

Validation of the Sport Fitness Index for Quantification of Injury Effects on Functional Status

Marlee Gross, MS, ATC, Sean Shelton, MS, ATC, CSCS, Gary B. Wilkerson, EdD, ATC, Carrie Baker, PhD, ATC



BACKGROUND AND PURPOSE

- The NCAA documented 182,000 injuries among athletes participating in 15 sports over a 16-year period¹
 - Research evidence has documented that targeted interventions for modifiable risk factors can prevent injury²
- Individualized risk assessment should include self-ratings of past injury effects on performance capabilities³
 - Modified musculoskeletal outcome surveys can be used for pre-participation examination (PPE) risk assessment
- The Sport Fitness Index (SFI) is a 10-item survey that numerically represents global function on a 0-100 scale⁴
 - Analyses of 5 well-validated survey instruments guided development of items most relevant to injury risk
- The purposes of this study were to validate the Sports Fitness Index (SFI) as a tool for injury risk prediction and to assess its potential value for representation of change in functional status among high school and college athletes

PARTICIPANTS AND PROCEDURES

- Survey completed at PPE by 84 high school and 186 NCAA Division I college athletes
 - High school football (HS FB); n=84; 15.2 ± 1.2 years; 179.5 ± 8.2 cm; 81.0 ± 16.6 kg
 - College football (College FB); n=73; 19.9 ± 1.3 years; 185.5 ± 6.5 cm; 104.6 ± 20.2 kg
 - Other college sports combined (College Other); n=113
 - Male: cross country/track & field, tennis, wrestling; n=40
 - 19.4 ± 1.4 years; 175.2 ± 7.0 cm; 76.8 ± 15.9 kg
 - Female: cross country/track & field, golf, soccer, softball, tennis, volleyball; n=73
 - 19.3 ± 1.2 years; 169.2 ± 8.0 cm; 64.6 ± 7.5 kg
- 0-100 score and injury data derived from survey administration during PPE and following regular season play
 - Injury definition: Any self-reported sprain or strain that required evaluation and treatment
 - Injury data obtained from self-reported history for prior 12 months and at the end of season
 - Follow-up limited to participants who were present for post-season survey administration
- Separate analyses performed for high school football, college football, and other college sports combined
 - Receiver operating characteristic (ROC) analyses identified both retrospective and prospective SFI cut-points
 - Cross-tabulation analyses performed to assess associations between SFI score and injury occurrence
 - Retrospective association of PPE SFI score to injury sustained during prior 12 months
 - Association of retrospectively derived PPE SFI score cut-points to subsequent injury during season
 - Association of prospectively derived PPE SFI score cut-points for prediction of injury during season
 - Retrospective association of SFI score change from PPE to post-season with injury occurrence

RESULTS

- Substantial associations between PPE SFI score and prior injury were evident for all 3 cohorts (Table 1)
 - Cut-points for 12-month injury history comparable for all 3 cohorts (84-86)
- Retrospectively derived cut-points demonstrated value for prediction of subsequent injury during season (Table 2)
 - Post-season injury reports obtained from 55 of 84 HS FB, 54 of 73 College FB, and 78 of 113 College Other
 - Comparable sensitivity and specificity values for HS FB and College FB; poor specificity for the other cohort
 - SFI score association with previous or subsequent injury graphically presented in Figures 1-3
- Prospectively derived cut-points improved injury prediction sensitivity for HS FB and College Other (Table 3)
 - Good sensitivity, but relatively poor specificity for all 3 cohorts
- Association of injury occurrence with change in SFI score from PPE to post-season evident (Table 4)
 - A ≥ 4-point change was associated with an injury having occurred during the season for all 3 cohorts

TABLE 1

Sport	n	Cut-point	Sensitivity	Specificity	OR	CI (90%)	P-value
HS FB	84	≤ 84	81	63	7.0	3.04, 16.12	<.001
College FB	73	≤ 86	74	63	4.6	1.93, 11.06	.003
College Other	113	≤ 86	87	64	11.6	5.32, 25.44	<.001

TABLE 2

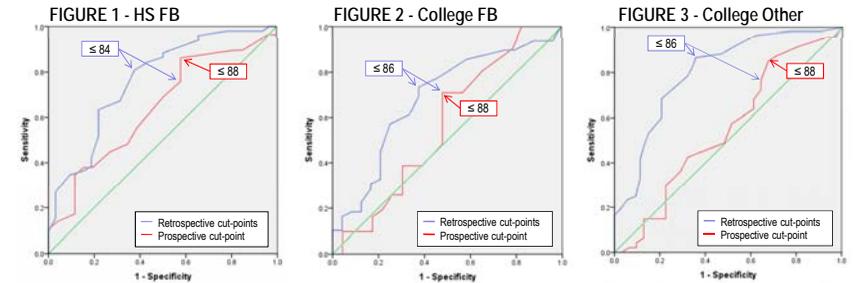
Sport	n	Cut-point	Sensitivity	Specificity	OR	CI (90%)	P-value
HS FB	55	≤ 84	69	50	2.2	0.88, 5.59	.123
College FB	54	≤ 86	71	52	2.7	1.04, 6.87	.075
College Other	78	≤ 86	77	36	1.8	0.78, 4.16	.183

TABLE 3

Sport	n	Cut-point	Sensitivity	Specificity	OR	CI (90%)	P-value
HS FB	55	≤ 88	83	42	3.5	1.25, 9.95	.040
College FB	54	≤ 86	71	52	2.7	1.04, 6.87	.075
College Other	78	≤ 88	85	32	2.7	1.08, 6.85	.063

TABLE 4

Sport	n	Change in Score	Sensitivity	Specificity	OR	CI (90%)	P-value
HS FB	55	≥ 4	52	69	2.4	0.95, 6.10	.097
College FB	54	≥ 4	61	87	10.5	3.22, 34.54	<.001
College Other	78	≥ 4	79	52	3.9	1.72, 9.07	.006



CLINICAL RELEVANCE

- The results confirm that persisting effects of previous injury elevate risk for subsequent injury during sport season
 - PPE SFI score in the ≤ 84-88 range indicates that athletes like those in our cohorts have elevated injury risk
- Optimal SFI cut-point for injury prediction appears to differ for specific populations defined by sport and level
 - Lesser discriminatory power for cut-point derived retrospectively than prospectively, but still valuable
 - Slightly poorer sensitivity and slightly improved specificity compared to prospective cut-point
 - High specificity advantageous to identify smallest subset of athletes likely to benefit most from intervention
- PPE to post-season SFI score change offers insight into effects of in-season injury on functional status
 - As little as a 4-point score decrease identified athletes who had sustained an injury during the season
 - Can be used to document post-season functional status and to identify need for post-season intervention
- SFI score may also have utility for serial assessment of functional status throughout sport season
 - May be used as a time-dependent covariate for assessment of factors that increase injury hazard

REFERENCES

- Hootman JM, Dick R, Agel J. Epidemiology of collegiate injuries for 15 sports: summary and recommendations for injury prevention initiatives. *J Athl Train.* 2007;42(2):311-319.
- Parkari J, Kuala U, Kannus P. Is it possible to prevent sports injuries? Review of controlled clinical trials and recommendations for future work. *Sports Med.* 2001;31(14):985-995.
- Sciascia A, Haegele LE, Lucas J, Uhl TL. Preseason perceived physical capability and previous injury. *J Athl Train.* 2015;50(9):937-943.
- Wilkerson GB, Colston MA, Baker CS. A sports fitness index for assessment of sport-related injury risk. *Clin J Sport Med.* 2015; doi:10.1097/JSM.0000000000000280