

Supplemental Table 1. Comparison of Uninjured and Injured Operators' Values

Variable	Uninjured Group				All Injuries				Lower Extremity Injuries				Upper Extremity Injuries				Spine Injuries							
	n	Mean ± SD	Median	IQR ^a	n	Mean ± SD	Median	IQR ^a	P Value	n	Mean ± SD	Median	IQR ^a	P Value	n	Mean ± SD	Median	IQR ^a	P Value	n	Mean ± SD	Median	IQR ^a	P Value
Demographics																								
Age, yr ^{b,c}	48	31.4 ± 4.6	30.0	29.0, 33.0	47	32.5 ± 5.3	31.5	27.0, 33.8	.296	26	32.2 ± 5.2	31.5	28.0, 32.8	0.802	17	34.2 ± 5.6	35.0	26.0, 36.8	0.039 ^e	23	32.7 ± 5.1	32.0	31.3, 39.5	.580
Height, cm	48	179.7 ± 4.9	180.3	176.5, 182.9	47	178.7 ± 6.3	179.5	174.7, 181.0	.377	26	179.3 ± 6.5	179.7	175.9, 182.2	0.960	17	177.4 ± 7.3	177.8	172.9, 180.3	0.158	23	179.8 ± 6.9	177.6	171.5, 186.0	.627
Weight, kg ^{c,f}	48	86.1 ± 10.5	83.3	79.1, 91.8	47	85.8 ± 11.2	82.4	75.2, 87.5	.515	26	87.6 ± 12.3	82.4	76.2, 87.0	0.354	17	84.1 ± 12.8	79.4	71.6, 88.0	0.210	23	89.9 ± 12.7	87.3	77.3, 100.6	.131
Body mass index, kg/m ^{2,c,f}	48	26.6 ± 2.9	25.4	24.0, 27.5	47	26.6 ± 2.5	25.8	23.9, 27.1	.870	26	27.2 ± 2.9	25.8	23.4, 26.8	0.279	17	26.6 ± 2.7	25.1	23.9, 27.1	0.835	23	27.8 ± 2.9	27.7	25.9, 29.4	.046 ^g
Physiology																								
Body fat, % ^c	48	17.0 ± 4.2	15.1	13.0, 18.7	47	17.6 ± 6.3	14.8	9.2, 18.4	.612	26	18.0 ± 6.2	13.6	8.9, 19.3	0.761	17	17.3 ± 7.4	14.8	8.5, 17.2	0.971	23	18.6 ± 6.3	18.5	12.0, 21.7	.171
Anaerobic power, W/kg	19	14.1 ± 1.0	14.3	13.6, 14.7	21	13.7 ± 1.7	13.7	11.9, 15.6	.321	12	13.3 ± 1.8	12.7	11.3, 15.2	0.084	11	14.4 ± 1.6	14.8	13.1, 15.9	0.156	8	13.5 ± 1.5	13.2	11.8, 14.7	.418
Anaerobic capacity, W/kg ^c	19	8.5 ± 0.8	8.8	8.5, 9.0	21	8.6 ± 1.2	9.0	8.6, 9.6	.698	12	8.4 ± 1.4	9.0	8.7, 9.8	0.573	11	8.6 ± 1.1	8.9	8.6, 10.4	0.794	8	8.4 ± 0.9	8.9	8.1, 9.3	.678
VO ₂ max, mL/min/kg ^c	45	47.8 ± 4.8	49.3	47.8, 53.0	45	46.0 ± 4.9	48.0	46.1, 52.9	.098	25	45.8 ± 4.1	48.0	46.03, 52.33	0.201	16	47.8 ± 5.7	46.9	46.4, 52.9	0.439	22	44.8 ± 3.9	46.9	42.8, 54.4	.013 ^g
Strength																								
Extension, % Body mass																								
Left knee ^c	40	234.10 ± 30.58	222.73	202.90, 236.62	38	222.27 ± 44.16	224.16	201.92, 276.19	.175	20	214.06 ± 34.87	224.16	204.75, 267.99	0.051	NA	NA	NA	NA	NA	18	211.08 ± 46.68	223.10	187.75, 266.27	.036 ^g
Right knee	40	239.71 ± 32.75	235.86	212.79, 254.55	38	239.02 ± 46.69	245.54	207.23, 287.60	.940	20	221.19 ± 38.78	224.72	198.55, 266.11	0.017 ^g	NA	NA	NA	NA	NA	18	238.78 ± 49.92	265.26	242.65, 282.61	.944
