

Brief Report: Behavioral Risk Factors for Youth Soccer (Football) Injury

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Objectives By most reports, soccer (football) is among the most played and most popular sports in the world. This study prospectively examined behavioral risk factors for youth soccer injury. **Method** Sixty 11- and 12-year-old boys who played on six teams in a suburban recreational soccer league were followed over the course of a season. Six predictors were assessed prior to the start of the season via self-report measures from coaches, parents, and the players themselves: inhibition, aggression, risk-taking, skill, experience playing soccer, and physical size. All games were videotaped, and tapes were reviewed to record players' collisions with other players, fouls, falls during the course of play, and injuries. **Results** Greater skill and less experience playing soccer best predicted injury risk. Inhibition, aggression, and risk-taking did not emerge as predictors. **Conclusion** Results are discussed with respect to previous research in youth sport and general pediatric injury risk.

Key words injury; personality; safety; soccer; temperament.

By most reports, soccer (also called football) is among the most played and most popular sports in the world [Committee on Sports Medicine and Fitness (COSMF), 2000; Metzl & Micheli, 1998]. Figures are somewhat imprecise, but reputable administrative bodies estimate over 200 million individuals worldwide, including about 13 million American children, play soccer regularly (COSMF, 2000; May, 1998; Metzl & Micheli, 1998).

Risk for injury in youth soccer is between .6 and 35.0 per 1000 hr played, depending on the definition of injury; whether rates are computed only for games or both games and practices; and the age, gender, and skill level of the players (COSMF, 2000; Junge & Dvorak, 2004). Risk is generally highest among older players; during games rather than practices; and, in some studies, among boys. About half of injuries reported from youth soccer occur as a result of player-to-player contact, typically when one player tackles another in an attempt to retrieve the ball (COSMF, 2000; Emery, Meeuwisse, & Hartmann, 2005). The present study focuses on such contact injuries, examining several behavioral risk factors (temperament and personality, player experience, player skill, and player size) as potential contributors

to injury risk among pre-adolescent male youth soccer players.

Temperament and personality traits such as impulsivity, inhibitory control, sensation-seeking, and aggression are established predictors of children's overall, nonathletic injury risk (Schwebel & Barton, 2006), but inconsistently predict youth sport injury (Bredemeier, Weiss, Shields, & Cooper, 1986; Daino, 1985; Smith, Ptacek, & Smoll, 1992). To examine this issue further, we targeted three traits in this study: inhibitory control (capacity to plan and to suppress inappropriate responses), aggression (hostile, aggressive actions, including person- and object-directed physical violence, verbal aggression, and hostile reactivity), and risk-taking [willingness and desire to try novel activities and experiences without fear (Capaldi & Rothbart, 1992)].

We also considered players' experience, skill, and size. Experienced and skilled players may be protected from injury because they develop greater ability to control themselves and recognize safe but skillful soccer maneuvers. Although research on experience is sparse, previous work does suggest that players of the same age, but who play in higher-skill leagues, have lower risk of

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injury (Peterson, Junge, Chomiak, Graf-Baumann, & Dvorak, 2000). Our inclusion of size was driven by developmental issues. The target group, boys aged 11–12 years, is entering puberty and therefore displays wide variation in height and weight. Smaller children—those not yet beginning pubertal development—might have increased risk, particularly when colliding with larger opponents.

We recruited sixty 11- and 12-year-old boys from six teams in a single youth soccer league. Parents, coaches, and players themselves completed brief personality and temperament questionnaires prior to the season. Parents also reported basic demographic and soccer history data, and coaches provided player skill ratings. All games in a single season were videotaped, and subsequently coded for injury, fall, collision, and foul rates.

Methods

Procedure

Consistent with recent consensus guidelines on the study of soccer injuries (Fuller et al., 2006), the three-phase study was conducted prospectively, over the course of an 8-week season. The cohort was comprised of players on all six teams in a metropolitan league.

Phase I occurred during the earliest practices of each team's season, before interteam games were played. Researchers distributed packets containing consent forms and questionnaires to players' parents, and packets were collected at each practice prior to the beginning of games. Following the team's last practice but prior to the first game (most teams held 6–8 practices before the games), coaches completed a brief survey on each player (see "Measures" section).

Phase II of the study began when teams began playing games. Some teams participated in pre-league tournaments, which included teams from leagues in other regional cities, and these games were included in the data. Other teams only played the intraleague round-robin, which included one game against each of the other five teams in the league. On average, teams played 6.33 games ($SD = 1.51$, range = 5–8) that were included in this study. All games played over the course of the spring season were included. The third and final phase of the study was comprised of reviewing videotapes of all games the teams played and coding behaviors of interest.

