

# Health-related Quality of Life Following Adolescent Sports-related Concussion or Fracture: A Prospective Cohort Study



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## OBJECTIVES

- 1) Compare health related quality of life (HRQoL) among adolescents with an acute sports related concussion (SRC) or sports-related fracture (SRF) who were followed until physician-documented clinical recovery
- 2) Identify clinical variables associated with worse HRQoL among adolescent SRC patients

## METHODS

- Prospective cohort of adolescents (13-18 years old) with acute SRC or SRF who were referred to either the Pan Am Concussion Program or the Pan Am Clinic Minor Injury for Kids Clinic in Winnipeg, Manitoba, Canada
- SRF patients served as a non brain-related injury comparison group because isolated orthopedic injuries can be associated with a disruption in sport participation and impairments in physical, psychological, social, and school functioning that are independent of TBI
- Pediatric Quality of Life Inventory (PedsQL), Cognitive Functioning PedsQL, and symptoms (Post-Concussion Symptom Scale – PCSS) were administered to patients at each visit to the clinic until clinical recovery

## RESULTS

- From Oct 2014 – Oct 2015, 135 SRC patients and 96 SRF patients were recruited
- Worse initial cognitive functioning, school, and overall HRQoL among SRC adolescents
- HRQoL was significantly worse at initial assessment for SRC patients who experienced delayed recovery compared to those who did not
- Overall HRQoL returned to normal among all patients at recovery although it was significantly worse among SRF patients compared SRC patients
- SRC patients who experienced delayed recovery had significantly worse school HRQoL compared to SRF patients but both groups reported normal school HRQoL at clinical recovery
- Overall, 132 (97.8%) of SRC patients and all SRF patients achieved physician-documented clinical recovery
- Median days until physician-diagnosed clinical recovery for the SRF patients was 31 days (IQR: 23, 42) while SRC patients varied:
  - Median days for normal SRC recovery ( $\leq 28$  days) was 17 (IQR: 13, 23) ( $p = <0.0001$ )
  - Median days for delayed SRC recovery ( $>28$  days) was 51 (IQR: 34, 83) ( $p = <0.0001$ )

**Table 1. Baseline characteristics and initial HRQoL**

	Sport-related concussion N=135	Sport-related Fracture N=96	p-value
<b>Age, mean (SD)</b>	14.7 (1.3)	14.1 (1.1)	<0.0001
<b>Male (%)</b>	81 (60.0)	57 (59.4)	0.924
<b>History of ADHD (%)</b>	6 (4.4)	5 (5.2)	0.788
<b>History of depression (%)</b>	7 (5.2)	2 (2.1)	0.230
<b>History of non-specific or migraine headaches (%)</b>	18 (13.3)	7 (7.3)	0.145
<b>History of previous concussion (%)</b>	81 (60.0)	13 (13.5)	<0.0001
<b>HRQoL Domain (max 100 points; 95% CI)</b>			
<b>Cognitive Functioning</b>	59.7 (55.6, 63.8)	83.2 (79.7, 86.6)	<0.0001
<b>Physical Functioning</b>	60.2 (56.1, 64.4)	57.2 (52.4, 61.9)	0.334
<b>Emotional Functioning</b>	75.4 (71.6, 79.3)	79.0 (75.1, 83.0)	0.212
<b>Social Functioning</b>	88.5 (86.2, 90.9)	85.8 (82.9, 88.8)	0.159
<b>School Functioning</b>	56.1 (51.2, 61.0)	75.4 (71.3, 79.5)	<0.0001
<b>Overall</b>	70.5 (67.1, 73.9)	75.8 (72.4, 79.1)	0.035
<b>Sport Played at the Time of Injury (%)</b>			
<b>Hockey</b>	62 (45.9)	9 (9.4)	
<b>Football</b>	20 (14.8)	21 (21.9)	
<b>Soccer</b>	18 (13.3)	16 (16.7)	
<b>Basketball</b>	8 (5.9)	16 (16.7)	
<b>Other</b>	28 (20.7)	34 (35.4)	
<b>Initial PCSS (median IQR)</b>	16 (6, 39)		

## DISCUSSION

- The magnitude of the HRQoL impairments for SRC patients at initial assessment predicted the length of physician-documented clinical recovery
- Initial symptom burden was the strongest predictor of delayed recovery following concussion
- School HRQoL was impacted by whether or not SRC patients perceived their school had provided adequate accommodations during recovery
- Parental responses were not collected and adolescents can under-report concussion symptoms – future work should include both parental and patient responses
- Clinical features of acute SRC such as exercise intolerance, vestibule-ocular dysfunction and cervical spine dysfunction were not assessed but are important contributors to symptom burden

**Table 2. Clinical variables associated with initial HRQoL among sports-related concussion patients (max 100 points; 95% CI)**

	Clinical Predictor	HRQoL (95% CI)	Change in HRQoL in youth with initial PCSS=16 vs 4
<b>Cognitive Functioning</b>	Initial $\sqrt$ PCSS	-6.5 (-8.7, -4.5)	-13.0
<b>Physical Functioning</b>	Initial $\sqrt$ PCSS	-7.1 (-8.8, -5.5)	-14.3
	Male	12.5 (5.9, 19.1)	
	Previous Concussion	-7.5 (-14.4, -0.5)	
	ADHD	25.7 (4.6, 46.8)	
<b>Emotional Functioning</b>	Initial $\sqrt$ PCSS	-3.7 (-6.1, -1.3)	-7.3
	Male	7.4 (-0.2, 15.0)	
	Previous Concussion	-10.9 (-19.0, -2.8)	
	Age	-3.3 (-6.5, -0.1)	
<b>Social Functioning</b>	Adequate School Accommodations	12.0 (2.2, 21.7)	
	Initial $\sqrt$ PCSS	-2.4 (-3.3, -1.4)	-4.8
<b>School Functioning</b>	Previous Concussion	-5.4 (-9.8, -1.0)	
	Initial $\sqrt$ PCSS	-4.3 (-6.8, -1.9)	-8.6
	Adequate School Accommodations	12.4 (1.8, 23.0)	
<b>Overall HRQoL</b>	Delayed Recovery	-13.4 (-23.8, -3.0)	
	Initial $\sqrt$ PCSS	-4.9 (-6.2, -3.6)	-9.8
	Male	6.7 (1.7, 11.6)	
	Previous Concussion	-8.8 (-14.2, -3.32)	

## CONCLUSIONS

- Acute SRC was associated with initial impairments in overall, physical, school, and cognitive HRQoL and SRC patients experienced greater impairments in cognitive, school and overall HRQoL than SRF patients
- No persistent impairments existed in HRQoL among adolescent SRC patients (regardless of normal or delayed recovery) who were followed to physician-documented clinical recovery
- Previous concussions, initial symptom burden and length of clinical recovery are the most important clinical variables that impact the degree of impairment experienced by SRC patients
- Future studies should include non-injury factors such as baseline HRQoL, socioeconomic status and baseline school performance and functioning that may impact recovery

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