

# Socioeconomic Factors for Sports Specialization and Injury in Youth Athletes

Neeru A. Jayanthi, MD,<sup>\*†‡</sup> Daniel B. Holt Jr, MD,<sup>§</sup> Cynthia R. LaBella, MD,<sup>||¶</sup>  
and Lara R. Dugas, PhD, MPH<sup>#</sup>

**Background:** The effect of socioeconomic status (SES) on rates of sports specialization and injury among youth athletes has not been described previously.

**Hypothesis:** Young athletes from lower socioeconomic status will have lower rates of sports specialization and subsequently lower risk of overuse injuries.

**Study Design:** Cohort study.

**Level of Evidence:** Level 3.

**Methods:** Injured athletes aged 7 to 18 years were recruited from 2 hospital-based sports medicine clinics and compared with uninjured athletes presenting for sports physicals at primary care clinics between 2010 and 2013. Participants completed surveys on training patterns. Electronic medical records provided injury details as well as patient zip code, race, and health insurance type. SES was estimated from zip codes. The sample was divided into SES tertiles. Analysis of variance and multivariate regression were used for continuous variables, and multivariate logistic regression analyses were conducted to explore relationships between risk factors and injury.

**Results:** Of 1190 athletes surveyed, 1139 (96%) had satisfactory SES data. Compared with low-SES athletes, high-SES athletes reported more hours per week spent playing organized sports ( $11.2 \pm 6.0$  vs  $10.0 \pm 6.5$ ;  $P = 0.02$ ), trained more months per year in their main sport ( $9.7 \pm 3.1$  vs  $7.6 \pm 3.7$ ;  $P < 0.01$ ), were more often highly specialized (38.9% vs 16.6%;  $P < 0.01$ ), and had increased participation in individual sports (64.8% vs 40.0%;  $P < 0.01$ ). The proportion of athletes with a greater than 2:1 ratio of weekly hours in organized sports to free play increased with SES. Accounting for age and weekly organized sports hours, the odds of reporting a serious overuse injury increased with SES (odds ratio, 1.5;  $P < 0.01$ ).

**Conclusion:** High-SES athletes reported more serious overuse injuries than low-SES athletes, potentially due to higher rates of sports specialization, more hours per week playing organized sports, higher ratio of weekly hours in organized sports to free play, and greater participation in individual sports.

**Clinical Relevance:** As SES increases, young athletes report higher degrees of sports specialization, greater participation in individual sports, and more serious overuse injuries.

**Keywords:** adolescent; youth sport; income; free play

Sports specialization has been defined as intensive, year-round training in a single sport at the exclusion of other sports.<sup>10</sup> Rates of sports specialization among youth athletes appear to be increasing based on public perception and media reports; however, this has been difficult to document as

there are no previous data on rates of sports-specialized training in youth sports. Significant financial resources and time may be allocated by families to support these specialized training patterns. There is also concern that this increase in sports specialization may increase the risk of injury and burnout in

From <sup>†</sup>Emory Sports Medicine Center, Emory Johns Creek Hospital, Johns Creek, Georgia, <sup>‡</sup>Department of Orthopedic Surgery and Family Medicine, Emory University School of Medicine, Atlanta, Georgia, <sup>§</sup>Indiana University School of Medicine, Indianapolis, Indiana, <sup>||</sup>Institute for Sports Medicine, Ann & Robert H. Lurie Children's Hospital of Chicago, Chicago, Illinois, <sup>¶</sup>Department of Pediatrics, Northwestern University's Feinberg School of Medicine, Chicago, Illinois, and <sup>#</sup>Public Health Sciences, Stritch School of Medicine, Loyola University Chicago, Maywood, Illinois

\*Address correspondence to Neeru A. Jayanthi, MD, Emory Sports Medicine Center, 6997 Hospital Parkway, Suite 302, Emory Johns Creek Hospital, Johns Creek, GA 30097 (email: neeru.jayanthi@emory.edu).

The following authors declared potential conflicts of interest: Neeru A. Jayanthi, MD, is a paid consultant for Aspen Institute Project Play and Cynthia R. LaBella, MD, receives royalties from AAP publishing.