Participants

Sixty boys (roughly 70% of those eligible; the remaining 30% failed to provide consent for a variety of reasons)

participated. All were aged 11 or 12 years ($M = 12.02$ years, $SD = 0.36$) and most (94%) were Caucasian. The teams were all based in suburban areas and were comprised of competitive, skilled players. Several of the teams traveled within the region to play in youth soccer tournaments. Three of the six teams were coached by fathers of players.

Families were generally well-educated and financially comfortable (median education of both mothers and fathers was a 4-year university degree; median family income between \$80,000 and \$100,000). All parents and coaches provided signed informed consent to participate in the study, all children provided signed assent, and all procedures were approved by the university IRB. Behavior by children on the teams whose parents did not provide consent was not coded or analyzed for this study. As token compensation, all players and coaches on the teams (including players who did not participate) were given a bottle of sports energy drink following the final game.

Measures

Demographic and Soccer History Questionnaires

Parents completed a basic questionnaire concerning child and family demographic information, including the child's height and weight. Parents also completed a brief questionnaire assessing their son's history of playing soccer, including the number of seasons played, the age at which the child started playing organized soccer, and the child's history of previous soccer-related injuries.

Early Adolescent Temperament Questionnaire-Revised (EATQ-R)

The EATQ-R (Capaldi & Rothbart, 1992) is a well-validated measure of early adolescent temperament normed for children aged 9–15 years. Items (62 on parent form, 65 on adolescent form) are answered using a 5-point scale. Three subscales were of particular interest: inhibitory control, fear, and aggression.

Coaches Survey

Each coach responded to four questions relating to players' skill and personality (impulsivity, risk-taking, and aggression) on a 5-point Likert scale. One coach consented to his team participating, but refused to complete surveys. A second coach rated all players on his team as 5 (the best possible score) in skill; those scores were not analyzed. These missing data left 47 usable ratings of player personality and 39 of player skill for analysis.

Because videotapes did not always capture the identity of players substituted during the game, at the end of the season, coaches estimated how many minutes each child played in a typical game. This report (adjusted for the number of games played) accounted for exposure opportunity.

Behavioral Measures

Coders reviewed videotapes of all games each team played, recording each instance of the following activities (note that many events were coded under multiple categories since a single collision could occur concurrently with a foul, fall, and/or injury):

- Collision—forceful contact between two or more players that occurred because one player was trying to gain a better position or to retrieve the ball; also recorded when two players incurred physical contact that resulted in one or both players showing visible signs of pain, falling down as a result of the contact, experiencing an injury that required adult attention, or if the coder or the referee at the game judged that a foul had been committed when the contact occurred;
- Fall—player's knee or rear end touched the ground for any length of time;
- Injury—incident serious enough to require an adult (coach, parent, or referee) to attend to the player, or requiring the player to leave the game for any length of time (Emery et al., 2005); and
- Foul—illegal behavior, as outlined in the official rules of the game of soccer, that involved contact with other players. Fouls witnessed by the coders, all of whom had experience playing in recreational soccer leagues, were recorded as coder-identified fouls. Fouls whistled by the referees during the live games were recorded as referee-identified fouls.

To establish interrater reliability, 24% of the games were independently reviewed by two researchers. Percentage agreement (proportion of agreement over agreements plus disagreements) in recognition of collisions was 81. Recognition of injuries matched 100%. Within matched observations of collisions, kappa measures of agreement on ratings of referee-identified fouls, coder-identified fouls, falls, and injuries were strong (range from 0.88 to 1.00).

Analytic Plan

Analyses were conducted in four steps: (a) examination of descriptive data and aggregation of measures of the same construct into composite scores; (b) consideration of injuries, and factors related to those injuries; (c) correlational analyses between predictor and outcome

variables; and (d) regression models predicting injury-risk outcome behaviors.

Results

Players were a mean of 58.17 in. (147.75 cm; $SD = 2.73$ in. or 6.93 cm) tall and weighed a mean of 87.25 pounds (39.58 kg; $SD = 15.24$ lb or 6.91 kg). Both coaches and parents rated the players as fairly skilled (3.87 and 4.11, respectively, on the 5-point scale). Players had a good bit of soccer experience—on average, they began playing organized soccer at age 5 years and had played 11 seasons (including spring, summer, and fall seasons) previously. Players experienced an average of 4.90 ($SD = 4.89$) collisions for each hour of soccer they played, and 1.26 ($SD = 1.33$) falls per hour. Referees ($M = 0.26$, $SD = 0.50$) and researchers ($M = 0.27$, $SD = 0.52$) both noted about one contact foul for every 4 hr played. On average, players experienced 0.02 ($SD = 0.06$) injuries per hour played, or 19.12 injuries per 1000 player-hours. Mean aggression ratings by coach, parent, and child, respectively, were 2.64 ($SD = 1.05$), 2.27 ($SD = 0.54$), and 1.91 ($SD = 0.52$); mean inhibition ratings were 3.51 ($SD = 1.04$), 3.85 ($SD = 0.46$), and 3.77 ($SD = 0.59$); and mean risk-taking ratings were 3.04 ($SD = 0.95$), 2.47 ($SD = 0.62$), and 2.71 ($SD = 0.72$).

