

# EVIDENCE REPOSITORY

# Concussion

## EVIDENCE REPOSITORIES

Evidence repositories are collections of best available resources and evidence (clinical guidelines, peer reviewed literature, systematic reviews, etc.), collated by our knowledge synthesis team and content advisors. This evidence repository is not intended to be an exhaustive list of resources for a topic, but rather a curated list of current, evidence-based resources, based on expert consensus of relevance and usability for a general emergency department setting. We search databases (Cochrane Library, PubMed, TRIP Database) and web search engines (Google, Google Scholar) to locate evidence. Additionally, hospital websites are browsed for guidance documents, such as clinical practice guidelines (CPG) for healthcare professionals.

Every effort is made to identify resources that are open access (i.e. publicly available, free of charge, not requiring a subscription).

More information about the creation of our evidence repositories can be found at <https://pubmed.ncbi.nlm.nih.gov/28537762/>

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TREKK developed resources for healthcare providers and parents & families can be found [here](#).

## Clinical Guidelines

1. PedsConcussion. [Considerations for telemedicine and virtual care algorithm](#). PedsConcussion. 2021.
2. PedsConcussion. [Telemedicine and virtual concussion care](#). PedsConcussion. 2021.
3. PedsConcussion. [Living guideline for pediatric concussion care](#). PedsConcussion. 2019.
4. Lumba-Brown A, Yeates KO, Sarmiento K, et al. [Centers for disease control and prevention guideline on the diagnosis and management of mild traumatic brain injury among children](#). JAMA Pediatrics. 2018;172(11):e182853-e.
5. Da Dalt L, Parri N, Amigoni A, et al. [Italian guidelines on the assessment and management of pediatric head injury in the emergency department](#). Ital J Pediatr. 2018;44(1):7.
6. Velikonja D, Baldisera T, Bauman S, et al. [Standards for post-concussion care: From diagnosis to the interdisciplinary concussion clinic](#). Ontario Neurotrauma Foundation. 2017.
7. McCrory P, Meeuwisse W, Dvořák J, et al. [Consensus statement on concussion in sport-the 5\(th\) international conference on concussion in sport held in Berlin, October 2016](#). Br J Sports Med. 2017;51(11):838-47.

## Overviews

1. Lynch W. [Options for evaluating and tracking pediatric concussion](#). J Head Trauma Rehabil. 2018;33(5):354-61.

## Systematic Reviews

1. Luther M, Poppert Cordts KM, Williams CN. [Sleep disturbances after pediatric traumatic brain injury: A systematic review of prevalence, risk factors, and association with recovery](#). Sleep. 2020;43(10).
2. Langevin P, Frémont P, Fait P, et al. [Aerobic exercise for sport-related concussion: A systematic review and meta-analysis](#). Med Sci Sports Exerc. 2020;52(12):2491-9.
3. DeMatteo C, Bednar ED, Randall S, et al. [Effectiveness of return to activity and return to school protocols for children postconcussion: A systematic review](#). BMJ Open Sport Exerc Med. 2020;6(1):e000667.
4. Torres AR, Espinosa B. [Prognosis of concussion in children](#). Semin Pediatr Neurol. 2019;30:96-8.
5. Purcell LK, Davis GA, Gioia GA. [What factors must be considered in 'return to school' following concussion and what strategies or accommodations should be followed? A systematic review](#). Br J Sports Med. 2019;53(4):250.
6. Botchway EN, Godfrey C, Anderson V, et al. [A systematic review of sleep-wake disturbances in childhood traumatic brain injury: Relationship with fatigue, depression, and quality of life](#). J Head Trauma Rehabil. 2019;34(4):241-56.
7. Bellesi G, Barker ED, Brown L, et al. [Pediatric traumatic brain injury and antisocial behavior: Are they linked? A systematic review](#). Brain Inj. 2019;33(10):1272-92.
8. Shaw L, Morozova M, Abu-Arafeh I. [Chronic post-traumatic headache in children and adolescents: Systematic review of prevalence and headache features](#). Pain Manag. 2018;8(1):57-64.
9. Schmidt J, Hayward KS, Brown KE, et al. [Imaging in pediatric concussion: A systematic review](#). Pediatrics. 2018;141(5).
10. Moser RS, Davis GA, Schatz P. [The age variable in childhood concussion management: A systematic review](#). Arch Clin Neuropsychol. 2018;33(4):417-26.

