or suburban (RUCA codes 1–6) and rural (RUCA codes 7–10).³³

Analysis

State-level youth football availability was calculated by the number of youth football organisations divided by the number of youth below the age of 18 in a given state, based on US Census 2010 data. Descriptive statistics of the demographic characteristics of the communities in which the community-based organisations were located were calculated separately for Washington and Georgia. Two-sample t-tests were used to compare mean values for community socioeconomic characteristics between the two states. The percentage of community-based organisations that offered tackle and/or flag football was calculated by age and state in three categories: (1) tackle, no flag; (2) tackle and flag;

Table 1 Demographic characteristics of communities in which youth football teams are located and football enrolment costs (Georgia n=175, Washington n=197)

	GA Mean (SD)	WA Mean (SD)	P*
Families below poverty line	19.41% (11.3)	12.62% (8.38)	<0.001
College degree (bachelor's degree or graduate)	30.11% (14.09)	32.75% (19.08)	0.135
Race/ethnicity†			
White	62.75% (26.10)	72.44% (20.68)	<0.001
Black	27.34% (24.85)	4.26% (5.32)	<0.001
American Indian/Alaska Native	0.24% (0.26)	1.27% (3.16)	<0.001
Asian	3.38% (4.85)	8.64% (8.26)	<0.001
Native Hawaiian/Pacific Islander	0.03% (0.13)	0.59% (0.97)	<0.001
White, non-Hispanic	57.03% (25.89)	71.52% (14.82)	<0.001
Hispanic, any race	9.03% (7.71)	9.62% (7.85)	0.447
Rural	8.05%	7.17%	
Enrolment cost per season			
Tackle football	\$225 (120)	\$233 (107)	0.569
Flag football	\$104 (53)	\$110 (62)	0.529
Financial aid offered	28.57%	7.92%	<0.001

*Two-sample t-test comparing percentage of respondents or mean response per category between Georgia and Washington states.

†Does not sum to 100 as Hispanic ethnicity category is inclusive of other races. GA, Georgia; WA, Washington.

(3) flag, no tackle. Pairwise correlations between all community-level socioeconomic variables were inspected for potential multicollinearity. The highest correlation was $r=0.52$ (between poverty and race/ethnicity) so all four socioeconomic predictors were included in the subsequent multivariate analyses.³⁴ Multivariate logistic regression models using robust SEs with clustering by state were calculated for each age with socioeconomic variables and state as predictors of the odds of a youth football organisation offering the option of flag football (operationalised as 1=any flag football, meaning flag only or flag and tackle and 0=only tackle football). To assist with interpretability, poverty, race/ethnicity and education variables were rescaled so that a one unit change reflected a 10% difference in the percentage of community resident in that demographic category. An alpha level of $P<0.05$ was used as the threshold for statistical significance.

RESULTS

Overall, there were more community-based football organisations in Washington (n=197, 1 per 8022 youth below the age of 18) as compared with Georgia (n=175, 1 per 14 229 youth below the age of 18). Socioeconomic characteristics of communities with youth football were significantly different between Georgia and Washington, with greater poverty in Georgia as compared with Washington. There was no difference in the mean cost of football participation (flag or tackle) between states; however, football organisations in Georgia were more likely to offer financial aid or scholarships to help subsidise participation. Additional descriptive characteristics are presented in table 1. Tackle and flag sponsorship by age and state is presented descriptively in table 2. With the exception of 6 year-olds in Washington, more than half of community-based football organisations in every other age group offered only tackle football. By the age of 9, more than 70% of football organisations offered only tackle football.

Results of the multivariate regression models predicting odds of flag football availability by age are presented in table 3. From

Table 2 Percentage of community-based clubs that offer tackle and/or flag football by age in Georgia and Washington

Age of child	Tackle, no flag		Tackle and flag		Flag, no tackle	
	GA % (n)	WA % (n)	GA % (n)	WA % (n)	GA % (n)	WA % (n)
6	69.29 (88)	35.00 (42)	5.51 (7)	2.50 (3)	25.20 (32)	62.50 (75)
7	77.10 (101)	50.38 (67)	8.40 (11)	8.27 (11)	14.50 (19)	41.35 (55)
8	78.42 (109)	66.87 (111)	9.35 (13)	4.82 (8)	12.23 (17)	28.31 (47)
9	81.76 (121)	70.59 (120)	5.41 (8)	4.12 (7)	12.84 (19)	25.29 (43)
10	82.14 (115)	70.41 (119)	5.00 (7)	4.14 (7)	12.86 (18)	25.44 (43)
11	86.83 (145)	70.76 (121)	2.99 (5)	4.09 (7)	10.18 (17)	25.15 (43)
12	84.96 (113)	72.35 (123)	2.26 (3)	4.12 (7)	12.78 (17)	23.53 (40)
13	83.15 (74)	82.17 (106)	–	3.10 (4)	16.85 (15)	14.73 (19)