Flexion, % Body weight																								
Left knee ^c	40	128.35 ± 23.62	120.28	105.45, 150.20	38	123.35 ± 22.15	125.77	106.87, 147.64	.338	20	120.45 ± 22.58	134.59	107.11, 144.59	0.348	NA	NA	NA	NA	NA	18	119.31 ± 21.54	109.88	101.01, 134.74	.165
Right knee ^c	40	130.27 ± 21.10	127.45	121.00, 138.64	38	127.40 ± 25.61	122.39	108.15, 148.95	.726	20	125.88 ± 24.08	132.14	112.81, 144.36	0.991	NA	NA	NA	NA	NA	18	123.40 ± 24.52	109.93	93.39, 150.68	.258
Flexion/extension ratio																								
Left knee	40	0.55 ± 0.07	0.56	0.49, 0.62	38	0.56 ± 0.08	0.54	0.53, 0.60	.434	20	0.57 ± 0.08	0.54	0.52, 0.61	0.504	NA	NA	NA	NA	NA	18	0.58 ± 0.10	0.53	0.47, 0.54	.554
Right knee ^{c,e,f}	40	0.55 ± 0.09	0.56	0.50, 0.62	38	0.55 ± 0.13	0.55	0.43, 0.61	.624	20	0.58 ± 0.16	0.58	0.50, 0.63	0.308	NA	NA	NA	NA	NA	18	0.53 ± 0.15	0.40	0.39, 0.55	.297
Internal rotation, % Body weight																								
Left shoulder ^{c,d}	40	57.18 ± 11.66	57.37	52.12, 67.87	39	58.32 ± 12.15	57.09	47.21, 62.49	.505	NA	NA	NA	NA	NA	16	57.25 ± 11.71	54.86	45.96, 61.55	0.893	NA	NA	NA	NA	NA
Right shoulder ^d	40	61.34 ± 13.17	62.62	56.36, 71.70	39	58.02 ± 11.78	55.43	49.18, 65.88	.242	NA	NA	NA	NA	NA	16	57.49 ± 11.37	55.43	47.56, 64.12	0.407	NA	NA	NA	NA	NA
External rotation, % Body weight																								
Left shoulder ^{c,d,f}	40	38.33 ± 4.79	38.76	37.50, 43.93	39	42.07 ± 8.84	41.27	35.98, 46.79	.164	NA	NA	NA	NA	NA	16	39.99 ± 7.02	38.87	34.31, 43.51	0.724	NA	NA	NA	NA	NA
Right shoulder ^{d,f}	40	39.01 ± 5.01	39.83	35.41, 42.55	39	41.39 ± 8.30	41.89	37.66, 48.77	.192	NA	NA	NA	NA	NA	16	39.82 ± 6.21	41.86	36.73, 45.00	0.990	NA	NA	NA	NA	NA
Protraction, % Body weight																								
Left shoulder	44	434.75 ± 113.33	496.53	390.52, 588.89	46	429.52 ± 114.72	455.89	397.63, 507.53	.828	NA	NA	NA	NA	NA	17	440.42 ± 111.37	427.97	340.63, 510.54	0.738	NA	NA	NA	NA	NA
Right shoulder	44	463.08 ± 98.92	503.83	439.15, 555.60	46	469.99 ± 113.29	496.49	447.49, 523.72	.759	NA	NA	NA	NA	NA	17	473.13 ± 95.70	502.40	448.82, 527.81	0.780	NA	NA	NA	NA	NA
Retraction, % Body mass																								
Left shoulder	44	507.45 ± 123.14	513.95	429.41, 620.48	46	487.80 ± 150.31	504.25	465.62, 580.51	.500	NA	NA	NA	NA	NA	17	498.45 ± 144.30	492.14	433.36, 580.51	0.973	NA	NA	NA	NA	NA
