

Supplementary Material

Cognitive and Mental Health in Recently Retired Collegiate Football Players: Findings from the CARE Consortium

Running title: Early post-retirement cognitive and mental health in collegiate football players

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Table S1. Demographic characteristics stratified by lifetime concussion

<i>Lifetime Concussions</i>	0 (n=270)	1 to 2 (n=265)	3+ (n=92)
Age			
Mean (SD)	24.9 (1.83)	24.9 (1.62)	25.0 (1.52)
Median (25 th – 75 th percentile)	25.0 (24.0-26.0)	25.0 (24.0-26.0)	25.0 (24.0-26.0)
Position			
Agility	88 (32.6%)	75 (28.3%)	26 (28.3%)
Cornerback	14 (5.2%)	5 (1.9%)	6 (6.5%)
Defensive Back	14 (5.2%)	11 (4.2%)	2 (2.2%)
Quarterback	12 (4.4%)	17 (6.4%)	2 (2.2%)
Safety	17 (6.3%)	13 (4.9%)	5 (5.4%)
Wide Receiver	31 (11.5%)	29 (10.9%)	11 (12.0%)
Hybrid	79 (29.3%)	77 (29.1%)	33 (35.9%)
Linebacker	43 (15.9%)	44 (16.6%)	14 (15.2%)
Running Back	21 (7.8%)	13 (4.9%)	9 (9.8%)
Tight End	15 (5.6%)	20 (7.5%)	10 (10.0%)
Line	80 (29.6%)	93 (35.1%)	32 (34.8%)
Center	6 (2.2%)	11 (4.2%)	4 (4.3%)
Defensive End	16 (5.9%)	22 (8.3%)	10 (10.9%)
Defensive Tackle	22 (8.1%)	15 (5.7%)	5 (5.4%)
Offensive Guard	15 (5.6%)	28 (10.6%)	7 (7.6%)
Offensive Tackle	21 (7.8%)	17 (6.4%)	6 (6.5%)
Special Teams	23 (8.5%)	20 (7.5%)	1 (1.1%)
Field Goal/Kickoff Team	1 (0.4%)	4 (1.5%)	0 (0.0%)
Kicker/Punter	17 (6.3%)	10 (3.8%)	0 (0.0%)
Long Snapper	5 (1.9%)	6 (2.3%)	1 (1.1%)
Years of Football Participation			
Mean (SD)	11.4 (3.75)	11.3 (3.6)	12.0 (3.1)
Median (25 th -75 th percentile)	11.7 (8.7-14.2)	11.2 (8.7-14.2)	12.4 (9.7-14.4)
Division			
Division I	164 (60.7%)	171 (64.5%)	58 (63.0%)
Division II	54 (20.0%)	41 (15.5%)	21 (22.8%)
Division III	52 (19.3%)	53 (20.0%)	13 (14.1%)
Race			
Black	82 (30.8%)	65 (25.2%)	23 (26.1%)
White	154 (57.9%)	161 (62.4%)	56 (63.6%)
Multiple/Other	30 (11.3%)	32 (12.4%)	9 (10.2%)
Missing/Skipped	4	7	4
AIMS Total Score			
Median (25 th -75 th percentile)	41.0 (34.0-49.0)	41.1 (34.0-50.0)	41.6 (36.0-50.0)
Missing	2	2	0
CD-RISC Total Score			