GA, Georgia; WA, Washington.

ages 6 to 12, socioeconomic variables were significantly associated with odds of flag football availability, with education appearing to have the most consistent effect across age groups. For 6 year-olds, every 10% increase in the number of adult residents with a college education was associated with 1.51 times the odds of flag football being available in the community (95% CI 1.22 to 1.86, $P<0.001$). Similarly for 11 year-olds, every 10% increase in adult residents with a college education was associated with 1.26 greater odds of flag football availability (95% CI 1.15 to 1.37, $P<0.001$). Among 6, 7 and 8 year-olds, communities with more poverty had significantly elevated odds of having flag football available.

DISCUSSION

In both Georgia and Washington, we found that youth football organisations located in communities with a greater proportion of adults with a college degree were more likely to have a flag football option through age 12. Differences in flag football availability by parent education may be the direct result of differences in parent advocacy or an indirect result of differential attrition from tackle football and the opportunistic provision of lower contact sport options (e.g., flag football). On one hand, this finding is consistent with a well-established literature on constrained access to organised sport and recreation options in low-resource communities.^{23–25} On the other hand, tackle football is more costly and resource intensive than flag football. Among the youngest participants, controlling for education and other socioeconomic characteristics, communities with greater poverty were more likely to offer flag football. This could suggest that in low-resource communities cost is a stronger determinant of sport selection at younger ages than at older ages, perhaps because parental 'investment' in sport is more discretionary rather than functional in terms of sport advancement at younger ages. Even after accounting for differences in community-level socioeconomic characteristics, football clubs in Georgia were less likely to offer flag football for 6 and 7 year-olds than clubs in Washington. This difference may reflect the cultural prominence of football in the American south as compared with the Pacific Northwest.³¹ Although sport is a social construct, changing sport rules, or in the case of flag football adopting a different version of the sport, is often met with resistance.³⁵ It is possible that the more culturally embedded a sport is in a given region, the more reluctance there may be by families to select alternative options, resulting in less pressure on sports clubs to offer lower contact alternatives.

Table 3 Results of multivariate logistic regression analyses predicting odds of flag football availability in community-based youth football organisations

	6 years OR (95% CI) P	7 years OR (95% CI) P	8 years OR (95% CI) P	9 years OR (95% CI) P	10 years OR (95% CI) P	11 years OR (95% CI) P	12 years OR (95% CI) P	13 years OR (95% CI) P
Poverty*	1.48 (1.45 to 1.51) <0.001	1.22 (1.06 to 1.39) 0.004	1.24 (1.16 to 1.32) <0.001	1.08 (0.67 to 1.75) 0.758	1.14 (0.77 to 1.69) 0.508	1.18 (0.77 to 1.81) 0.437	1.20 (0.78 to 1.84) 0.416	1.19 (0.75 to 1.89) 0.457
College degree†	1.51 (1.22 to 1.86) <0.001	1.64 (1.28 to 2.10) <0.001	1.41 (0.97 to 2.05) 0.073	1.28 (1.09 to 1.50) 0.003	1.31 (1.04 to 1.66) 0.022	1.26 (1.15 to 1.37) <0.001	1.16 (1.14 to 1.17) <0.001	2.03 (0.90 to 1.18) 0.636
Non-Hispanic white‡	1.10 (0.83 to 1.45) 0.506	0.96 (0.81 to 1.13) 0.637	0.97 (0.78 to 1.21) 0.816	0.94 (0.71 to 1.24) 0.673	0.94 (0.72 to 1.25) 0.688	0.91 (0.65 to 1.28) 0.595	0.92 (0.65 to 1.32) 0.664	0.91 (0.62 to 1.34) 0.640
Rurality (Ref=rural)	1.36 (0.85 to 2.17) 0.199	1.02 (0.26 to 4.01) 0.978	0.52 (0.41 to 0.65) <0.001	0.60 (0.49 to 0.74) <0.001	0.62 (0.43 to 0.89) 0.010	0.69 (0.37 to 1.27) 0.236	0.65 (0.42 to 1.02) 0.058	3.03 (0.65 to 14.23) 0.160
State (Ref=Washington)	0.28 (0.19 to 0.43) <0.001	0.38 (0.28 to 0.50) <0.001	0.68 (0.53 to 0.87) 0.002	0.62 (0.52 to 0.75) <0.001	0.60 (0.47 to 0.77) <0.001	0.43 (0.29 to 0.62) <0.001	0.47 (0.29 to 0.74) 0.001	0.83 (0.56 to 1.23) 0.364
Adjusted R ²	0.11	0.11	0.05	0.04	0.04	0.04	0.03	0.02