DOI: 10.1177/1941738118778510

© 2018 The Author(s)

young athletes.<sup>11</sup> For this reason, the American Academy of Pediatrics and the American Medical Society for Sports Medicine have both discouraged sport specialization before adolescence but acknowledge that this recommendation is largely based on expert opinion, as there are limited data to support these recommendations.<sup>1,4</sup>

Previous studies have analyzed the effect of geographic residence, income, education levels, and other biological and psychological risk factors on sports-related injury risk in children and adolescents.<sup>14,17</sup> Hispanic, Native American, and African American children are more frequently of lower socioeconomic status (SES), have fewer doctor visits, a longer time span between visits, and are in poorer health according to surveys completed by their own parents.<sup>7</sup> Multiple studies have shown that youth sports participation is proportional to family income and SES.<sup>2,6,12,22</sup> However, the effect of SES on rates of sports specialization and injury among young athletes has not been previously described. The purpose of this study was to determine whether SES, health insurance status (public vs private), and/or race are associated with rates of sports specialization and/or injury among young athletes.

## METHODS

### Sampling Design and Participant Recruitment

Signed parental consent was obtained for each participant. Signed assent was also obtained from participants aged 12 years and older. Study approval was obtained from all affiliated institutional review boards. Athletes were invited to participate if they met the following inclusion criteria: (1) were 7 to 18 years of age, (2) participated in 1 or more organized sports, and (3) presented to 1 of 2 university hospital-based sports medicine clinics for a sports-related injury or to an affiliated primary care clinic for a sports physical examination or well-child care visit.

### Surveys

All participants completed a 15-item survey to report sex, age, number and list of organized sports they participated in throughout the year, hours per week spent playing organized sports (training and competition), physical education (PE) class and free play (in the past 6 months), and degree of sports specialization (see Appendix 1, available in the online version of this article). Injured athletes who had suffered a sports-related injury in the past 6 months that prevented sports participation completed an additional 11-item survey to report injury mechanism (acute vs overuse), training volume prior to injury, and whether the injury was new or recurrent. Only injuries acquired in organized sports were included.

### Anthropometrics

A registered nursing staff, medical assistant, athletic trainer, or research assistant measured each participant's height and weight at enrollment. We calculated body mass index (BMI) as  $\text{kg}/\text{m}^2$ .

### Electronic Medical Records

Electronic medical records (EMRs) were used to obtain diagnosis and treatment for each reported injury, participants' race (white, black, Asian, Hispanic, or other, including multiracial), zip code, and health insurance status (private vs public [state-funded Medicaid available to those whose annual household income for a family of 4 is <\$31,716]).<sup>21</sup> Using US Census Bureau data, we estimated each participant's annual household income from his or her zip code and then divided the sample into tertiles of high, medium, and low SES based on this estimated annual household income.<sup>3</sup>

### Injury Type

Injuries were classified by clinical diagnosis and confirmed from participants' EMR. Injury mechanisms were determined from participant surveys as either acute (related to a single, traumatic event) or overuse (gradual onset). "Serious overuse injuries" were categorized as those overuse injuries for which the physician recommended treatment of longer than 1 month of rest from sports. These included spondylolysis, stress fractures, physeal stress injuries, overuse elbow ligament injuries, and osteochondritis dissecans.

### Statistical Analysis

All analyses were completed using STATA software (v12; STATA Corp). The main outcome variables were proportion of athletes classified by degree of specialization (low, moderate, and highly specialized) as well as the proportion of athletes presenting with either acute, overuse, or serious overuse injuries, categorized according to 3 main categories: (1) insurance type (private vs public), (2) SES status (low, middle, and high SES), and (3) race (Hispanic, white, black, Asian, other, not indicated). Descriptive summary variables included age, hours per week of organized sports, hours per week of free play, hours per week of PE class, and team vs individual sport. For continuous variables (eg, age, weight, BMI, weekly hours of sports, free play, and PE class), means, medians (ratio of organized sport to free play), and standard deviations were computed, and proportions were calculated for categorical variables (sex, team vs individual sport, degree of specialization, and injury type). Associations by insurance type were explored using analysis of variance (ANOVA) for continuous variables (eg, age, weight, BMI, and weekly hours of sports) and chi-square analysis for categorical variables (eg, sex). To evaluate the associations between insurance type and degree of specialization (low, moderate, and highly specialized) and injury type (overuse, serious overuse, and acute), multiple logistic regression was used to adjust for the covariates of age and hours spent playing sports. Associations between the 3 tertiles of SES were evaluated using ANOVA with Bonferroni correction for continuous summary variables and chi-square analysis for categorical variables. Multiple logistic regression was used to explore associations between SES type and degree of specialization and injury types, adjusting for the covariates of age and hours spent