Median (25 th -75th percentile)	81.0 (71.0-89.0)	81.0 (71.0-90.0)	80.5 (66.5-90.0)
Missing	1	2	0
PSQI Total Score			
Median (25 th -75th percentile)	4.0 (3.0-7.0)	5.0 (3.0-7.0)	6.0 (4.0-9.0)
Missing	11	12	4
SF-12 Bodily Pain T-score			
Median (25 th -75th percentile)	57.4 (57.4-57.4)	57.4 (57.4-57.4)	57.4 (47.3-57.4)
Missing	0	3	0
SF-12 Phys. Function T-score			
Median (25 th -75th percentile)	56.5 (56.5-56.5)	56.5 (56.5-56.5)	56.5 (56.5-56.5)
Missing	0	3	0
AUDIT Total Score			
Median (25 th -75th percentile)	5.0 (2.0-8.3)	5.0 (3.0-8.0)	5.0 (3.0-9.0)
Missing	2	3	0
Time between Assessments (days)			
Median (25 th -75th percentile)	1,741.5 (1,500.0, 2,019.0)	1,746.00 (1,576.0, 2,014.0)	1,812.5 (1,643.0, 2,067.0)
Salary			
Low (0-\$60,000)	144 (61.8%)	131 (55.3%)	46 (52.3%)
Medium (\$60,000-\$90,000)	62 (26.6%)	60 (25.3%)	25 (28.4%)
High (\$90,000+)	27 (11.6%)	46 (19.4%)	17 (19.3%)
Missing	37	28	4
Post-Graduate Degree			
Unknown/Skipped	47 (19.0%)	43 (20.1%)	17 (23.0%)
	22	51	18
Psych. Disorder Diagnosis			
Missing	6 (2.2%)	8 (3.0%)	5 (5.4%)
	3	3	1

Note: AIMS: Athletic Identity Measurement Scale, CD-RISC: Connor-Davidson Resilience Scale, PSQI: Pittsburgh Sleep Quality Index, SF-12: Short Form Health Survey, AUDIT: Alcohol Use Disorders Identification Test.

Table S2. Univariate regression model output

Neuro-QoL T-score	B	SE	p	η_p²
<i>Concussion (ref: 0)</i>			<0.001	0.06
1-2 Concussions	-1.19	0.70	0.091	
3+ Concussions	-6.39	0.98	<0.001	
<i>Position (ref: Special Teams)</i>			0.148	0.01
Agility	0.27	1.40	0.845	
Line	-1.44	1.39	0.300	
Hybrid	0.18	1.40	0.900	
<i>Football Participation Yrs. (cont.)</i>				<0.01

Each Additional Year	-0.10	0.09	0.305	
PHQ-9 Total Score	B	SE	p	η_p^2
<i>Concussion (ref: 0)</i>			<0.001	0.05
1-2 Concussions	0.51	0.39	0.190	
3+ Concussions	3.17	0.68	<0.001	
<i>Position (ref: Special Teams)</i>			0.009	0.02
Agility	1.08	0.80	0.175	
Line	2.28	0.79	0.004	
Hybrid	1.24	0.80	0.119	
<i>Football Participation Yrs. (cont.)</i>				<0.01
Each Additional Year	-0.02	0.05	0.749	
SF-12 MCS T-score	B	SE	p	η_p^2
<i>Concussion (ref: 0)</i>			<0.001	0.03
1-2 Concussions	-0.27	0.89	0.758	
3+ Concussions	-4.95	1.23	<0.001	
<i>Position (ref: Special Teams)</i>			0.002	0.02
Agility	-3.34	1.71	0.051	
Line	-5.86	1.70	0.001	
Hybrid	-3.42	1.72	0.047	
<i>Football Participation Yrs. (cont.)</i>				<0.01
Each Additional Year	0.09	0.12	0.464	
SWLS Total Score	B	SE	p	η_p^2
<i>Concussion (ref: 0)</i>			0.016	0.01
1-2 Concussions	0.22	0.57	0.700	
3+ Concussions	-2.03	0.80	0.011	
<i>Position (ref: Special Teams)</i>			0.177	0.01
Agility	-1.24	1.11	0.263	
Line	-2.10	1.10	0.057	
Hybrid	-1.03	1.11	0.355	
<i>Football Participation Yrs. (cont.)</i>				0.01
Each Additional Year	0.15	0.07	0.050	

Note. Neuro-QoL: Quality of Life in Neurological Disorders - Cognitive Domain, PHQ-9: Patient Health Questionnaire, SF-12 MCS: Short Form Health Survey Mental Component Score, SWLS: Satisfaction with Life Scale. B: unstandardized beta. SE: standard error. η_p^2 : partial eta-squared. Bolded values indicate significance at $\alpha=0.05$.

Table S3 Multivariable model covariate estimates.

