CONTACT AND COLLISION SPORTS PARTICIPATION DURING ADOLESCENCE IS ASSOCIATED WITH REDUCED ANXIETY AND DEPRESSIVE SYMPTOMS

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Background: Recently, participation in contact and/or collision youth sports has received attention due to concern over exposure to repetitive head impacts. However, few studies have examined the relative risks and benefits of participation in contact and/or collision sports among young athletes currently engaged in these sports.

Purposes and Hypotheses: We sought to examine whether participation in contact and/or collision sports during adolescence would be associated with quality of life (QOL) among a sample of healthy adolescent athletes undergoing a pre-participation examination. We hypothesized QOL domains scores would be similar between contact/collision and no/limited contact sport athletes.

Methods: We conducted a cross-sectional study of adolescent athletes undergoing a pre-participation physical examination. During the assessment, participants completed a sport participation questionnaire and the Patient-Reported Outcomes Measurement Information System (PROMIS) Pediatric-25 Profile, a measure of health-related quality of life. We grouped patients based on reported organized contact/collision or limited/non-contact sports participation in the past year, as delineated by Rice (2008). We compared PROMIS domain scores between groups using Mann-Whitney U tests, and used multivariable linear regression to identify the association between PROMIS domains scores and contact/collision sport participation while adjusting for
covariates (sex, age, height, history of bone, muscle, ligament, or tendon injury, history of acute fracture or dislocation) in separate models.

**Results:** A total of 281 adolescents participated: 143 (51%) reported contact or collision sport participation in the year prior to the study. There was a significantly greater proportion of females in the no/limited contact sport group compared to the contact/collision sport group (Table 1). There was a significantly greater proportion of contact/collision sport athletes who reported past bone, muscle, ligament, or tendon injuries and acute fracture or dislocation injuries compared to no/limited contact sport athletes (Table 1). Upon univariable comparison, those in the contact/collision sport group reported significantly lower anxiety and depressive symptom domain scores than the no/limited contact sport group (Table 2). After covariate adjustment, contact/collision sport participation was significantly associated with lower anxiety and depressive symptom domain scores (Table 3).

**Conclusion:** Adolescents participating in organized contact/collision sports reported lower anxiety and depressive symptoms than adolescents participating in no/limited contact sports. These results reinforce the need to re-examine assumptions that youth contact/collision sports are necessarily associated with negative quality of life. Future prospective studies will be required to better understand any causal relationship between contact sports and psychological well-being in young athletes, both in the short- and long-term.
Table 1. Demographic and injury history characteristics among both participant groups. Data are presented as means (standard deviation) or n (%).

| Variable                                      | Contact/Collision Sport Group (n=143) | No/Limited Contact Sport Group (n=138) | P value |
|-----------------------------------------------|--------------------------------------|----------------------------------------|---------|
| Female sex                                    | 34 (24%)                             | 91 (66%)                               | < 0.001 |
| Age (years)                                   | 15.1 (1.7)                           | 15.4 (1.2)                             | 0.07    |
| Height (cm)                                   | 170.7 (14.6)                         | 167.9 (8.2)                            | 0.05    |
| Weight (kg)                                   | 64.6 (17.0)                           | 63.2 (15.0)                            | 0.46    |
| Average time training per week (hours)        | 11.6 (4.9)                           | 11.7 (5.0)                             | 0.85    |
| Varsity athlete                               | 52 (36%)                             | 43 (31%)                               | 0.36    |
| History of bone, muscle, ligament, or tendon injury | 73 (51%)                             | 40 (29%)                               | < 0.001 |
| History of acute fracture or dislocation      | 65 (46%)                             | 35 (26%)                               | < 0.001 |
| History of stress fracture                    | 12 (9%)                              | 7 (5%)                                 | 0.26    |
| History of concussion                         | 35 (25%)                             | 27 (20%)                               | 0.29    |
| Organized Sports Played in the Past Year †    | Football: 74                         | Track & Field: 28                      |         |
|                                               | Basketball: 42                       | Cross Country: 20                      |         |
|                                               | Soccer: 29                           | Poms: 17                               |         |
|                                               | Wrestling: 12                        | Volleyball: 15                         |         |
|                                               | Gymnastics: 10                       | Softball: 14                           |         |
|                                               | Martial arts: 10                     | Swimming: 13                           |         |
|                                               | Cheerleading: 6                      | Tennis: 10                             |         |
|                                               | Diving: 2                            | Baseball: 7                            |         |
|                                               | Extreme Sports: 1                    | Golf: 7                                |         |
|                                               | Rugby: 1                             | Dance: 5                               |         |
|                                               | Water Polo: 1                        | Marching Band: 4                       |         |
|                                               | **Total**: 225                       | Football (flag/touch): 2               |         |
|                                               |                                      | Horseriding: 1                         |         |
|                                               |                                      | Racquetball: 1                         |         |

