

## Appendix A. Video Review Definitions.

**Injury Play:** *For each concussion reported in the NFL's EMR system, the single play during which the concussion was determined to have been sustained.*

**Exposure:** *A visibly apparent direct impact to the helmet of the concussed player, or motion of the helmet/head without direct contact to the helmet (e.g., motion arising from acceleration of the upper torso).*

**Exposure with direct helmet contact:** *A visibly apparent (or identifiable) direct impact to the helmet shell or facemask of the concussed player, of magnitude that could reasonably be expected to be related to the concussion injury.*

**Exposure without direct helmet contact:** *A visibly apparent inertial motion of the helmet/head of the concussed player, without direct contact to the helmet, of magnitude that could reasonably be expected to be related to the concussion injury.*

**Single-exposure case:** *An injury play involving only one exposure for the concussed player.*

**Multi-exposure case:** *An injury play involving two or more exposures for the concussed player (e.g., a helmet-to-helmet impact immediately followed by a helmet-to-ground impact).*

**Primary exposure:** *An exposure occurring during an injury play that is observed to be markedly more severe than any other exposure occurring during that play and was considered to be the primary source of the concussion.*

**Unclear primary exposure:** *An injury play involving multiple exposures of similar severity, in which identification of a primary exposure is not obvious or possible.*

**Helmet impact source:** *The specific object that directly contacts the helmet of the concussed player during an exposure, such as another helmet, the ground, a shoulder, a thigh, a knee, etc.*

**Determinate case:** *An injury play in which visualization of the concussed player is sufficient from available videos to enable documentation of exposures, impact types, impact sources, and impact locations.*

**Indeterminate case:** An injury play in which visualization of the concussed player is not sufficient from available videos to enable documentation of exposures, impact types, impact sources, and impact locations.

**Helmet Impact Location:** Location on the helmet of the concussed player that is contacted by the helmet impact source.

## Appendix B. Tabulated Data Summary.

Table B1. Distribution of Helmet Impact Source by Player Position, Play Type, and Player Activity.

Counts by Helmet Impact Source (n=322)						
Player Position	Helmet	Body*	Ground	Pure shoulder	subtotal	%
Cornerback	16	33	13	11	73	22.7
Wide Receiver	17	2	17	11	47	14.6
Linebacker	13	16	2	6	37	11.5
Offensive Line	16	8	3	10	37	11.5
Safety	11	15	0	6	32	9.9
Tight End	12	9	6	1	28	8.7
Running Back	15	3	5	3	26	8.1
Defensive Line	7	4	4	6	21	6.5
Quarterback	5	2	9	2	18	5.6
Kicker	3	0	0	0	3	0.9
<b>subtotal</b>	<b>115</b>	<b>92</b>	<b>59</b>	<b>56</b>	<b>322</b>	<b>100.0</b>
<b>%</b>	<b>35.7</b>	<b>28.6</b>	<b>18.3</b>	<b>17.4</b>	<b>100.0</b>	
Counts by Helmet Impact Source (n=322)						
Play Type	Helmet	Body*	Ground	Pure shoulder	subtotal	%
Passing	43	45	50	24	162	50.3
Rushing	37	32	3	17	89	27.6
Kickoff	24	5	3	10	42	13.0
Punt	11	9	2	5	27	8.4
Field goal/Extra point	0	1	1	0	2	0.6
<b>subtotal</b>	<b>115</b>	<b>92</b>	<b>59</b>	<b>56</b>	<b>322</b>	<b>100.0</b>
<b>%</b>	<b>35.7</b>	<b>28.6</b>	<b>18.3</b>	<b>17.4</b>	<b>100.0</b>	
Counts by Helmet Impact Source (n=322)						
Player Activity	Helmet	Body*	Ground	Pure shoulder	subtotal	%
Tackling	37	65	12	19	133	41.3
Tackled	33	7	23	9	72	22.4
Blocking	26	13	1	19	59	18.3
Blocked	17	5	4	9	35	10.9
Diving/Leaping	0	0	17	0	17	5.3
Other	2	2	2	0	6	1.9
<b>subtotal</b>	<b>115</b>	<b>92</b>	<b>59</b>	<b>56</b>	<b>322</b>	<b>100.0</b>
<b>%</b>	<b>35.7</b>	<b>28.6</b>	<b>18.3</b>	<b>17.4</b>	<b>100.0</b>	

\* "Body" refers to all helmet-to-body impacts except those that are helmet-to-shoulder ("Pure shoulder").

Table B2. Distribution of Helmet Impact Source by Helmet Impact Location.

	Helmet (n=115)	Body* (n=92)	Ground (n=59)	Shoulder (n=56)	All (n=322)
Helmet Impact Location	%	%	%	%	%
Top	7.4	4.3	0.0	4.5	4.7
Front	11.3	6.5	4.0	13.4	9.0
Side (upper)	36.1	45.7	40.1	38.4	40.0
Side (lower)	13.0	10.9	0.6	14.3	10.4
Rear (upper)	2.2	8.7	37.3	0.0	10.1
Rear (lower)	1.3	1.6	0.0	0.0	0.9
Facemask (central)	16.5	13.6	10.2	13.4	14.0
Facemask (upper edge)	3.5	2.7	2.3	4.5	3.2
Facemask (side edge)	8.7	6.0	5.6	11.6	7.9
<i>cumulative %</i>	<i>100.0</i>	<i>100.0</i>	<i>100.0</i>	<i>100.0</i>	<i>100.0</i>

\* "Body" refers to all helmet-to-body impacts except those that are helmet-to-shoulder ("pure shoulder").

Table B3. Distribution of Helmet Impact Source.

Helmet Impact Source	Count (n=322)	%
Helmet	115	<b>35.7</b>
Shoulder	56	<b>17.4</b>
Shoulder/Body	17	<b>5.3</b>
Arm	9	<b>2.8</b>
Torso	13	<b>4.0</b>
Hip/Pelvis	12	<b>3.7</b>
Thigh	13.5	<b>4.2</b>
Knee	17.5	<b>5.4</b>
Lower Leg	4	<b>1.2</b>
Foot/Ankle	6	<b>1.9</b>
Ground	59	<b>18.3</b>
<i>subtotal</i>	<i>322</i>	<i>100.0</i>

Table B4. Distribution of Player Activity by Player Position (n=322).

Player Position	Tackling	Tackled	Blocking	Blocked	Diving/Leaping	Other	subtotal	%
Cornerback	56	2	1	7	3	4	73	22.7
Wide Receiver	5	23	1	7	11	0	47	14.6
Linebacker	26	0	3	8	0	0	37	11.5
Offensive Line	1	0	32	4	0	0	37	11.5
Safety	27	0	3	2	0	0	32	9.9
Tight End	2	14	8	3	1	0	28	8.7
Running Back	2	15	7	1	1	0	26	8.1
Defensive Line	12	0	4	3	1	1	21	6.5
Quarterback	0	17	0	0	0	1	18	5.6
Kicker	2	1	0	0	0	0	3	0.9
<i>subtotal</i>	<i>133</i>	<i>72</i>	<i>59</i>	<i>35</i>	<i>17</i>	<i>6</i>	<i>322</i>	<i>100.0</i>
<i>%</i>	<i>41.3</i>	<i>22.4</i>	<i>18.3</i>	<i>10.9</i>	<i>5.3</i>	<i>1.9</i>	<i>100.0</i>	