Right shoulder	44	478.22 ± 110.74	529.64	426.50, 630.12	46	471.65 ± 133.28	486.80	419.92, 544.98	.800	NA	NA	NA	NA	NA	17	481.80 ± 152.11	511.50	447.69, 643.99	0.797	NA	NA	NA	NA	NA
Trunk extension, % Body mass ^{c,d,f}	48	324.84 ± 72.44	321.59	284.48, 356.88	47	299.66 ± 82.87	273.05	238.61, 335.76	.036 ^g	26	298.31 ± 102.23	261.21	222.89, 409.69	0.062	NA	NA	NA	NA	NA	23	301.63 ± 92.18	273.05	232.41, 409.16	.241
Trunk flexion, % Body mass	48	200.08 ± 36.77	178.78	172.84, 204.38	47	186.21 ± 30.40	185.65	155.31, 208.47	.048 ^g	26	181.00 ± 31.50	179.26	149.20, 210.39	0.032 ^g	NA	NA	NA	NA	NA	23	187.46 ± 34.04	173.97	157.39, 213.51	.358
Trunk flexion:extension ratio ^{c,d,f}	48	1.66 ± 0.42	1.79	1.48, 1.97	47	1.61 ± 0.36	1.61	1.33, 1.81	.417	26	1.63 ± 0.41	1.52	1.31, 2.00	0.757	NA	NA	NA	NA	NA	23	1.61 ± 0.42	1.72	1.30, 1.97	.476
Flexibility																								
Extension, °																								
Left hip ^{c,d,f}	44	23.5 ± 4.3	21.7	20.3, 27.7	44	23.4 ± 4.3	23.7	21.0, 29.0	.716	25	23.7 ± 4.8	22.8	21.0, 31.2	0.978	NA	NA	NA	NA	NA	21	22.7 ± 4.1	26.5	22.0, 31.0	.410
Right hip ^{c,d,f}	44	23.1 ± 3.7	20.7	20.0, 28.7	44	24.0 ± 5.3	26.0	21.7, 31.3	.679	25	24.5 ± 5.8	26.0	22.8, 33.8	0.445	NA	NA	NA	NA	NA	21	23.5 ± 5.0	27.8	25.0, 31.7	.845
Left active knee	48	18.9 ± 10.1	21.0	15.0, 27.0	45	19.2 ± 8.9	18.2	14.9, 30.3	.882	25	18.7 ± 8.6	18.2	15.4, 30.8	0.808	NA	NA	NA	NA	NA	22	21.4 ± 9.5	23.3	15.4, 37.0	.185
Right active knee ^{c,d,f}	48	16.4 ± 10.6	19.3	17.7, 31.7	45	18.6 ± 10.0	22.7	15.0, 29.6	.393	25	18.7 ± 9.8	23.8	17.8, 37.1	0.640	NA	NA	NA	NA	NA	22	19.4 ± 10.5	23.0	10.9, 38.3	.299
Shoulder tightness, °																								
Left posterior ^d	48	111.7 ± 7.6	110.7	108.7, 120.0	46	113.6 ± 9.5	115.3	104.9, 119.0	.270	NA	NA	NA	NA	NA	16	111.4 ± 8.7	107.5	103.0, 119.0	0.640	NA	NA	NA	NA	NA
Right posterior	48	110.5 ± 9.2	109.7	111.2 ± 9.6	46	111.2 ± 9.6	112.7	104.9, 120.8	.722	NA	NA	NA	NA	NA	16	108.7 ± 8.2	108.5	99.3, 117.0	0.312	NA	NA	NA	NA	NA
Internal rotation, °																								
Left shoulder ^{d,f}	48	60.6 ± 8.5	58.0	51.3, 65.0	46	60.1 ± 10.2	61.5	45.7, 64.8	.806	NA	NA	NA	NA	NA	16	58.7 ± 7.5	62.3	61.2, 68.3	0.500	NA	NA	NA	NA	NA
Right shoulder	48	58.2 ± 9.3	53.3	44.3, 61.7	46	56.4 ± 12.2	56.2	43.8, 64.1	.423	NA	NA	NA	NA	NA	16	54.6 ± 12.6	58.0	52.3, 68.0	0.284	NA	NA	NA	NA	NA
External rotation, °																								