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11. Lumba-Brown A, Yeates KO, Sarmiento K, et al. [Diagnosis and management of mild traumatic brain injury in children: A systematic review](#). JAMA Pediatr. 2018;172(11):e182847.
12. Haider MN, Leddy JJ, Pavlesen S, et al. [A systematic review of criteria used to define recovery from sport-related concussion in youth athletes](#). Br J Sports Med. 2018;52(18):1179-90.
13. Chamard E, Lichtenstein JD. [A systematic review of neuroimaging findings in children and adolescents with sports-related concussion](#). Brain Inj. 2018;32(7):816-31.
14. Appenteng R, Nelp T, Abdelgadir J, et al. [A systematic review and quality analysis of pediatric traumatic brain injury clinical practice guidelines](#). PLoS One. 2018;13(8):e0201550.
15. Schneider KJ, Leddy JJ, Guskiewicz KM, et al. [Rest and treatment/rehabilitation following sport-related concussion: A systematic review](#). Br J Sports Med. 2017;51(12):930-4.
16. Iverson GL, Gardner AJ, Terry DP, et al. [Predictors of clinical recovery from concussion: A systematic review](#). Br J Sports Med. 2017;51(12):941-8.

## Key Studies

1. Podolak OE, Chaudhary S, Haarbauer-Krupa J, et al. [Characteristics of diagnosed concussions in children aged 0 to 4 years presenting to a large pediatric healthcare network](#). Pediatr Emerg Care. 2021;37(12):e1652-e7.
2. Root JM, Sady MD, Gai J, et al. [Effect of cognitive and physical rest on persistent postconcussive symptoms following a pediatric head injury](#). J Pediatr. 2020;227:184-90.e4.
3. Patsimas T, Howell DR, Potter MN, et al. [Concussion-symptom rating correlation between pediatric patients and their parents](#). J Athl Train. 2020;55(10):1020-6.
4. Olson A, Ellis MJ, Selci E, et al. [Delayed symptom onset following pediatric sport-related concussion](#). Front Neurol. 2020;11:220.
5. Master CL, Curry AE, Pfeiffer MR, et al. [Characteristics of concussion in elementary school-aged children: Implications for clinical management](#). The Journal of Pediatrics. 2020;223:128-35.
6. Lumba-Brown A, Teramoto M, Bloom OJ, et al. [Concussion guidelines step 2: Evidence for subtype classification](#). Neurosurgery. 2020;86(1):2-13.
7. Kontos AP, Jorgensen-Wagers K, Trbovich AM, et al. [Association of time since injury to the first clinic visit with recovery following concussion](#). JAMA Neurology. 2020;77(4):435-40.
8. Howell DR, O'Brien MJ, Fraser J, et al. [Continuing play, symptom severity, and symptom duration after concussion in youth athletes](#). Clin J Sport Med. 2020;30 Suppl 1:S42-s6.
9. Gravel J, Ledoux AA, Tang K, et al. [Early versus delayed emergency department presentation following mild traumatic brain injury and the presence of symptom at 1, 4 and 12 weeks in children](#). Emergency Medicine Journal. 2020;37(6):338-43.
10. Coslick AM, Chin KE, Kalb LG, et al. [Participation in physical activity at time of presentation to a specialty concussion clinic is associated with shorter time to recovery](#). Pm r. 2020;12(12):1195-204.
11. Corwin DJ, Arbogast KB, Swann C, et al. [Reliability of the visio-vestibular examination for concussion among providers in a pediatric emergency department](#). Am J Emerg Med. 2020;38(9):1847-53.
12. Bressan S, Clarke CJ, Anderson V, et al. [Use of the sport concussion assessment tools in the emergency department to predict persistent post-concussive symptoms in children](#). J Paediatr Child Health. 2020;56(8):1249-56.