P<0.05 bolded for emphasis.

*One unit change in poverty variable represents a 10% change in the number of community residents who are classified as below the poverty line.

†One unit change in college degree variable represents a 10% change in number of community residents who graduated from college.

‡One unit change in college degree variable represents a 10% change in number of community residents who graduated from college.

An implication of the absence of a ban on youth tackle football is that it is acceptable for fully informed families to make different decisions about participation based on their priorities and values. However, if some families are systematically less able to choose a low contact substitute for tackle football because of who they are or where they live, this lack of choice may contribute to health inequities related to brain trauma from sport.²⁹ A first step in addressing this problem is making sure all parents, regardless of their educational background or place of residence, are aware of the risks of contact sport participation. This may mean developing risk communication tools that address challenges with accurate risk perceptions³⁶ that paediatricians can use to help families make informed decisions about sport participation, something that is at present not standard practice.¹⁸ However, these decisions are more involved than simply accurately appraising the risk of concussion and may be subject to cultural inertia. Sport has meaning for families³⁷ and participation in sports popular in ones' community can provide opportunity for peer affiliation and function as a source of social status in youth peer groups.³⁸ Family and peer socialisation related to sport choice is intertwined with sport availability: what is believed to be normative is a function of what is visible.³⁹

These results are a cause for reflection about the extent to which policy change is needed to equitably reduce the burden of brain trauma from youth football. Other sports have instituted bans on contact at younger ages, including restricting body checking in ice hockey and heading in soccer.^{11 12} The differential availability of flag football by age, as observed in the present study, suggests that there is implicit preference for lower contact options at younger ages. Given the existence of tackling in high school football, it is likely that as youth approach high school age participating in a sport that more closely replicates the high school rules is considered important. Some authors have argued that tackle football should not be allowed even at the high school level.⁴⁰ At a minimum, eliminating tackling at younger ages, such as under the age of 12, would bring football in closer alignment with the rules instituted in soccer and ice hockey. It would also

mean that millions of elementary school-age kids would have less exposure to brain trauma, and that participation in tackle football will not be patterned by community socioeconomic status.

Limitations

An important limitation of the present study is its assumption that flag football is a safer alternative to tackle football. Participation in flag football has been encouraged by the AAP¹⁵; however, data comparing concussion incidence in youth flag and tackle football are limited.¹⁷ Even if flag football is not in fact a lower risk sport, increases in flag football enrolment⁴¹ suggest that parents may be perceiving it to be so. Thus, the present paper suggests that there is differential community-level adoption of interventions that are at least perceived to be risk reducing. Additionally, the present study focused only on flag football as a substitute for tackle football. Research is needed to understand the extent to which access to other non-contact options is patterned by community socioeconomic characteristics. Another limitation is that the present study was only conducted in two American states and our data set only included communities in which a youth football organisation was located. Research is needed to look at differences between communities that sponsor any football and those that do not, to incorporate a geospatial perspective in which accessibility in proximate communities is modelled, and to look at how flag football availability varies as a function of population density. It is also possible that our online search process missed some community-based football organisations if they do not have a web presence and they do not compete under the umbrella of a 'parent' organisation (e.g., USA Football, YMCA). It is likely that organisations without a web presence would be from lower resource communities, meaning that their exclusion from the sample would understate the present findings.

CONCLUSIONS

It is critical that we make sure that all families are able to make informed choices about contact sport participation in a context

where there are other options for safe sport. The present results suggest that youth in communities characterised by less educational attainment have less access to flag football. This should be a cause for reflection about whether allowing tackle football among elementary school-age kids is defensible from the perspective of health equity. Relying on voluntary adoption of lower contact alternatives to tackle football may contribute to an inequitable burden of brain trauma from youth sport.