Table 1. Participant characteristics by insurance type<sup>a</sup>

	Total Public/Private	Public Insurance	Private Insurance	P Value
Participants	1121 (100)	211 (19)	910 (81)	
Males	563 (51)	133 (66)	430 (48)	<0.01
Age, y	13.73 ± 2.3	13.76 ± 2.4	13.72 ± 2.3	0.78
Age started competitive sports, y	7.89 ± 3.13	8.59 ± 3.50	7.73 ± 3.03	<0.01
Age of specialization, y	11.87 ± 2.53	12.14 ± 2.60	11.82 ± 2.51	0.35
Weight, kg	58.83 ± 17.4	63.06 ± 18.9	57.88 ± 16.9	<0.01
Females	54.93 ± 13.9	57.23 ± 13.0	54.58 ± 14.0	0.14
Males	62.51 ± 19.5	66.13 ± 20.8	61.39 ± 18.9	0.01
BMI, kg/m <sup>2</sup>	21.85 ± 4.4	23.43 ± 5.1	21.50 ± 4.2	<0.01
Total physical activity, h/wk	19.00 ± 9.15	20.25 ± 10.64	18.72 ± 8.76	0.03
PE class, h/wk	3.15 ± 2.00	3.25 ± 2.00	3.13 ± 2.00	0.43
Free play, h/wk	5.58 ± 5.38	7.13 ± 6.18	5.23 ± 5.13	<0.01
Organized sports, h/wk	10.62 ± 6.26	10.35 ± 6.89	10.69 ± 6.11	0.49
Ratio of organized sports:free play ratio >2:1	653 (58.25)	105 (49.76)	548 (60.22)	<0.01
Median ratio organized sports:free play	1.86	1.20	2.00	0.05
Main sport is team sport	493 (46.51)	117 (58.79)	375 (43.67)	<0.01
Time training for main sport, mo/y	8.67 ± 3.49	7.81 ± 3.63	8.85 ± 3.44	<0.01
Training >8 mo/y	801 (71.45)	155 (65.40)	663 (72.86)	0.03
Weekly sports hours > age in years	348 (31.52)	67 (33.00)	281 (31.19)	0.62
Specialization				
Low	392 (34.97)	81 (38.39)	311 (34.18)	0.25
Moderate	352 (31.40)	72 (34.12)	280 (30.77)	0.34
High	290 (25.87)	34 (16.11)	256 (28.13)	<0.01
Injured	810 (72.26)	144 (68.2)	666 (73.19)	0.15
Overuse injury	396 (35.33)	70 (33.18)	326 (35.82)	0.47
Serious overuse injury	129 (11.68)	16 (7.88)	113 (12.54)	0.06
Acute injury	270 (24.09)	54 (25.59)	216 (23.74)	0.57

BMI, body mass index; PE, physical education.

<sup>a</sup>Data are presented as n (%) or mean ± SD.

playing sports. Finally, associations by race (Hispanic, white, black, Asian, other, not indicated) were explored using ANOVA with Bonferroni correction for continuous summary variables

and chi-square analysis for categorical variables. Similarly, multiple logistic regression was used to explore associations between race and degree of specialization and injury type,

Table 2. Participant characteristics by SES<sup>a</sup>

	SES				P Value
	Total	Low	Middle	High	
Participants	1139 (100)	380 (33)	378 (33)	381 (33)	
Males	586 (51)	212 (58)	1960 (53)	160 (43)	<0.01
Age, y	13.70 ± 2.3	13.78 ± 2.3	13.53 ± 2.4	13.80 ± 2.3	0.52
Age started competitive sports, y	7.87 ± 3.13	8.64 ± 3.36	7.47 ± 3.20	7.52 ± 2.68	<0.01
Age of specialization, y	11.84 ± 2.52	12.26 ± 2.81	11.70 ± 2.48	11.71 ± 2.35	0.05
Weight, kg	58.7 ± 17.4	61.81 ± 18.5	56.56 ± 15.5	57.76 ± 17.7	<0.01
Females	54.81 ± 13.9	58.50 ± 14.7	53.39 ± 12.4	53.29 ± 14.0	<0.14
Males	62.38 ± 19.5	64.15 ± 20.6	59.36 ± 17.4	63.74 ± 20.2	0.08
BMI, kg/m <sup>2</sup>	21.83 ± 4.4	22.82 ± 4.7	21.47 ± 4.2	21.22 ± 4.3	<0.01
Total physical activity, h/wk	19.00 ± 9.17	18.72 ± 10.04	19.02 ± 8.88	19.25 ± 8.54	0.64
PE class, h/wk	3.16 ± 1.95	3.06 ± 2.04	3.24 ± 1.86	3.16 ± 1.96	0.15
Free play, h/wk	5.59 ± 5.38	6.00 ± 5.79	5.54 ± 5.14	5.25 ± 5.17	0.20
Organized sports, h/wk	10.61 ± 6.26	10.00 ± 6.46	10.55 ± 6.28	11.27 ± 5.99	0.07
Ratio of organized sports:free play ratio >2:1	664 (58.30)	200 (52.63)	219 (57.94)	245 (64.30)	0.01
Median ratio organized sports:free play	1.85	1.43	1.93	2.08	0.05
Main sport is team sport	498 (46.41)	214 (59.94)	157 (44.23)	127 (35.18)	<0.01
Time training for main sport, mo/y	8.67 ± 3.50	7.63 ± 3.67	8.61 ± 3.48	9.67 ± 3.05	<0.01
Training >8 mo/y	352 (31.51)	112 (30.35)	110 (29.57)	130 (34.57)	0.174
Weekly sports hours > age in years	814 (71.47)	239 (62.89)	267 (70.63)	308 (80.84)	<0.01
Specialization					
Low	396 (34.77)	162 (42.63)	128 (33.86)	106 (27.82)	<0.01
Moderate	356 (31.26)	118 (31.05)	138 (36.51)	100 (26.27)	<0.11
High	295 (25.90)	63 (16.58)	84 (22.22)	148 (38.85)	<0.01
Injured	814 (71.47)	268 (70.53)	268 (70.90)	278 (72.97)	0.48
Overuse injury	398 (34.94)	137 (36.05)	129 (34.13)	132 (34.65)	0.68
Serious overuse injury	129 (11.55)	21 (5.69)	53 (14.25)	55 (14.63)	<0.01
Acute injury	271 (23.79)	105 (27.63)	79 (20.90)	87 (22.8)	0.02