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13. Argyropoulou MI, Alexiou GA, Xydis VG, et al. [Pediatric minor head injury imaging practices: Results from an ESPR survey](#). *Neuroradiology*. 2020;62(2):251-5.
14. Anderson V, Davis GA, Takagi M, et al. [Trajectories and predictors of clinician-determined recovery after child concussion](#). *J Neurotrauma*. 2020;37(12):1392-400.
15. Yeates KO, Tang K, Barrowman N, et al. [Derivation and initial validation of clinical phenotypes of children presenting with concussion acutely in the emergency department: Latent class analysis of a multi-center, prospective cohort, observational study](#). *J Neurotrauma*. 2019;36(11):1758-67.
16. Wiseman-Hakes C, Gosselin N, Sharma B, et al. [A longitudinal investigation of sleep and daytime wakefulness in children and youth with concussion](#). *ASN Neuro*. 2019;11:1759091418822405.
17. Van Markus-Doornbosch F, Peeters E, van der Pas S, et al. [Physical activity after mild traumatic brain injury: What are the relationships with fatigue and sleep quality?](#) *European Journal of Paediatric Neurology*. 2019;23(1):53-60.
18. Sinnott AM, Elbin RJ, Collins MW, et al. [Persistent vestibular-ocular impairment following concussion in adolescents](#). *J Sci Med Sport*. 2019;22(12):1292-7.
19. Puffenbarger MS, Ahmad FA, Argent M, et al. [Reduction of computed tomography use for pediatric closed head injury evaluation at a nonpediatric community emergency department](#). *Academic Emergency Medicine*. 2019;26(7):784-95.
20. Mannix R, Zemek R, Yeates KO, et al. [Practice patterns in pharmacological and non-pharmacological therapies for children with mild traumatic brain injury: A survey of 15 Canadian and United States centers](#). *J Neurotrauma*. 2019;36(20):2886-94.
21. Lindholm EB, D'Cruz R, Fajardo R, et al. [Admission of pediatric concussion injury patients: Is it necessary?](#) *J Surg Res*. 2019;244:107-10.
22. Ledoux AA, Tang K, Yeates KO, et al. [Natural progression of symptom change and recovery from concussion in a pediatric population](#). *JAMA Pediatr*. 2019;173(1):e183820.
23. Leddy JJ, Haider MN, Ellis MJ, et al. [Early subthreshold aerobic exercise for sport-related concussion: A randomized clinical trial](#). *JAMA Pediatrics*. 2019;173(4):319-25.
24. Howell DR, Wilson JC, Kirkwood MW, et al. [Quality of life and symptom burden 1 month after concussion in children and adolescents](#). *Clin Pediatr (Phila)*. 2019;58(1):42-9.
25. Howell DR, Oldham JR, Brilliant AN, et al. [Trouble falling asleep after concussion is associated with higher symptom burden among children and adolescents](#). *Journal of Child Neurology*. 2019;34(5):256-61.
26. Howell DR, Kriz P, Mannix RC, et al. [Concussion symptom profiles among child, adolescent, and young adult athletes](#). *Clin J Sport Med*. 2019;29(5):391-7.
27. Gravel J, Boutis K, Tang K, et al. [Association between ondansetron use and symptom persistence in children with concussions: A 5P substudy](#). *Canadian Journal of Emergency Medicine*. 2019;21(2):204-10.
28. Fehr SD, Nelson LD, Scharer KR, et al. [Risk factors for prolonged symptoms of mild traumatic brain injury: A pediatric sports concussion clinic cohort](#). *Clinical Journal of Sport Medicine*. 2019;29(1):11-7.
29. DeMatteo CA, Randall S, Lin C-YA, et al. [What comes first: Return to school or return to activity for youth after concussion? Maybe we don't have to choose](#). *Frontiers in Neurology*. 2019;10.