What is already known on the subject

- ▶ The American Academy of Pediatrics has recommended that non-tackling (eg, flag football) leagues be expanded based on concern about the risks of brain trauma from tackle football.
- ▶ Access to sport and recreational facilities and organisations tends to be more limited in communities characterised by low socioeconomic status residents.

What this study adds

- ▶ Youth living in communities characterised by low educational attainment have the least access to youth flag football.
- ▶ Relying on voluntary community-level adoption of lower contact alternatives to tackle football may result in inequitable access to such sport options.

Contributors EK and AJS participated in the concept and design; analysis and interpretation of data; drafting and revising of the manuscript. SPC and FR participated in the analysis and interpretation of data; drafting and revising of the manuscript. All authors approved the manuscript as submitted and agree to be accountable for all aspects of the work.

Competing interests None declared.

Ethics approval Seattle Children's Research Institute.

Provenance and peer review Not commissioned; externally peer reviewed.

© Article author(s) or their employer(s) unless otherwise stated in the text of the article) 2019. All rights reserved. No commercial use is permitted unless otherwise expressly granted.

REFERENCES

- 1 Physical Activity Council. *2017 Participation Report: The Physical Activity Council's annual study tracking sports, fitness, and recreation participation in the US*. United States: Physical Activity Council, 2017.
- 2 Geidne S, Quennerstedt M, Eriksson C. The youth sports club as a health-promoting setting: an integrative review of research. *Scand J Public Health* 2013;41:269–83.
- 3 Marshall SW, Guskiewicz KM, Shankar V, et al. Epidemiology of sports-related concussion in seven US high school and collegiate sports. *Inj Epidemiol* 2015;2:13.
- 4 Kerr ZY, Cortes N, Caswell AM, et al. Concussion Rates in U.S. Middle School Athletes, 2015–2016 School Year. *Am J Prev Med* 2017;53:914–8.
- 5 Broglio SP, Martini D, Kasper L, et al. Estimation of head impact exposure in high school football: implications for regulating contact practices. *Am J Sports Med* 2013;41:2877–84.
- 6 Daniel RW, Rowson S, Duma SM. Head impact exposure in youth football. *Ann Biomed Eng* 2012;40:976–81.
- 7 Bahrami N, Sharma D, Rosenthal S, et al. Subconcussive head impact exposure and white matter tract changes over a single season of youth football. *Radiology* 2016;281:919–26.
- 8 Mez J, Daneshvar DH, Kiernan PT, et al. Clinicopathological evaluation of chronic traumatic encephalopathy in players of American football. *JAMA* 2017;318:360–70.
- 9 Ford JH, Giovanello KS, Guskiewicz KM. Episodic memory in former professional football players with a history of concussion: an event-related functional neuroimaging study. *J Neurotrauma* 2013;30:1683–701.
- 10 Stamm JM, Koerte IK, Muehlmann M, et al. Age at first exposure to football is associated with altered corpus callosum white matter microstructure in former professional football players. *J Neurotrauma* 2015;32:1768–76.
- 11 Emery CA, Kang J, Shrier I, et al. Risk of injury associated with body checking among youth ice hockey players. *JAMA* 2010;303:2265–72.
- 12 Yang YT, Baugh CM. US Youth Soccer Concussion Policy: Heading in the Right Direction. *JAMA Pediatr* 2016;170:413–4.
- 13 Quarrie KL, Brooks JHM, Burger N, et al. Facts and values: on the acceptability of risks in children's sport using the example of rugby - a narrative review. *Br J Sports Med* 2017;51:1134–9.
- 14 Kerr ZY, Yeargin S, Valovich McLeod TC, et al. Comprehensive coach education and practice contact restriction guidelines result in lower injury rates in youth American football. *Orthop J Sports Med* 2015;3:232596711559457.
- 15 Council on Sports Medicine and Fitness. Tackling in Youth Football. *Pediatrics* 2015;136:e1419–30.
- 16 Peterson AR, Kruse AJ, Meester SM, et al. Youth football injuries: a prospective cohort. *Orthop J Sports Med* 2017;5:232596711668678.