BMI, body mass index; PE, physical education; SES, socioeconomic status.

<sup>a</sup>Data are presented as n (%) or mean ± SD.

Table 3. Participant characteristics by race<sup>a</sup>

	Hispanic	White	Black	Asian	Other, Including Multiracial	Not Indicated or Missing	P Value
Participants	69 (6)	731 (63)	183 (16)	28 (2)	111 (10%)	41 (4)	
Males	34 (49.28)	345 (46.31)	119 (64.25)	18 (62.96)	68 (59.43)	26 (61.54)	<0.01
Age, y	13.64 ± 2.23	13.61 ± 2.36	13.79 ± 2.48	14.12 ± 1.84	13.99 ± 2.02	14.00 ± 2.38	0.5
Age started competitive sports, y	8.52 ± 3.25	7.40 ± 2.88	8.84 ± 3.19	9.04 ± 3.01	8.82 ± 3.81	7.87 ± 3.39	<0.01
Age of specialization, y	11.49 ± 2.30	11.81 ± 2.39	12.49 ± 2.81	10.50 ± 2.42	11.71 ± 2.70	11.67 ± 3.41	0.23
SES							
High	2 (2.90)	319 (43.6)	16 (8.7)	10 (35.7)	22 (19.8)	18 (43.9)	<0.01
Middle	21 (30.4)	277 (37.8)	36 (19.67)	14 (50.00)	28 (25.23)	12 (29.27)	<0.01
Low	46 (66.67)	135 (18.47)	131 (71.58)	4 (14.29)	61 (54.95)	11 (26.83)	<0.01
Insurance							
Private	54 (78.26)	644 (89.94)	106 (58.24)	23 (82.14)	64 (58.72)	37 (90.24)	<0.01
Public	15 (21.74)	72 (10.06)	76 (41.76)	5 (17.86)	45 (41.28)	4 (9.76)	<0.01
Weight, kg	53.77 ± 14.73	57.15 ± 17.24	64.55 ± 17.35	61.04 ± 15.98	61.51 ± 16.80	60.38 ± 21.05	<0.01
Females	56.04 ± 17.49	61.40 ± 19.74	64.91 ± 18.98	65.70 ± 17.56	64.69 ± 18.15	66.21 ± 23.85	0.14
Males	51.69 ± 11.53	53.42 ± 13.68	63.93 ± 14.17	53.58 ± 9.75	57.00 ± 13.63	51.06 ± 10.79	<0.01
BMI, kg/m <sup>2</sup>	21.15 ± 3.82	21.43 ± 4.45	23.24 ± 4.33	21.57 ± 3.53	22.83 ± 4.39	21.52 ± 4.49	<0.01
Total physical activity, h/wk	18.26 ± 10.82	19.24 ± 8.60	18.81 ± 10.56	18.04 ± 8.56	18.82 ± 9.67	17.74 ± 9.02	0.84
PE class, h/wk	2.91 ± 1.98	3.14 ± 1.93	3.38 ± 1.95	2.77 ± 2.08	3.32 ± 2.01	2.71 ± 2.03	0.22
Free play, h/wk	6.10 ± 6.16	5.53 ± 5.28	5.89 ± 5.4	4.35 ± 4.89	5.84 ± 5.72	4.80 ± 4.95	0.61
Organized sports, h/wk	9.83 ± 6.93	10.90 ± 5.80	10.03 ± 7.78	10.92 ± 6.09	10.06 ± 6.22	10.36 ± 6.08	0.43
Organized sports:free play ratio > 2:1	36 (52.17)	430 (59.81)	97 (54.19)	19 (70.37)	56 (52.83)	26 (66.67)	0.22
Median ratio organized sports:free play	1.50	2.00	1.20	2.75	1.78	2.67	0.10
Main sport is team sport	44 (66.67)	291 (42.98)	89 (53.61)	9 (36.00)	48 (47.06)	17 (45.95)	<0.01
Time training for main sport, mo/y	7.65 ± 3.80	9.07 ± 3.33	7.75 ± 3.49	8.89 ± 3.71	7.89 ± 4.05	8.75 ± 3.30	<0.01
Weekly sports hours > age in years	20 (29.85)	231 (32.63)	58 (33.53)	5 (19.23)	29 (27.88)	9 (23.08)	0.47
Training >8 mo/y	44 (63.77)	536 (74.55)	116 (64.80)	20 (74.07)	70 (66.04)	28 (71.79)	0.05
Specialization							
Low	34 (49.28)	233 (32.41)	67 (37.43)	10 (37.04)	43 (40.57)	9 (23.08)	0.03
Moderate	17 (24.64)	220 (30.60)	59 (32.96)	9 (33.33)	36 (33.96)	15 (38.46)	0.68
High	11 (15.94)	216 (30.04)	30 (16.76)	6 (22.22)	23 (21.70)	9 (23.08)	<0.01
Injured	50 (72.46)	520 (72.32)	107 (59.78)	24 (88.89)	86 (81.13)	27 (69.23)	<0.01
Overuse injury	35 (50.72)	239 (33.24)	46 (25.70)	15 (55.56)	47 (44.34)	16 (41.03)	<0.01
Serious overuse injury	4 (5.97)	92 (12.99)	9 (5.20)	5 (19.23)	15 (14.42)	4 (10.26)	0.03
Acute injury	10 (14.49)	180 (25.03)	47 (26.26)	4 (14.81)	24 (22.64)	6 (15.38)	0.2

