

Appendix 1

Frequency and Rate of Game-Related Collegiate Football Injuries Between FieldTurf and Natural Grass by Head, Knee, and Shoulder Trauma^a

Variable	FieldTurf (n=230)				Natural Grass (n=235)			
	Number Injuries	%	IIR	95%CI	Number Injuries	%	IIR	95%CI
Head injury								
1° cerebral concussion	49	69.0	2.1	1.7-2.7	61	62.9	2.6	2.1-3.2
2° cerebral concussion	20	28.2	0.9	0.6-1.3	28	28.9	1.2	0.8-1.7
3° cerebral concussion	1	1.4	0.0	0.0-0.2	1	1.1	0.0	0.0-0.2
Posttraumatic headache	0	0.0	0.0	0.0-0.0	2	2.1	0.1	0.0-0.3
Second-impact syndrome	0	0.0	0.0	0.0-0.0	0	0.0	0.0	0.0-0.0
Epistaxis	1	1.4	0.0	0.0-0.2	5	5.3	0.2	0.1-0.5
Concussion injuries combined	70	100.0	3.0	2.5-3.7	90	100.0	3.8	3.2-4.5
Knee injury								
Medial collateral	55	40.4	2.4	1.9-3.0	58	39.1	2.5	2.0-3.1
Lateral collateral	5	3.7	0.2	0.1-0.5	5	3.4	0.2	0.1-0.5
Anterior cruciate	7	5.1	0.3	0.1-0.6	17	11.5	0.7	0.5-1.1
ACL and associated tissue	15	11.0	0.7	0.4-1.0	13	8.8	0.6	0.3-0.9
Posterior cruciate	5	3.7	0.2	0.1-0.5	5	3.4	0.2	0.1-0.5
PCL and associated tissue	1	0.7	0.0	0.0-0.2	2	1.4	0.1	0.0-0.3
Arcuate-popliteal complex	8	5.9	0.3	0.2-0.7	11	7.4	0.5	0.3-0.8
Lateral meniscus	6	4.4	0.3	0.1-0.6	5	3.4	0.2	0.1-0.5
Medial meniscus	5	3.7	0.2	0.0-0.5	4	2.7	0.2	0.1-0.4
Articular cartilage	0	0.0	0.0	0.0-0.0	1	0.7	0.0	0.0-0.2
Plica syndrome	2	1.5	0.1	0.0-0.3	1	0.7	0.0	0.0-0.2
Patellar tendon/syndrome	27	19.9	1.2	0.8-1.7	25	16.8	1.1	0.7-1.5
Patellar fracture	0	0.0	0.0	0.0-0.0	1	0.7	0.0	0.0-0.2
ACL injuries combined	22	100.0	1.0	0.6-1.4	30	100.0	1.3	0.9-1.8
Shoulder injury								
AC separation	60	53.6	2.6	2.1-3.2	73	50.6	3.1	2.5-3.7
Rotator cuff tear	2	1.8	0.1	0.0-0.3	9	6.3	0.4	0.2-0.7
Dead arm syndrome	41	36.6	1.8	1.3-2.3	37	25.7	1.6	1.2-2.1
Impingement syndrome	0	0.0	0.0	0.0-0.0	1	0.7	0.0	0.0-0.2
SLAP lesion	5	4.4	0.2	0.1-0.5	16	11.1	0.7	0.4-1.1
Hill-Sachs lesion	2	1.8	0.1	0.0-0.3	5	3.5	0.2	0.1-0.5
Bankart lesion	2	1.8	0.1	0.0-0.3	3	2.1	0.1	0.0-0.4

^a%, percentage of total injuries within each category that occurred on the specific playing surface; IIR, injury incidence rate = (number of injuries ÷ number of team games) x 10; CI, confidence interval; ACL, anterior cruciate ligament; PCL, posterior cruciate ligament; AC, acromioclavicular; SLAP, superior labrum anterior-to-posterior.