- 17 Kaplan Y, Myklebust G, Nyska M, et al. The epidemiology of injuries in contact flag football. *Clin J Sport Med* 2013;23:39–44.
- 18 Fishman M, Taranto E, Perlman M, et al. Attitudes and counseling practices of pediatricians regarding youth sports participation and concussion risks. *J Pediatr* 2017;184:19–25.
- 19 Lin AC, Salzman GA, Bachman SL, et al. Assessment of parental knowledge and attitudes toward pediatric sports-related concussions. *Sports Health* 2015;7:124–9.
- 20 Bloodgood B, Inokuchi D, Shawver W, et al. Exploration of awareness, knowledge, and perceptions of traumatic brain injury among American youth athletes and their parents. *J Adolesc Health* 2013;53:34–9.
- 21 Romaine A, DeFreese JD, Guskiewicz K, et al. Sport parent perceptions of American youth football costs, benefits, and safety. *J Clin Sport Psychol* 2016;10:253–71.
- 22 Weber EU, Blais AR, Betz NE. A domain-specific risk-attitude scale: measuring risk perceptions and risk behaviors. *J Behav Decis Mak* 2002;15:263–90.
- 23 Santos MP, Esculcas C, Mota J. The relationship between socioeconomic status and adolescents' organized and nonorganized physical activities. *Pediatr Exerc Sci* 2004;16:210–8.
- 24 Powell LM, Slater S, Chaloupka FJ, et al. Availability of physical activity-related facilities and neighborhood demographic and socioeconomic characteristics: a national study. *Am J Public Health* 2006;96:1676–80.
- 25 Eime RM, Charity MJ, Harvey JT, et al. Participation in sport and physical activity: associations with socio-economic status and geographical remoteness. *BMC Public Health* 2015;15:434.
- 26 Sabo D, Veliz P. Participation in organized competitive sports and physical activity among US adolescents: assessment of a public health resource. *Health Behav Policy Rev* 2014;1:503–12.
- 27 Sorek T, White RG. American football and national pride: Racial differences. *Soc Sci Res* 2016;58:266–78.
- 28 Sørensen K, Van den Broucke S, Fullam J, et al. Health literacy and public health: a systematic review and integration of definitions and models. *BMC Public Health* 2012;12:80.
- 29 Lorenc T, Petticrew M, Welch V, et al. What types of interventions generate inequalities? Evidence from systematic reviews. *J Epidemiol Community Health* 2013;67:190–3.
- 30 United States Census Bureau. *Geographic Terms and Concepts- Census Divisions and Census Regions*. United States: US Census Bureau, 2010.
- 31 Morgan LJ, Klimasewski T. Pigskin Power Region: Dominance of Southern Collegiate Football. *Southeast Geogr* 2015;55:214–24.
- 32 Rural Health Research Center. RUCA Data. <http://depts.washington.edu/uwruca/ruca-codes.php>
- 33 Weeks WB, Kazis LE, Shen Y, et al. Differences in health-related quality of life in rural and urban veterans. *Am J Public Health* 2004;94:1762–7.
- 34 Dormann CF, Elith J, Bacher S, et al. Collinearity: a review of methods to deal with it and a simulation study evaluating their performance. *Ecography* 2013;36:27–46.
- 35 Bachynski KE, Goldberg DS. Youth Sports & Public Health: Framing Risks of Mild Traumatic Brain Injury in American Football and Ice Hockey. *The Journal of Law, Medicine & Ethics* 2014;42:323–33.
- 36 Sheridan SL, Halpern DJ, Viera AJ, et al. Interventions for individuals with low health literacy: a systematic review. *J Health Commun* 2011;16:30–54.
- 37 Wheeler S, Green K. Parenting in relation to children's sports participation: generational changes and potential implications. *Leisure Studies* 2014;33:267–84.
- 38 Shakib S, Veliz P, Dunbar MD, et al. Athletics as a Source for Social Status among Youth: Examining Variation by Gender, Race/Ethnicity, and Socioeconomic Status. *Social Sport J* 2011;28:303–28.
- 39 Neuwirth K, Frederick E. Peer and social influence on opinion expression: Combining the theories of planned behavior and the spiral of silence. *Comm Res* 2004;31:669–703.
- 40 Johnson LS. Return to play guidelines cannot solve the football-related concussion problem. *J Sch Health* 2012;82:180–5.
- 41 Sports & Fitness Industry Association. Football (flag) participation report. 2016 https://www.sfia.org/reports/483_Football-%28Flag%29-Participation-Report-2016