BMI, body mass index; PE, physical education; SES, socioeconomic status.

<sup>a</sup>Data presented as n (%) or mean ± SD.

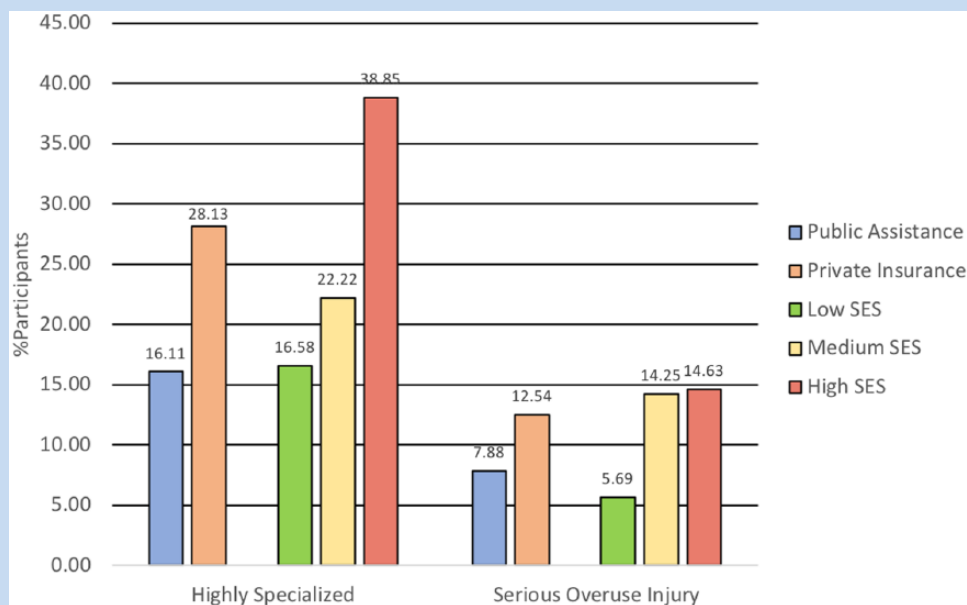


Figure 1. Sports specialization and serious overuse injury risk based on socioeconomic status (SES) and health insurance type.

adjusting for age and hours spent playing sports. A *P* value of <0.05 was considered statistically significant.

