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To be added once reviews are completed

Appendix A—Literature Search Details

The review of the evidence for this CPG encompassed a consideration of the range of physical impairments that may be relevant when making a differential diagnosis after a concussive event, with the goal of determining the underlying cause(s) of presenting signs and symptoms and matching them with intervention priorities. The GDG worked with a librarian from the University of North Carolina at Chapel Hill to engage in the two phases of the literature search process (Preliminary Searches and Systematic Searches) as recommended by the APTA Clinical Practice Guideline Process Manual.¹ EndNote X8 (Clarivate Analytics; Boston, Massachusetts) and DistillerSR software (Evidence Partners; Ottawa, Ontario, Canada) were used to manage the literature searches, coordinate evidence selection, carry out critical appraisals, and store notes and information about the evidence sources.

The first phase of the literature searching process was conducted in October of 2014 and entailed preliminary searches to help determine the extent to which a reasonable body of evidence was present to support the development of a guideline and identify existing guidelines and systematic reviews available at the time on concussion management. The preliminary searches explored the use of the following key words separately and in various combinations: “concussion,” “mild traumatic brain injury,” “mild closed head injury,” “rehabilitation,” “physical therapy,” “physiotherapy,” and “exercise.” Databases searched included PubMed, SportDiscus, and PsychInfo. The preliminary searches helped identify previously published CPGs, systematic reviews, and meta-analyses pertaining to the topic of concussion. From these preliminary searches, the GDG refined the scope and plan for the CPG and developed a formal strategy for the second phase.

The second phase entailed iterative systematic searches performed for studies up through April 30th 2015, May 1st, 2015 – October 31st, 2015; November 1st, 2016 - March 31st, 2017; April 1st, 2017 – April 30th, 2018; and May 1st, 2018 - December 31, 2018. The second phase searches entailed the high-level key word searches from Phase 1 and added the following additional search terms separate and in combination to ensure a wide breadth and comprehensive search process to capture impairments in vestibular, cervical, physical exertion, and functional mobility. The electronic systematic searches were supplemented through manual searching of journals and bibliographies, Google and Google Scholar searches, and word-of-mouth.

SEARCH STRATEGIES FOR ALL DATABASES SEARCHED

MEDLINE, CINAHL, EMBASE

("Brain Injuries"[MeSH] AND (mild[tiab] OR moderate[tiab] OR minor[tiab] OR concussion[tiab] OR concussions[tiab] OR concussive[tiab] OR mtbi[tiab] OR "post-traumatic"[tiab] OR posttraumatic[tiab] OR postconcussion[tiab] OR postconcussive[tiab] OR "post-concussion"[tiab] OR "post-concussive"[tiab] OR "post-concussional"[tiab] OR postconcussional[tiab])) AND ("Physical Therapy Modalities"[mesh] OR "Rehabilitation"[mesh] OR "Physical and Rehabilitation Medicine"[mesh] OR "Exercise"[mesh] OR "Disability Evaluation"[mesh] OR "Recovery of Function"[mesh] OR "physical therapy"[all fields] OR ("rehabilitation"[Subheading] OR "rehabilitation"[All Fields] OR "rehabilitation"[MeSH Terms]) OR physiotherapy[tiab] OR "rehabilitation"[Subheading] OR neurorehabilitation[all fields] OR "neuro-rehabilitation"[all fields]) AND (Randomized Controlled Trial[ptyp] OR ("Meta-analysis"[pt] OR "Practice Guideline"[pt] OR "Randomized Controlled Trial"[pt] OR "Longitudinal Studies"[MeSH] OR systematic[ti] OR "Follow-up Studies"[mh] OR "Retrospective Studies"[mh] OR "Clinical Trial"[pt]) AND ("2000/01/01"[PDAT] : "2018/12/31"[PDAT]) AND English[lang])

("Brain Injuries"[MeSH] OR brain[ti]) AND (mild[tiab] OR moderate[tiab] OR minor[tiab] OR concussion[tiab] OR concussions[tiab] OR concussive[tiab] OR mtbi[tiab] OR "post-traumatic"[tiab] OR postconcussion[tiab] OR postconcussive[tiab] OR "post-concussion"[tiab] OR "post-concussive"[tiab]) AND ("Physical Therapy Modalities"[mesh] OR "Rehabilitation"[mesh] OR "Physical and Rehabilitation Medicine"[mesh] OR "Exercise"[mesh] OR "Disability