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30. Corwin DJ, Propert KJ, Zorc JJ, et al. [Use of the vestibular and oculomotor examination for concussion in a pediatric emergency department.](#) The American Journal of Emergency Medicine. 2019;37(7):1219-23.
31. Cohen E, Rodean J, Diong C, et al. [Low-value diagnostic imaging use in the pediatric emergency department in the United States and Canada.](#) JAMA Pediatrics. 2019;173(8):e191439-e.
32. Brooks LB, Sayers PQ, Virani S, et al. [Insomnia in adolescents with slow recovery from concussion.](#) Journal of Neurotrauma. 2019;36(16):2391-9.
33. Borland ML, Dalziel SR, Phillips N, et al. [Delayed presentations to emergency departments of children with head injury: A predict study.](#) Annals of Emergency Medicine. 2019;74(1):1-10.
34. Rhine T, Byczkowski T, Altaye M, et al. [Characterizing hospitalizations for pediatric concussion and trends in care.](#) J Hosp Med. 2018;13(10):673-80.
35. Master CL, Master SR, Wiebe DJ, et al. [Vision and vestibular system dysfunction predicts prolonged concussion recovery in children.](#) Clin J Sport Med. 2018;28(2):139-45.
36. Kanani AN, Hartshorn S. [Resumption of physical activity within 7 days of a concussion was associated with lower rates of persistent postconcussive symptoms \(PPCS\).](#) Archives of disease in childhood - Education & Practice. 2018;103(2):110-1.
37. Howell DR, Zemek R, Brilliant AN, et al. [Identifying persistent postconcussion symptom risk in a pediatric sports medicine clinic.](#) The American Journal of Sports Medicine. 2018;46(13):3254-61.
38. Cohrs G, Huhndorf M, Niemczyk N, et al. [MRI in mild pediatric traumatic brain injury: Diagnostic overkill or useful tool?](#) Child's Nervous System. 2018;34(7):1345-52.
39. Bresee N, Aglipay M, Dubrovsky AS, et al. [No association between metoclopramide treatment in ED and reduced risk of post-concussion headache.](#) The American Journal of Emergency Medicine. 2018;36(12):2225-31.
40. Boutis K, Gravel J, Freedman SB, et al. [The diagnosis of concussion in pediatric emergency departments: A prospective multicenter study.](#) J Emerg Med. 2018;54(6):757-65.
41. Davis GA, Purcell L, Schneider KJ, et al. [The child sport concussion assessment tool 5th edition \(Child SCAT5\): Background and rationale.](#) British Journal of Sports Medicine. 2017;51(11):859-61.
42. Brooks TM, Smith MM, Silvis RM, et al. [Symptom-guided emergency department discharge instructions for children with concussion.](#) Pediatr Emerg Care. 2017;33(8):553-63.
43. Zemek R, Barrowman N, Freedman SB, et al. [Clinical risk score for persistent postconcussion symptoms among children with acute concussion in the ED.](#) Jama. 2016;315(10):1014-25.
44. Grool AM, Aglipay M, Momoli F, et al. [Association between early participation in physical activity following acute concussion and persistent postconcussive symptoms in children and adolescents.](#) JAMA. 2016;316(23):2504-14.
45. Easter JS, Bakes K, Dhaliwal J, et al. [Comparison of PECARN, CATCH, and CHALICE rules for children with minor head injury: A prospective cohort study.](#) Ann Emerg Med. 2014;64(2):145-52, 52.e1-5.

## Other Resources

1. Ontario Neurotrauma Foundation. [Management of acute symptoms algorithm.](#) PedsConcussion. 2021.
2. Centers for Disease Control and Prevention (CDC). [Heads up apps.](#) Centers for Disease Control and Prevention (CDC). 2021.

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3. DeMatteo C, Randall S, Falla K, et al. [Concussion management for children has changed: New pediatric protocols using the latest evidence](#). Clin Pediatr (Phila). 2020;59(1):5-20.
4. Maternal Newborn Child and Youth Strategic Clinical Network, Alberta Health Services. [Concussions and head injuries in children: Care instructions](#). Recover. 2019.
5. Lynch W. [Options for evaluating and tracking pediatric concussion](#). J Head Trauma Rehabil. 2018;33(5):354-61.
6. Dr. Shelina Babul and BC Injury Research and Prevention Unit, BC Children's Hospital. [Concussion awareness training tool \(CATT\)](#). 2018.
7. Echemendia RJ, Meeuwisse W, McCrory P, et al. [The sport concussion assessment tool 5th edition \(SCAT5\)](#). British Journal of Sports Medicine. 2017.
8. Davis GA, Purcell L, Schneider KJ, et al. [The child sport concussion assessment tool 5th edition \(Child SCAT5\)](#). British Journal of Sports Medicine. 2017.
9. Goia G, Collins M. [Acute concussion evaluation \(ACE\): Physician/clinician office version](#). Centers for Disease Control and Prevention (CDC). 2006.