Appendix 2
 Frequency and Rate of Game-Related Collegiate Football Injuries Between FieldTurf and Natural Grass by Category, Time, Severity, and Player Position^a

Variable	FieldTurf (n=230)				Natural Grass (n=235)			
	Number Injuries	%	IIR	95%CI	Number Injuries	%	IIR	95%CI
Injury category								
Player-to-player collision	570	54.3	24.8	23.7-25.4	660	54.9	28.0	27.1-28.5
Player-to-turf collision	102	9.7	4.4	3.8-5.1	108	9.0	4.6	4.0-5.2
Shoe surface (contact)	229	21.8	10.0	9.8-10.0	276	22.9	11.7	11.1-12.3
Shoe surface (noncontact)	35	3.3	1.5	1.1-2.0	41	3.4	1.7	1.3-2.3
Muscle-tendon overload	114	10.9	5.0	4.3-5.6	118	9.8	5.0	4.4-5.7
Time of injury								
Pregame	5	0.5	0.2	0.1-0.5	4	0.3	0.2	0.1-0.4
First quarter	161	15.3	7.0	6.4-7.6	182	15.1	7.7	7.2-8.2
Second quarter	297	28.3	12.9	12.2-13.5	371	30.8	15.8	14.9-16.4
Third quarter	303	28.9	13.2	12.4-13.8	359	29.8	15.3	14.4-15.9
Fourth quarter	282	26.9	12.3	11.6-12.8	284	23.6	12.3	11.6-12.9
Overtime	2	0.2	0.1	0.0-0.3	3	0.2	0.1	0.0-0.4
Injury time loss								
0 days	507	48.3	22.0	21.2-22.6	526	43.7	22.4	21.5-23.0
1-2 days	209	19.9	9.1	8.6-9.4	225	18.7	9.6	9.2-9.8
3-6 days	159	15.1	6.9	6.3-7.5	187	15.5	8.0	7.4-8.4
7-9 days	66	6.3	2.9	2.3-3.5	108	9.0	4.6	4.0-5.2 ^b
10-21 days	48	4.6	2.1	1.6-2.7	61	5.1	2.6	2.1-3.2
22 days or more	61	5.8	2.7	2.1-3.3	96	8.0	4.1	3.5-4.7 ^c
Position played at time of injury								
Offense	483	46.0	21.0	20.3-21.5	539	44.8	22.9	22.0-23.5
Quarterback	60	5.7	2.6	2.1-3.2	55	4.6	2.3	1.8-2.9
Backfield	116	11.0	5.0	4.4-5.7	153	12.7	6.5	5.9-7.1
Offensive line	143	13.6	6.2	5.6-6.8	164	13.6	7.0	6.4-7.5
Tight end	53	5.0	2.3	1.8-2.9	52	4.3	2.2	1.7-2.8
Receiver	110	10.5	4.8	4.2-5.4	116	9.6	4.9	4.3-5.6
Defense	421	40.1	18.3	17.6-18.7	505	42.0	21.5	20.7-22.0
Defensive line	145	13.9	6.3	5.7-6.9	173	14.4	7.4	6.8-7.9
Linebacker	122	11.6	5.3	4.7-5.9	154	12.8	6.6	5.9-7.1
Secondary	155	14.8	6.7	6.1-7.3	177	14.7	7.5	6.9-8.0
Special teams	146	13.9	6.3	5.7-6.9	159	13.2	6.8	6.1-7.3

^a%, percentage of total injuries within each category that occurred on the specific playing surface; IIR, injury incidence rate = (number of injuries ÷ number of team games) x 10; CI, confidence interval.

^bP = .017.

^cP = .044.

Appendix 3
 Frequency and Rate of Game-Related Collegiate Football Injuries Between FieldTurf and Natural Grass by Mechanism and Situation^a