† Participants selected all organized sports they played in the past year, so the total n adds up to > 100%.
Table 2. Univariable PROMIS domain comparisons between contact/collision and no/limited contact sport groups.

| PROMIS Domain          | Contact/Collision Sport Group |               | No/Limited Contact Sport Group |               | P value |
|------------------------|-------------------------------|---------------|-------------------------------|---------------|---------|
|                        | Median [IQR]                  | Mean (95% CI) | Median [IQR]                  | Mean (95% CI) |         |
| Mobility               | 0 [0, 0]                      | 0.09 (0.03, 0.15) | 0 [0, 0]                      | 0.21 (0.12, 0.31) | 0.013   |
| Anxiety                | 0 [0, 2]                      | 1.55 (1.15, 1.94) | 2 [0, 6]                      | 3.26 (2.69, 3.83) | < 0.001 |
| Depressive symptoms    | 0 [0, 1]                      | 0.82 (0.53, 1.12) | 0 [0, 2]                      | 1.88 (1.34, 2.41) | 0.005   |
| Fatigue                | 1 [0, 3]                      | 1.67 (1.27, 2.06) | 1 [0, 3]                      | 2.16 (1.69, 2.62) | 0.087   |
| Peer relationships     | 15 [13, 16]                   | 13.6 (12.9, 14.2) | 15 [12, 16]                   | 13.0 (12.3, 13.7) | 0.183   |
| Pain Interference      | 0 [0, 2]                      | 1.32 (0.91, 1.73) | 0 [0, 2]                      | 1.53 (1.04, 2.02) | 0.81    |
| Pain scale             | 0 [0, 2]                      | 1.08 (0.82, 1.33) | 0 [0, 1]                      | 0.89 (0.60, 1.18) | 0.06    |
Table 3. Effect of contact/collision sport participation on patient reported quality of life outcome measures, adjusting for sex, age, past history of bone, muscle, ligament, tendon injury, bone fracture or dislocation, and height.

|                           | β coefficient | Standard error | 95% CI       | P value |
|---------------------------|---------------|----------------|--------------|---------|
| Mobility                  | -0.106        | 0.065          | -0.235, 0.022| 0.10    |
| Anxiety*                  | -1.072        | 0.387          | -1.834, -0.310| 0.006   |
| Depressive Symptoms*      | -0.807        | 0.344          | -1.484, -0.130| 0.020   |
| Fatigue                   | -0.187        | 0.346          | -0.868, 0.494| 0.59    |
| Peer relationships        | 0.434         | 0.576          | -0.700, 1.568| 0.45    |
| Pain Interference         | -0.118        | 0.369          | -0.845, 0.610| 0.75    |
| Pain scale                | 0.185         | 0.221          | -0.251, 0.621| 0.40    |

*Those in the contact/collision sport participation group reported significantly lower anxiety and depressive symptom scores than those in the limited/non-contact sport participation group after adjusting for potential confounders.