Seven composite measures were created: size, skill, experience, aggression, inhibition, risk-taking, and fouls. In all cases, variables were standardized, reflected as appropriate, and then aggregated. In case of missing data, aggregates were created from available data points. The player-size composite included players' height, weight, and BMI (average intercorrelation = .59). The player-skill composite comprised parent and coach ratings of skill ($r = .43$). The player-experience composite included the age at which the player first played organized soccer (reversed) and the number of seasons he had played ($r = .69$). The aggression, inhibitory control, and risk-taking composites were each created by aggregating coach, parent, and child ratings of those traits (average intercorrelations = .07, .26, and .19, respectively). Finally, the fouls composite included referee and researcher reports of fouls ($r = .98$ between the count of referee fouls and researcher fouls; agreement between referee and researcher was also high, $\kappa = .90$).

Study participants incurred just six injuries during the season: four to the lower extremities, one to the face, and one to the back. No player had more than one injury. Low variance of the measure prohibited inferential statistics, so we used fouls, collisions, and falls as proxy measures for injury instead. This decision was supported

by previous research, which suggests that youth soccer injuries are incurred most frequently in situations of player-to-player contact (COSMF, 2000; Emery et al., 2005; Kakavelakis, Vlazakis, Vlahakis, & Charissis, 2003; Peterson et al., 2000) and that many are the result of illegal play (Peterson et al., 2000).

As an empirical test of the validity of using falls, collisions, and fouls as proxies for injury risk, we considered how they correlated with parent-reported history of soccer injury in this sample. Parents responded to two questions about children's injury history: (a) number of times the child required attention from an adult (such as a coach or parent) due to an injury while playing soccer in the past 12 months (answered on 4-point scale from none to six or more; $M=1.86$, $SD=0.80$), and (b) number of times in the child's

lifetime he required attention from a doctor/dentist due to soccer injury ($M=0.49$, $SD=1.07$). Both measures correlated well with collisions, falls, and fouls per hour (for less major injuries over the past year, $r(49)=.39$, $p=.01$; $.43$, $p<.01$; and $.25$, $p<.10$, respectively; for more major lifetime injuries, $r(49)=.46$, $.44$, and $.47$, $ps<.05$, respectively).

Table I displays an intercorrelation matrix. The skill and size composites both correlated moderately with experience. Skill also correlated positively with risk-taking. Otherwise, no predictor variables intercorrelated. The outcome variables were highly intercorrelated. Relations between predictors and outcomes were scattered, but generally modest. The strongest correlations were between size and falls—smaller players were more likely to fall, and between experience and all three outcomes—more experienced players were less likely to have collisions, falls, and fouls.

Table II shows three regression models, predicting each of the outcome variables. Multicollinearity diagnostics indicated low levels of collinearity (all tolerance levels $<.90$). Two composites emerged consistently as the strongest predictors of injury risk—lesser experience and greater skill. Experience significantly predicted collisions and fouls, and emerged as a trend in the model predicting falls. Skill significantly predicted falls, and emerged as a trend in the model predicting collisions. Smaller size also emerged as a trend in the model predicting falls.

Discussion

Results suggest that less-experienced and more-skilled players had the greatest risk for injury in this prospective study of injury risk among pre-adolescent male youth soccer players. Temperament and personality measures were not related to injury risk.

Unlike previous work suggesting that same-aged players in higher-skill leagues have lower injury risk

Table I. Correlation Matrix ($N=60$)

Variable	2	3	4	5	6	7	8	9
Predictors								
1. Skill composite	.18	.41***	.26*	.03	.28**	.22	.26*	.10
2. Size composite	–	.40***	.09	–.03	.08	–.27*	–.33**	–.13
3. Experience composite	–	–.05	.18	.18	–.33**	–.30**	–.36***	
4. Aggression composite		–	–.17	.19	.04	.03	.09	
5. Inhibition composite			–	–.09	.01	–.08	–.01	
6. Risk-taking composite				–	.17	.02	.16	
Outcomes								
7. Collisions per hour						–	.91***	.77***
8. Falls per hour							–	.67***
9. Fouls per hour								–

* $p<.10$, ** $p<.05$, *** $p<.01$.