Variable	FieldTurf (n=230)				Natural Grass (n=235)			
	Number Injuries	%	IIR	95%CI	Number Injuries	%	IIR	95%CI
Injury mechanism								
Blocked below waist	76	7.2	3.3	2.7-3.9	80	6.7	3.4	2.8-4.0
Blocked above waist	65	6.2	2.8	2.3-3.4	92	7.6	3.9	3.3-4.6
Tackling	210	20.0	9.1	8.7-9.4	261	21.7	11.1	10.6-11.6
Tackled below waist	99	9.4	4.3	3.7-5.0	93	7.7	4.0	3.4-4.6
Tackled above waist	125	11.9	5.4	4.8-6.1	144	12.0	6.1	5.5-6.7
Blocking	174	16.6	7.6	7.0-8.1	183	15.2	7.8	7.2-8.3
Impact with playing surface	84	8.0	3.7	3.1-4.3	82	6.8	3.5	2.9-4.1
Stepped on/fallen/kicked	85	8.1	3.7	3.1-4.3	111	9.2	4.7	4.1-5.4
No contact-rotation/plant	34	3.2	1.5	1.1-2.0	40	3.3	1.7	1.3-2.2
Sprinting/running	45	4.3	2.0	1.5-2.5	41	3.4	1.7	1.3-2.3
Catching/blocking pass/punt	17	1.6	0.7	0.5-1.2	25	2.1	1.1	0.7-1.5
Blocking a kick/punt	2	0.2	0.1	0.0-0.3	2	0.2	0.1	0.0-0.3
Clipped	0	0.0	0.0	0.0-0.0	4	0.3	0.2	0.1-0.4
Heat illness	16	1.5	0.7	0.4-1.1	31	2.6	1.3	0.9-1.8
Overuse	18	1.7	0.8	0.5-1.2	14	1.2	0.6	0.4-1.0
Injury Situation								
Warmup	3	0.3	0.1	0.0-0.4	7	0.6	0.3	0.1-0.6
Rushing	365	34.8	15.9	15.0-16.5	416	34.6	17.7	16.9-18.2 ^b
Passing	40	3.8	1.7	1.3-2.3	42	3.5	1.8	1.4-2.3
Pass catching	123	11.7	5.3	4.7-6.0	138	11.5	5.9	5.2-6.5
Pass protection	99	9.4	4.3	3.7-5.0	107	8.9	4.6	3.9-5.2
Pass rush	115	11.0	5.0	4.4-5.6	105	8.7	4.5	3.8-5.1
Pass defense	149	14.2	6.5	5.8-7.1	213	17.7	9.1	8.6-9.4 ^c
Kickoff return	34	3.2	1.5	1.1-2.0	39	3.2	1.7	1.2-2.2
PAT/FG	9	0.9	0.4	0.2-0.7	5	0.4	0.2	0.1-0.5
Kickoff	73	7.0	3.2	2.6-3.8	57	4.7	2.4	1.9-3.0
Punting	11	1.0	0.5	0.3-0.8	28	2.3	1.2	0.8-1.7 ^d
Punt return	19	1.8	0.8	0.5-1.3	27	2.2	1.1	0.8-1.6
Fumble recovery	7	0.7	0.3	0.1-0.6	4	0.3	0.2	0.1-0.4
Piling-on	3	0.3	0.1	0.0-0.4	15	1.2	0.6	0.4-1.0 ^e

^a%, percentage of total injuries within each category that occurred on the specific playing surface; IIR, injury incidence rate = (number of injuries ÷ number of team games) x 10; CI, confidence interval; PAT/FG, point after touchdown/field goal.

^bP = .040.

^cP = .023.

^dP = .020.

^eP = .011.

Appendix 4

Frequency and Rate of Game-Related Collegiate Football Injuries Between FieldTurf and Natural Grass By Primary Type of Injury, Grade, Location, and Tissue Injured^a