## RESULTS

### Participant Characteristics and SES

Of the 1190 athletes with completed sports participation surveys, 1121 (94%) had insurance data and 1139 (96%) had SES data satisfactory for analysis. Comparisons of athletes on private insurance versus public assistance are noted in Table 1. The median estimated annual household income for athletes with public insurance was \$55,123 (95% CI, \$36,896-\$97,479) compared with \$72,817 (95% CI, \$41,549-\$140,473) for athletes with private insurance. SES was further divided based on estimated median annual household income. Median annual household incomes were \$50,080 (95% CI, \$30,624-\$60,383), \$71,379 (95% CI, \$64,284-\$81,039), and \$101,456 (95% CI, 85,740-156,394), for low-, medium-, and high-SES tertiles, respectively, and participant demographics based on SES are reported in Table 2.

Further study characteristics, including details regarding sports specialization, type of training, types of sports (team vs individual), injury type, and participant race, are provided in Tables 1 through 3 and Figures 1 through 4.

## DISCUSSION

The percentage of athletes participating in intensive, year-round specialized sports training increases as SES increases, and athletes with higher SES begin competitive sports at a younger age. This is possibly due to the greater financial cost associated with higher degrees of specialization and greater access to

various types and levels of organized sports for those of higher SES. The proportion of athletes reporting serious overuse injuries increased as SES increased. This may be due to higher degrees of sports specialization and more weekly hours in organized sports among high-SES athletes compared with low-SES athletes. Additionally, high-SES athletes were more likely to participate in individual sports, which may be associated with higher rates of overuse injuries than those seen in team sports and due to the repetition required to perfect the technical skills of the sport.<sup>9,19,20</sup> This may also be due to differences in the balance of time spent in organized sports compared with free play. A greater percentage of high-SES athletes exceeded a 2:1 ratio of weekly hours in organized sports to free play. It is possible that the greater amounts of free play relative to organized sports among low-SES athletes may have played a role in reducing their risk for serious overuse injuries. Unstructured free play may provide exposure to a wider variety of movement patterns and exercise intensities than does organized sports training and therefore may promote more balanced muscle strength and flexibility and enhanced neuromuscular control, which have been shown to reduce the risk for injury.<sup>8,15,16</sup> Additionally, free play is child-driven, which may allow for more self-regulation than adult-driven organized sports training and competition, during which a young athlete may not feel comfortable volunteering symptoms of injury as readily. It may be more difficult for athletes to remove themselves from competition or training (as opposed to removing themselves from free play) when they are fatigued or injured due to concerns this may affect future participation or success in the sport. They also may feel pressure to continue participating so as to avoid disappointing parents, coaches, or

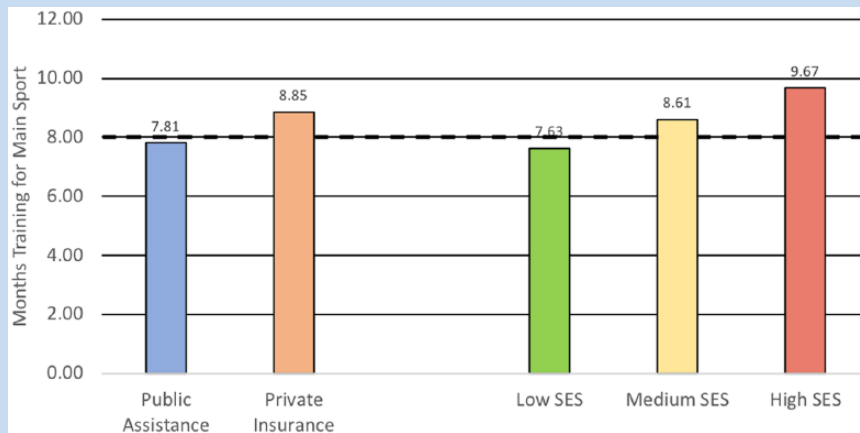


Figure 2. Months athletes spent training for their main sports by insurance type and socioeconomic status (SES).