Searches related to common impairment patterns

Expanded search to include SPORTDISCUS, PSYCHINFO

- i. Cervical and dizziness, cervical and concussion, cervical and mTBI, cervicogenic dizziness and concussion, cervicogenic and mTBI
- ii. Balance and concussion, balance and mTBI, balance and cervical
- iii. Dizziness and concussion, dizziness and mTBI, vertigo and concussion, vertigo and mTBI
- iv. Concussion and Fatigue, concussion and mTBI, concussion and exertion, exertion and mTBI
- v. Dual task and concussion, dual task and mTBI
- vi. Vision and concussion, vision and mTBI, Ocular motor and concussion, ocular motor and mTBI

[Cervical Complications](#)

("Brain Concussion"[mh] OR concussion[tw] OR concussions[tw] OR mtbi[tw] OR "mild traumatic brain"[tw] OR concussive[tw] OR "post-concussion"[tw] OR "post-concussive"[tw] OR postconcussion[tw]) AND ("Neck"[mh] OR "Neck Pain"[mh] OR "Cervical Vertebrae"[mh] OR "neck"[tw] OR "cervical"[tw] OR cervicogenic[tw]) AND English[lang] AND ("2000/01/01"[PDAT] : "2016/12/31"[PDAT]) NOT (Case Reports[ptyp] OR "case report"[ti])

[Balance](#)

("Brain Concussion"[mh] OR concussion[tw] OR concussions[tw] OR mtbi[tw] OR "mild traumatic brain"[tw] OR concussive[tw] OR "post-concussion"[tw] OR "post-concussive"[tw] OR postconcussion[tw]) AND ("Postural Balance"[Mesh] OR "Proprioception"[Mesh] OR "Gait"[mh] OR balance[ti] OR equilibrium[ti]) AND English[lang] AND ("2000/01/01"[PDAT] :

<p>Evaluation"[mesh] OR "Recovery of Function"[mesh] OR "physical therapy"[tiab] OR rehabilitation[tiab] OR physiotherapy[tiab] OR "rehabilitation"[Subheading] OR ("neurological rehabilitation"[MeSH Terms] OR ("neurological"[All Fields] AND "rehabilitation"[All Fields]) OR "neurological rehabilitation"[All Fields] OR "neurorhabilitation"[All Fields])) AND ("2000/12/01"[PDAT] : "2018/12/31"[PDAT])</p>	<p>"2016/12/31"[PDAT]) NOT (Case Reports[ptyp] OR "case report"[ti])</p> <p>Dizziness/Vertigo ("Brain Concussion"[mh] OR concussion[tw] OR concussions[tw] OR mtbi[tw] OR "mild traumatic brain"[tw] OR concussive[tw] OR "post-concussion"[tw] OR "post-concussive"[tw] OR postconcussion[tw]) AND ("Dizziness"[Mesh] OR "Vertigo"[Mesh] OR dizzy[ti] OR dizziness[ti] OR vertigo[ti]) AND English[lang] AND ("2000/01/01"[PDAT] : "2016/12/31"[PDAT]) NOT (Case Reports[ptyp] OR "case report"[ti])</p> <p>Fatigue/Exertion ("Brain Concussion"[mh] OR concussion[tw] OR concussions[tw] OR mtbi[tw] OR "mild traumatic brain"[tw] OR concussive[tw] OR "post-concussion"[tw] OR "post-concussive"[tw] OR postconcussion[tw]) AND ("Fatigue"[Mesh] OR "Physical Exertion"[Mesh] OR "Exercise"[Mesh] OR fatigue[ti] OR fatigued[ti] OR exertion[ti] OR exercise[ti]) AND English[lang] AND ("2000/01/01"[PDAT] : "2016/12/31"[PDAT]) NOT (Case Reports[ptyp] OR "case report"[ti])</p> <p>Dual Task ("Brain Concussion"[mh] OR concussion[tw] OR concussions[tw] OR mtbi[tw] OR "mild traumatic brain"[tw] OR concussive[tw] OR "post-concussion"[tw] OR "post-concussive"[tw] OR postconcussion[tw]) AND ("dual task" OR "divided attention" OR "Stroop Test"[mh] OR Stroop[tw]) AND English[lang] AND ("2000/01/01"[PDAT] : "2016/12/31"[PDAT]) NOT (Case Reports[ptyp] OR "case report"[ti])</p> <p>Vision/ Ocular Motor ("Brain Concussion"[mh] OR concussion[tw] OR concussions[tw] OR mtbi[tw] OR "mild traumatic brain"[tw] OR concussive[tw] OR "post-concussion"[tw] OR "post-concussive"[tw] OR postconcussion[tw]) AND ("Vision, Ocular"[Mesh] OR "Visual Perception"[Mesh] OR vision[ti] OR visual[ti] OR "ocular motor"[ti] OR oculomotor[ti]) AND English[lang] AND ("2000/01/01"[PDAT] : "2016/12/31"[PDAT]) NOT (Case Reports[ptyp] OR "case report"[ti])</p>
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Appendix B—Search Results