Neuro-QoL T-score	B	SE	p	η_p^2
Race: Black (ref: White)	-0.06	0.75	0.931	0.01
Race: Other	-1.74	0.94	0.143	
AIMS Total Score	-0.03	0.03	0.374	0.01
CD-RISC Total Score	0.10	0.02	<0.001	0.11
PSQI Total Score	-0.82	0.11	<0.001	0.14

Division II/III (ref: Division I)	1.00	0.61	0.176	0.01
SF-12 Bodily Pain T-score	0.09	0.05	0.129	0.01
SF-12 Physical Function T-score	-0.03	0.07	0.779	<0.01
Salary: \$0-60,000 (ref: \$90,001+)	1.69	0.91	0.143	0.01
Salary: \$60,001-\$90,000	0.26	1.05	0.843	
Graduate Degree: No (ref: Yes)	-0.31	0.82	0.823	<0.01
AUDIT Total Score	-0.15	0.07	0.079	0.01
PHQ-9 Total Score	B	SE	p	η_p^2
Race: Black (ref: White)	0.62	0.41	0.244	0.02
Race: Other	0.85	0.53	0.244	
AIMS Total Score	0.01	0.01	0.492	0.01
CD-RISC Total Score	-0.08	0.02	<0.001	0.23
PSQI Total Score	0.73	0.07	<0.001	0.31
Division II/III (ref: Division I)	-0.42	0.31	0.252	<0.01
SF-12 Bodily Pain T-score	-0.04	0.03	0.244	0.01
SF-12 Physical Function T-score	-0.09	0.05	0.218	0.01
Salary: \$0-60,000 (ref: \$90,001+)	-0.27	0.53	0.614	0.01
Salary: \$60,001-\$90,000	-0.74	0.51	0.244	
Graduate Degree: No (ref: Yes)	0.38	0.39	0.418	<0.01
AUDIT Total Score	0.06	0.04	0.244	0.01
SF-12 MCS T-score	B	SE	p	η_p^2
Race: Black (ref: White)	-1.52	0.92	0.347	<0.01
Race: Other	-0.16	1.09	0.936	
AIMS Total Score	-0.01	0.03	0.927	0.01
CD-RISC Total Score	0.28	0.03	<0.001	0.31
PSQI Total Score	-1.18	0.14	<0.001	0.18
Division II/III (ref: Division I)	0.32	0.73	0.916	<0.01
SF-12 Bodily Pain T-score	0.04	0.07	0.799	<0.01
SF-12 Physical Function T-score	-0.08	0.09	0.782	<0.01
Salary: \$0-60,000 (ref: \$90,001+)	0.07	1.12	0.952	<0.01
Salary: \$60,001-\$90,000	0.81	1.16	0.791	
Graduate Degree: No (ref: Yes)	-1.18	0.93	0.570	<0.01
AUDIT Total Score	-0.1	0.08	0.570	<0.01
SWLS Total Score	B	SE	p	η_p^2
Race: Black (ref: White)	-2.82	0.59	<0.001	0.06
Race: Other	-1.63	0.83	0.147	
AIMS Total Score	0.01	0.02	0.869	<0.01
CD-RISC Total Score	0.16	0.03	<0.001	0.23
PSQI Total Score	-0.56	0.10	<0.001	0.10
Division II/III (ref: Division I)	-0.61	0.49	0.492	<0.01
SF-12 Bodily Pain T-score	0.05	0.04	0.515	<0.01
SF-12 Physical Function T-score	-0.05	0.07	0.656	<0.01
Salary: \$0-60,000 (ref: \$90,001+)	-0.74	0.70	0.524	0.01
Salary: \$60,001-\$90,000	0.66	0.72	0.586	

Graduate Degree: No (ref: Yes)	-1.78	0.57	0.007	0.02
AUDIT Total Score	-0.04	0.06	0.654	<0.01

Note. Neuro-QoL: Quality of Life in Neurological Disorders - Cognitive Domain, PHQ-9: Patient Health Questionnaire, SF-12 MCS: Short Form Health Survey Mental Component Score, SWLS: Satisfaction with Life Scale. B: unstandardized beta. SE: standard error. η_p^2 : partial eta-squared. Bolded values indicate significance at $\alpha=0.05$.