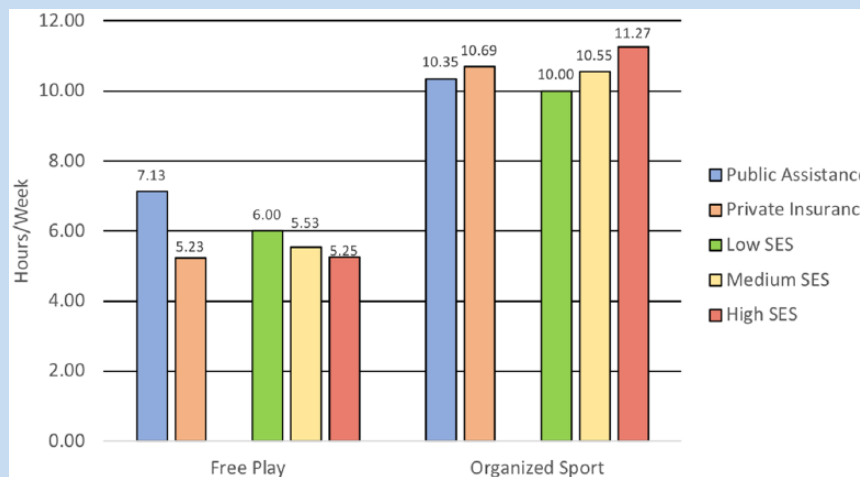


Figure 3. Activity patterns based on socioeconomic status (SES) and insurance type.

teammates or because parents and coaches have invested significant time and financial resources to support and promote their participation.

### SES and Sport Type

Athletes with public health insurance and those in lower SES groups played more team sports, potentially related to a sex-based bias. This is potentially the reason there were more males in the lower SES categories, as males primarily play popular team sports such as football and baseball. SES may influence the selection of sport type, as team sports such as basketball and baseball tend to be more financially accessible as they are commonly offered at schools and park districts where fees are minimal. However, exceptions to this rule exist, as team sports such as hockey and lacrosse may still be expensive while others that do not require significant equipment such as soccer may still have costly elite clubs that recommend early specialization.

However, typically, most individual sports such as tennis and gymnastics are more commonly offered through private clubs or leagues where fees can be high. Individual sports also tend to be more skill based and technical and thus may require more organized practice and coaching to achieve success.

### Limitations

The sports specialization survey developed for this study has not been previously validated, and the cross-sectional design did not allow for calculation of population-based injury rates or relative risk ratios. The sample only included athletes who sought care for their injuries from sports medicine specialists. This likely underestimated the percentage of injuries in low-SES groups, which have limited access to medical care, especially from a specialist. It also may have overestimated the proportion of overuse injuries since acute injuries are more likely to be treated in an emergency department or urgent care center. Also,



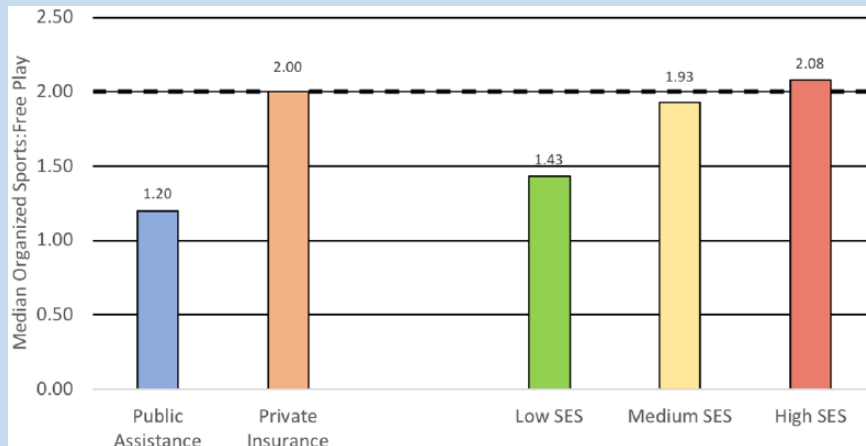


Figure 4. Median organized sports to free play ratios by insurance type and socioeconomic status (SES).

sports participation was self-reported and therefore subject to recall bias. While using zip codes to estimate household incomes may not accurately reflect actual household incomes for our participants, this method of using zip code data to determine SES in population-based studies is widely used and may be the best available tool for estimating household income data for clinical studies.<sup>5,13,18,23</sup>

## CONCLUSION

High-SES athletes had a higher degree of sports specialization and reported more serious overuse injuries than low-SES athletes.