Table II. Regression Models Predicting Injury Risk ($N=60$)

Variable	Collisions/hour ($R^2=.30$)			Falls/hour ($R^2=.28$)			Fouls/hour ($R^2=.24$)		
	B	SE B	β	B	SE B	β	B	SE B	β
Skill composite	1.97	0.99	.34*	0.64	0.27	.41**	0.32	0.22	.26
Size composite	–1.05	0.91	–.17	–0.43	0.25	–.27*	0.03	0.21	.02
Experience composite	–2.35	0.93	–.43**	–0.50	0.25	–.34*	–0.61	0.21	–.52***
Aggression composite	–.01	1.35	–.00	0.04	0.36	.02	–0.16	0.30	–.09
Inhibition composite	1.34	1.21	.16	0.14	0.33	.07	0.08	0.27	.04
Risk-taking composite	1.44	1.03	.20	0.00	0.28	.00	0.36	0.23	.23

* $p<.10$, ** $p<.05$, *** $p<.01$.

(Peterson et al., 2000), we found skilled players had somewhat greater risk for injury, particularly as measured by risk for falls. The two studies differ in a critical way. Peterson et al. compared players in different leagues and found that the players in the league with the higher skill level had fewer injuries. Our study considered players within the same league, and discovered that greater skill predicted more injuries. It seems plausible that the better players within a particular league are more actively engaged in the game. They are likely to touch the ball more frequently and to experience action more frequently—and therefore have greater exposure to contact, collisions, and risky situations. Thus, our finding that the more-skilled players had greater risk for injury might simply be an artifact of skill causing them to be engaged in more active, involved play.

In the Peterson and colleagues (2000) study, where the comparison was made across leagues rather than across players, the confounding influence of the more-skilled players being likely to be more active, engaged players is mute. In that case, the more-skilled players might avoid injury due to their experience with similar situations in the past. This possibility is supported by our finding that the players with greater experience playing soccer had less risk for injury. Experience might help players avoid injury because they have encountered similar situations before—and know how to engage in safe but competent play without placing themselves at risk. Inexperienced players might not recognize the danger involved in particular maneuvers or plays.

Inhibition, aggression, and risk-taking did not predict injury risk in our study. To explore the result more thoroughly, we computed post hoc correlations between the nonaggregated coach, parent, and child reports of temperament and personality and the three dependent measures of collisions, falls, and fouls. Results were similar: No statistically significant correlations emerged. This finding, although consistent with previous work with high school basketball, wrestling, and gymnastics teams (Smith et al., 1992), contradicts a large literature suggesting temperament and personality are related to children's general risk for injury (Schwebel & Barton, 2006).

It is challenging to speculate why neither inhibition nor aggression correlated with youth soccer injury risk. One possibility is idiosyncrasies in this data set; further research is recommended. Another explanation is that youth soccer injuries (and perhaps pediatric athletic injuries more broadly) are caused by a range of environmental, intrapsychic, and interpersonal

differences, but not by temperament or personality differences as general pediatric injuries are. A third possibility is that the personality measures used in this study were general individual difference measures, and were not taken from the sport psychology literature. The fields of sport psychology and sport personology remain mixed on whether general measures should be used to predict sport performance and sport injury risk, with some arguing that sport-specific or sport-relevant measures might yield more accurate results (Auwuele, Nys, Rzewnicki, & Van Mele, 2001; Deaner & Silva, 2002).

Like all empirical research, this study had limitations. The sample was comprised only of 11- and 12-year-old boys in a single suburban area, almost all of whom were Caucasian and from financially comfortable families. Further, the sample size may not have been large enough to capture small effect sizes. Power to detect medium and large effect sizes ($\alpha = .05$, $N = 60$), respectively, was .67 and .99 for the correlations and .53 and .92 for the regressions.

The study was also limited by measurement issues. We obtained reports from multiple informants, but all individual difference data were self-reported. As is typically the case in the temperament and personality literature (Rothbart & Bates, 1998), child-, parent-, and coach-reports corresponded poorly. One factor may be the use of nonstandardized, single-item questions with coaches; another may be the fact that constructs were not universally defined. A second measurement limitation is the use of videotapes. The photographers, all research assistants, followed the action of the ball but did not capture the full field. It is conceivable that collisions and falls were missed because they occurred off-camera, away from the action of the ball.

As to future research, perhaps the most pressing matter is the fact that there are numerous behavioral influences on child soccer injury risk that we did not assess. Among those that might be particularly important to examine in future research are coaching styles and influences (how much does the coach encourage aggressive play among the players?); parenting influences (do parents encourage cautious or aggressive play?); referee influences (a "strict" referee who sets the principle of a closely monitored game might elicit less risk-taking than a more permissive referee who encourages or allows more physical contact during play); developmental influences (would findings hold across different age groups?); and gender influences (would findings hold among samples of girls?). Future research—including studies with larger samples and longer

designs to enable “accumulation” of actual injury events and avoid use of proxy measures—should address these and other important questions in this still-very-youthful field of inquiry.

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