Variable	FieldTurf (n=230)				Natural Grass (n=235)			
	Number Injuries	%	IIR	95%CI	Number Injuries	%	IIR	95%CI
Primary type of injury								
Surface/epidermal	10	1.0	0.4	0.2-0.8	16	1.3	0.7	0.4-1.1
Contusion	243	23.1	10.6	10.1-10.9	247	20.5	10.5	10.1-10.9
Concussion	70	6.7	3.0	2.5-3.7	90	7.5	3.8	3.2-4.5
Inflammation	36	3.4	1.6	1.2-2.1	31	2.6	1.3	0.9-1.8
Ligament sprain	331	31.5	14.4	13.6-15.0	385	32.0	16.4	15.6-17.0
Ligament tear	28	2.7	1.2	0.9-1.7	55	4.6	2.3	1.9-2.9 ^b
Cartilage tear	9	0.9	0.4	0.2-0.7	10	0.8	0.4	0.2-0.8
Muscle strain/spasm	142	13.5	6.2	5.5-6.8	170	14.1	7.2	6.6-7.8
Muscle tear	3	0.3	0.1	0.0-0.4	21	1.7	0.9	0.6-1.3 ^c
Tendon strain	24	2.3	1.0	0.7-1.5	28	2.3	1.2	0.8-1.7
Tendon tear	2	0.2	0.1	0.0-0.3	0	0.0	0.0	00-0.0
Hyperextension	16	1.5	0.7	0.4-1.1	9	0.7	0.4	0.2-0.7
Herniation	1	0.1	0.0	0.0-0.2	1	0.1	0.0	0.0-0.2
Neural	56	5.3	2.4	1.9-3.0	55	4.6	2.3	1.8-2.9
Subluxation/ dislocation	37	3.5	1.6	1.2-2.1	43	3.6	1.8	1.4-2.4
Fracture	42	4.0	1.8	1.4-2.4	42	3.5	1.8	1.4-2.3
Grade of injury								
First degree	812	77.3	35.3	34.1-35.9	819	68.1	34.9	33.6-35.5
Second degree	145	13.8	6.3	5.7-6.9	235	19.5	10.0	9.8-10.0 ^d
Third degree	93	8.9	4.0	3.4-4.7	149	12.4	6.3	5.7-6.9 ^e
Anatomical location of injury								
Cranial/cervical	120	11.4	5.2	4.6-5.9	145	12.1	6.2	5.5-6.8
Upper extremity	319	30.4	13.9	13.1-14.5	411	34.2	17.5	16.7-18.0
Thoracic	73	7.0	3.2	2.6-3.8	75	6.2	3.2	2.6-3.8
Lower extremity	538	51.2	23.4	22.4-24.0	572	47.5	24.3	23.3-25.0
Type of tissue injured								
Bone	42	4.0	1.8	1.4-2.4	42	3.5	1.8	1.4-2.3
Joint	485	46.2	21.1	20.3-21.6	555	46.1	23.6	22.6-24.2
Muscle	385	36.7	16.7	15.9-17.3	441	36.7	18.8	18.1-19.1
Neural	126	12.0	5.5	4.8-6.1	144	12.0	6.1	5.5-6.7
Other	12	1.1	0.5	0.3-0.9	21	1.7	0.9	0.6-1.3

^a%, percentage of total injuries within each category that occurred on the specific playing surface; IIR, injury incidence rate = (number of injuries ÷ number of team games) x 10; CI, confidence interval.

^bP = .024.

^cP = .002.

^dP = .0001.

^eP = .007.

Appendix 5

Frequency and Rate of Game-Related Collegiate Football Injuries Between FieldTurf and Natural Grass by Environmental Factors^a

Variable	FieldTurf (n=230)				Natural Grass (n=235)			
	Number Injuries	%	IIR	95%CI	Number Injuries	%	IIR	95%CI
Field conditions								
No precipitation/dry field	906	86.3	39.4	38.4-39.6	974	81.0	41.4	40.3-42.0 ^b
Rain	101	9.6	4.4	3.8-5.0	123	10.2	5.2	4.6-5.9
Snow	2	0.2	0.1	0.0-0.3	4	0.3	0.2	0.1-0.4
Sleet	0	0.0	0.0	0.0-0.0	0	0.0	0.0	0.0-0.0
No precipitation/wet field	41	3.9	1.8	1.3-2.3	102	8.5	4.3	3.7-5.0 ^c
Temperature								
Cold days ($\leq 69^\circ\text{F}$)	570	54.3	24.8	23.7-25.4	426	35.4	18.1	17.4-18.6 ^c
Hot days ($\geq 70^\circ\text{F}$)	480	45.7	20.9	20.2-21.3	777	64.6	33.1	31.9-33.7 ^c

^a%, percentage of total injuries within each category that occurred on the specific playing surface; IIR, injury incidence rate = (number of injuries \div number of team games) x 10; CI, confidence interval.

^b $P = .003$.

^c $P = .0001$.