Left shoulder ^{c,d,f}	48	95.6 ± 9.8	96.0	90.0, 105.7	46	95.6 ± 9.9	100.2	95.5, 106.3	.498	NA	NA	NA	NA	NA	16	95.9 ± 7.4	98.3	91.7, 106.8	0.928	NA	NA	NA	NA	NA
Right shoulder ^{d,f}	48	97.0 ± 9.2	99.7	89.7, 106.0	46	98.2 ± 8.8	101.3	98.7, 105.2	.334	NA	NA	NA	NA	NA	16	97.6 ± 9.1	99.0	96.5, 107.0	0.770	NA	NA	NA	NA	NA
Balance																								
Dynamic postural stability index																								
Left	44	0.3623 ± 0.0468	0.3566	0.3315, 0.3890	41	0.3540 ± 0.0405	0.3720	0.3490, 0.4121	.385	23	0.3557 ± 0.0384	0.3676	0.3516, 0.4203	0.735	NA	NA	NA	NA	NA	20	0.3593 ± 0.0446	0.4121	0.3486, 0.4337	.907
Right ^d	29	0.3739 ± 0.0426	0.3597	0.3476, 0.3886	29	0.3631 ± 0.0408	0.3802	0.3556, 0.4124	.327	16	0.3756 ± 0.0309	0.3824	0.3628, 0.4318	0.614	NA	NA	NA	NA	NA	12	0.3564 ± 0.0497	0.3972	0.3354, 0.4138	.263
Medial-lateral stability index																								
Left	44	0.0293 ± 0.0055	0.0297	0.0276, 0.0349	41	0.0281 ± 0.0060	0.0275	0.0223, 0.0327	.368	23	0.0273 ± 0.0054	0.0269	0.0233, 0.0286	0.157	NA	NA	NA	NA	NA	20	0.0297 ± 0.0056	0.0326	0.0242, 0.0383	.399
Right	29	0.0307 ± 0.0044	0.0297	0.0267, 0.0326	29	0.0310 ± 0.0056	0.0298	0.0262, 0.0349	.810	16	0.0305 ± 0.0048	0.0293	0.0242, 0.0326	0.779	NA	NA	NA	NA	NA	12	0.0317 ± 0.0062	0.0345	0.0257, 0.0436	.479
Sensory Organization Test score	44	80.0450 ± 4.6203	81.0000	76.0000, 84.0000	45																			

Supplemental Table 2. Relative Risk Values

Variable	Cut-Off Value	All Injuries	Lower Extremity Injuries	Upper Extremity Injuries	Spine Injuries
		RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)
Age, y	>38	1.186 (0.654, 2.150)	1.195 (0.800, 1.784)	1.234 (0.875, 1.739)	1.123 (0.790, 1.596)
Physiology					
Body fat, %	>18	0.825 (0.556, 1.225)	0.878 (0.689, 1.119)	0.933 (0.775, 1.122)	1.004 (0.798, 1.264)
Anaerobic power, W/kg	<12.96	2.706 (0.771, 9.491)	1.506 (0.801, 2.832)	1.029 (0.744, 1.425)	1.393 (0.716, 1.667)
Anaerobic capacity, W/kg	<7.3	1.533 (0.306, 7.688)	2.217 (0.445, 11.037)	1.239 (0.554, 2.773)	1.141 (0.509, 2.561)
VO ₂ max (mL/min/kg)	<42.5	1.083 (0.643, 1.826)	0.982 (0.726, 1.329)	0.969 (0.776, 1.210)	1.135 (0.817, 1.576)
Strength, % Body mass					
Flexion					
Left knee	<104.4	1.590 (0.697, 3.630)	1.518 (0.851, 2.708)	NA	1.157 (0.762, 1.755)
Right knee	<108.97	1.313 (0.683, 2.524)	0.989 (0.708, 1.380)	NA	1.313 (0.855, 2.015)
Extension					
Left knee	<195.7	2.593 (0.933, 7.203)	1.531 (0.894, 2.620)	NA	1.901 (1.029, 3.512) [‡]