## REFERENCES

- American Academy of Pediatrics. Intensive training and sports specialization in young athletes. *Pediatrics*. 2000;106(1, pt 1):154-157.
- Colabianchi N, Johnston L, O'Malley PM. *Sports Participation in Secondary Schools: Resources Available and Inequalities in Participation—A BTG Research Brief*. Ann Arbor, MI: Bridging the Gap Program, Survey Research Center, Institute for Social Research, University of Michigan, 2012. <http://www.bridgingthegapresearch.org>. Accessed April 30, 2018.
- Community facts. Retrieved from <http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml>. Accessed November 1, 2015.
- DiFiori JP, Benjamin HJ, Brenner JS, et al. Overuse injuries and burnout in youth sports: a position statement from the American Medical Society for Sports Medicine. *Br J Sports Med*. 2014;48:287-288.
- Doctor N, Yang S, Maerzacker S, Watkins P, Dissanaik S. Socioeconomic status and outcomes after burn injury. *J Burn Care Res*. 2016;37:e56-e62.
- Fairclough SJ, Boddy LM, Hackett AF, Stratton G. Associations between children's socioeconomic status, weight status, and sex, with screen-based sedentary behaviours and sport participation. *Int J Pediatr Obes*. 2009;4:299-305.
- Flores G, Bauchner H, Feinstein AR, Nguyen US. The impact of ethnicity, family income, and parental education on children's health and use of health services. *Am J Public Health*. 1999;89:1066-1071.
- Gregory S. How kids' sports became a \$15 billion industry. *Time*. August 24, 2017. <http://time.com/4913687/how-kids-sports-became-15-billion-industry/>. Accessed October 1, 2017.
- Hreljac A. Impact and overuse injuries in runners. *Med Sci Sports Exerc*. 2004;36:845-849.
- Jayanthi N, Pinkham C, Dugas L, Patrick B, Labella C. Sports specialization in young athletes: evidence-based recommendations. *Sports Health*. 2013;5:251-257.
- Jayanthi NA, LaBella CR, Fischer D, Pasulka J, Dugas LR. Sports-specialized intensive training and the risk of injury in young athletes: a clinical case-control study. *Am J Sports Med*. 2015;43:794-801.
- Johnston LD, Delva J, O'Malley PM. Sports participation and physical education in American secondary schools: current levels and racial/ethnic and socioeconomic disparities. *Am J Prev Med*. 2007;33(suppl 4):S195-S208.
- Krieger N, Chen JT, Waterman PD, Soobader MJ, Subramanian SV, Carson R. Choosing area based socioeconomic measures to monitor social inequalities in low birth weight and childhood lead poisoning: The Public Health Disparities Geocoding Project (US). *J Epidemiol Community Health*. 2003;57:186-199.
- Lam LT. Hospitalisation due to sports-related injuries among children and adolescents in New South Wales, Australia: an analysis on socioeconomic and geographic differences. *J Sci Med Sport*. 2005;8:433-440.
- Myer GD, Jayanthi N, DiFiori JP, et al. Sports specialization, part II: alternative solutions to early sport specialization in youth athletes. *Sports Health*. 2016;8:65-73.
- Myer GD, Sugimoto D, Thomas S, Hewett TE. The influence of age on the effectiveness of neuromuscular training to reduce anterior cruciate ligament injury in female athletes: a meta-analysis. *Am J Sports Med*. 2012;41:203-215.
- Pickett W, Garner MJ, Boyce WF, King MA. Gradients in risk for youth injury associated with multiple-risk behaviours: a study of 11,329 Canadian adolescents. *Soc Sci Med*. 2002;55:1055-1068.
- Powell LM, Slater S, Chaloupka FJ, Harper D. Availability of physical activity-related facilities and neighborhood demographic and socioeconomic characteristics: a national study. *Am J Public Health*. 2006;96:1676-1680.
- Roos KG, Marshall SW. Definition and usage of the term "overuse injury" in the US high school and collegiate sport epidemiology literature: a systematic review. *Sports Med*. 2014;44:405-421.
- Roos KG, Marshall SW, Kerr ZY, et al. Epidemiology of overuse injuries in collegiate and high school athletics in the United States. *Am J Sports Med*. 2015;43:1790-1797.
- State Medicaid and CHIP income eligibility standards expressed in monthly income, household size of four. Retrieved from [http://www.medicaid.gov/medicaid-chip-program-information/program-information/downloads/medicaid-and-chip-eligibility-levels-table\\_hhsize4.pdf](http://www.medicaid.gov/medicaid-chip-program-information/program-information/downloads/medicaid-and-chip-eligibility-levels-table_hhsize4.pdf). Accessed November 1, 2015.
- Vella SA, Cliff DP, Okely AD. Socio-ecological predictors of participation and dropout in organised sports during childhood. *Int J Behav Nutr Phys Act*. 2014;11:62.
- Zonfrillo MR, Zaniletti I, Hall M, et al. Socioeconomic status and hospitalization costs for children with brain and spinal cord injury. *J Pediatr*. 2016;169:250-255.

For reprints and permission queries, please visit SAGE's Web site at <http://www.sagepub.com/journalsPermissions.nav>.