Right knee	<202.57	1.744 (0.753, 4.039)	2.029 (1.011, 4.075) [‡]	NA	1.268 (0.813, 1.979)
Internal rotation					
Left shoulder	<34.12	1.098 (0.614, 1.965)	NA	1.031 (0.785, 1.354)	0.938 (0.706, 1.244)
Right shoulder	<47.98	1.486 (0.715, 3.091)	NA	1.053 (0.787, 1.408)	0.958 (0.710, 1.295)
External rotation					
Left shoulder	<34.13	0.929 (0.537, 1.606)	NA	1.078 (0.788, 1.475)	1.110 (0.758, 1.625)
Right shoulder	<34.01	1.012 (0.553, 1.852)	NA	0.983 (0.749, 1.291)	1.012 (0.714, 1.434)
Protraction					
Left shoulder	<329.63	1.169 (0.668, 2.045)	NA	0.982 (0.779, 1.236)	1.061 (0.777, 1.449)
Right shoulder	<366.63	1.186 (0.654, 2.150)	NA	1.013 (0.783, 1.309)	1.013 (0.744, 1.379)
Retraction					
Left shoulder	<363.08	2.063 (0.871, 4.885)	NA	1.142 (0.829, 1.573)	1.741 (1.003, 3.021) [‡]
Right shoulder	<360.50	1.526 (0.776, 2.998)	NA	1.199 (0.869, 1.653)	1.351 (0.894, 2.043)
Trunk extension	<248.35	1.418 (0.729, 2.758)	1.350 (0.861, 2.117)	1.013 (0.783, 1.309)	1.123 (0.790, 1.596)
Trunk flexion	<166.82	1.230 (0.717, 2.108)	1.348 (0.912, 1.992)	1.018 (0.807, 1.285)	1.078 (0.801, 1.452)
Flexion:extension ratio					
Left knee	<0.48 or >0.85	1.083 (0.643, 1.826)	0.900 (0.685, 1.182)	NA	1.250 (0.870, 1.796)
Right knee	<0.48 or >0.85	1.306 (0.756, 2.254)	1.085 (0.791, 1.49)	NA	1.145 (0.840, 1.562)
Trunk	<1.3 or >1.75	0.533 [‡] (0.341, 0.831)	0.819 (0.635, 1.057)	0.913 (0.755, 1.105)	0.852 (0.675, 1.076)
Flexibility, °					
Extension					
Left hip	<20	1.130 (0.705, 1.814)	1.068 (0.797, 1.430)	NA	1.130 (0.850, 1.503)
Right hip	<20	0.915 (0.596, 1.405)	0.992 (0.753, 1.305)	NA	1.051 (0.805, 1.373)
Left active knee	>25	0.915 (0.596, 1.405)	0.861 (0.675, 1.099)	NA	1.130 (0.850, 1.503)
Right active knee	>24	1.201 (0.733, 1.970)	0.940 (0.721, 1.226)	NA	1.071 (0.813, 1.412)
Shoulder tightness					
Left posterior	<106	1.357 (0.802, 2.297)	NA	1.109 (0.870, 1.413)	1.071 (0.813, 1.412)
Right posterior	<105	0.801 (0.538, 1.194)	NA	0.989 (0.808, 1.209)	0.879 (0.704, 1.098)
Internal rotation					
Left shoulder	<55	0.967 (0.631, 1.481)	NA	0.932 (0.772, 1.125)	1.067 (0.823, 1.384)
Right shoulder	<50	1.509 (0.883, 2.577)	NA	1.151 (0.902, 1.470)	1.390 (0.998, 1.936)
External rotation					
Left shoulder	<90	0.923 (0.609, 1.399)	NA	0.978 (0.803, 1.192)	1.200 (0.906, 1.589)
Right shoulder	<90	0.874 (0.576, 1.325)	NA	0.949 (0.781, 1.154)	1.285 (0.941, 1.754)
Balance					
Dynamic postural stability index					
Left	>0.3778	0.754 (0.507, 1.120)	0.861 (0.675, 1.099)	0.901 (0.750, 1.082)	0.980 (0.763, 1.258)
Right	>0.3849	0.878 (0.540, 1.427)	0.962 (0.703, 1.317)	0.962 (0.748, 1.147)	0.919 (0.703, 1.202)
Medial-lateral stability index					
Left	>0.0323	0.955 (0.598, 1.523)	0.940 (0.711, 1.242)	1.018 (0.807, 1.285)	1.078 (0.801, 1.452)
Right	>0.0357	1.440 (0.642, 3.231)	1.160 (0.729, 1.846)	1.004 (0.747, 1.350)	1.048 (0.716, 1.534)
Sensory Organization Test Score	<77	0.910 (5.880, 1.409)	0.958 (0.729, 1.258)	1.050 (0.834, 1.322)	1.014 (0.778, 1.322)
Stop-jump biomechanics					
Flexion at initial contact, °					
Left knee	<19.47	1.250 (0.533, 4.220)	0.900 (0.685, 1.182)	NA	1.250 (0.870, 1.796)
Right knee	<18.68	1.013 (0.592, 1.731)	0.796 (0.629, 1.007)	NA	1.013 (0.744, 1.379)
Knee flexion, °					
Left maximum	<79.4	1.464 (0.784, 2.734)	0.982 (0.762, 1.329)	NA	1.250 (0.870, 1.796)
Right maximum	<82.0	1.250 (0.708, 2.208)	0.982 (0.726, 1.329)	NA	1.036 (0.770, 1.393)
Varus at initial contact, °					
Left knee	<-5 or >5	0.978 (0.657, 1.457)	0.982 (0.767, 1.257)	NA	1.064 (0.845, 1.338)
Right knee	<-5 or >5	1.109 (0.739, 1.666)	1.233 (0.947, 1.605)	NA	0.886 (0.708, 1.108)
Vertical ground reaction force, % body mass					
Left peak	>241.3	1.613 (0.766, 3.393)	1.106 (0.756, 1.619)	NA	1.163 (0.798, 1.694)
Right peak	>223.0	1.478 (0.886, 2.467)	1.156 (0.859, 1.557)	NA	1.067 (0.823, 1.384)
Drop-landing biomechanics					
Flexion at initial contact, °					
Left knee	<9.39	0.958 (0.608, 1.510)	1.150 (0.829, 4.395)	NA	1.033 (0.785, 1.360)
Right knee	<9.30	0.904 (0.578, 1.413)	0.854 (0.666, 1.094)	NA	1.145 (0.840, 1.562)
Knee flexion, °					
Left maximum	<51.9	0.897 (0.567, 1.418)	1.048 (0.762, 1.439)	NA	1.013 (0.763, 1.345)
Right maximum	<53.0	1.137 (0.697, 1.854)	1.034 (0.772, 1.386)	NA	0.943 (0.737, 1.206)
Varus at initial contact, °					
Left knee	<-5 or >5	1.126 (0.570, 2.223)	1.375 (0.791, 2.391)	NA	1.216 (0.767, 1.929)
Right knee	<-5 or >5	0.875 (0.446, 1.718)	1.018 (0.626, 1.655)	NA	1.066 (0.658, 1.728)
Vertical ground reaction force, % body mass					
Left peak	>601.2	0.786 (0.509, 1.216)	1.007 (0.733, 1.383)	NA	0.968 (0.733, 1.279)
Right peak	>640.8	0.744 (0.500, 1.107)	1.340 (0.772, 1.386)	NA	1.217 (0.507, 2.922)

Abbreviations: CI, confidence interval; NA, not applicable; RR, relative risk.

[‡] Significant RR value (95% CI does not include 1.00).