Date Conducted	Results with all Databases Combined, Duplicates Removed
April 30 th , 2015	210
October 31st, 2015	823
March 31st, 2017	103
December 31, 2018	1136
Total	2,272

Appendix C—Article Inclusion and Exclusion Criteria

Inclusion Criteria

Clinical Practice Guidelines:

- Published January 1, 2015 or later
- Included a multi-disciplinary team for authorship
- Recommendations based off of a systematic review and appraisal of the literature
- Included recommendations that pertained to movement-related impairments
- determined to be acceptable based on critical appraisal by two trained independent reviewers using criteria on the AGREE II tool

Original Studies and Systematic Reviews

- Included human participants with clear designation of a concussion or history of concussive event
- Two trained independent reviewers appraised it as relevant to scope of the CPG
- Critical review of document by two trained independent reviewers appraised it as an acceptable level of quality for inclusion

Expert Consensus Documents

- Two trained independent reviewers appraised it as relevant to scope of the CPG
- Based off of a systematic search of the literature OR a Delphi study methodology
- Described sound methods for consensus generation
- Adequate evidence of applicable expertise of participants/authors was provided
- Critical review of document by two trained independent reviewers appraised it as an acceptable level of quality for inclusion

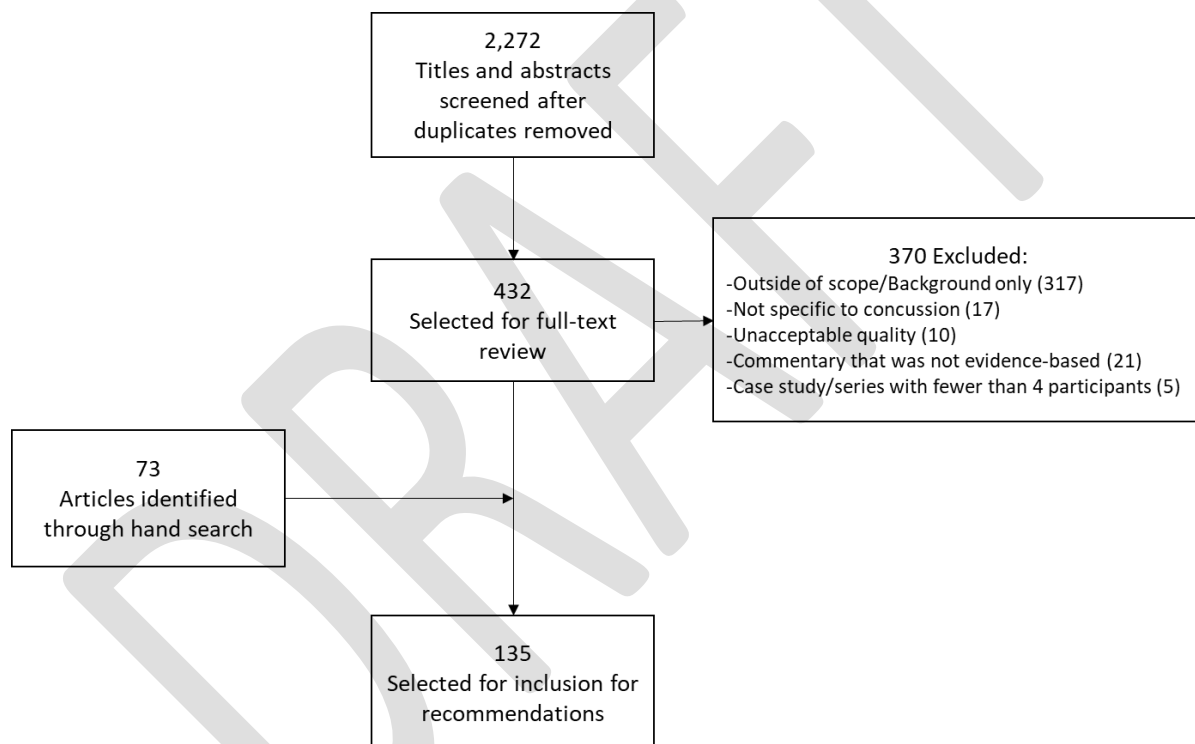
Conceptual and Theoretical Documents:

- Two trained independent reviewers appraised it as relevant to scope of the CPG
- Source perceived as trustworthy
- Critical review of document by two trained independent reviewers appraised it as an acceptable level of quality for inclusion

Exclusion Criteria

- Not available in English
- Determined to not be relevant for the CPG scope by two independent reviewers
- Inclusion of only healthy participants (no participants with history of concussive event)
- No clear delineation of outcomes specific to individuals with concussion/mild traumatic brain injury when the study also included participants with more severe brain injury
- Participants or target population mean age younger than 8 years of age
- Case study/series with fewer than four participants
- Commentary that was not evidence-based
- Critical appraisal resulted in rating of unacceptable quality

Appendix C—Flow Chart of Articles



Appendix D—Articles Included in Recommendations by Topic

COMPONENT 1: DETERMINE APPROPRIATENESS OF PHYSICAL THERAPY EXAMINATION *Early Diagnosis*

Marshall S, Bayley M, McCullagh S, et al. Updated clinical practice guidelines for concussion/mild traumatic brain injury and persistent symptoms. *Brain Inj.* 2015;29(6):688-700.

VA/DoD Clinical Practice Guideline for The Management of Concussion-Mild Traumatic Brain Injury Version 2.0. 2016;

<https://www.healthquality.va.gov/guidelines/Rehab/mtbi/>. Accessed December 19, 2018.

Screen for Indicators of Emergency Conditions

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 Pediatr*. 2018:e182853.

Marshall S, Bayley M, McCullagh S, et al. Updated clinical practice guidelines for concussion/mild traumatic brain injury and persistent symptoms. *Brain Inj*. 2015;29(6):688-700.

Determination of Appropriateness of Concussion Diagnosis

Alsalaheen B, Stockdale K, Pechumer D, Broglio SP. Measurement Error in the Immediate Postconcussion Assessment and Cognitive Testing (ImPACT): Systematic Review. *J Head Trauma Rehabil*. 2016;31(4):242-251.

Alsalaheen B, Stockdale K, Pechumer D, Broglio SP. Validity of the Immediate Post Concussion Assessment and Cognitive Testing (ImPACT). *Sports Med*. 2016;46(10):1487-1501.

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 Pediatr*. 2018:e182853.

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:e182847.

Makdissi M, Schneider KJ, Feddermann-Demont N, et al. Approach to investigation and treatment of persistent symptoms following sport-related concussion: a systematic review. *Br J Sports Med*. 2017;51(12):958-968.

Marshall S, Bayley M, McCullagh S, et al. Updated clinical practice guidelines for concussion/mild traumatic brain injury and persistent symptoms. *Brain Inj*. 2015;29(6):688-700.

McCrory P, Meeuwisse W, Dvorak J, et al. Consensus statement on concussion in sport-the 5th international conference on concussion in sport held in Berlin, October 2016. *Br J Sports Med*. 2017.

VA/DoD Clinical Practice Guideline for The Management of Concussion-Mild Traumatic Brain Injury Version 2.0. 2016;

<https://www.healthquality.va.gov/guidelines/Rehab/mtbi/>. Accessed December 19, 2018.

Comprehensive Intake Interview

Gagnon I, Friedman D, Beauchamp MH, et al. The Canadian Pediatric Mild Traumatic Brain Injury Common Data Elements Project: Harmonizing Outcomes to Increase Understanding of Pediatric Concussion. *J Neurotrauma*. 2018;35(16):1849-1857.

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 Pediatr*. 2018:e182853.

- Marshall S, Bayley M, McCullagh S, et al. Updated clinical practice guidelines for concussion/mild traumatic brain injury and persistent symptoms. *Brain Inj.* 2015;29(6):688-700.
- McCulloch KL, Goldman S, Lowe L, et al. Development of clinical recommendations for progressive return to activity after military mild traumatic brain injury: guidance for rehabilitation providers. *J Head Trauma Rehabil.* 2015;30(1):56-67.
- McCrory P, Meeuwisse W, Dvorak J, et al. Consensus statement on concussion in sport-the 5th international conference on concussion in sport held in Berlin, October 2016. *Br J Sports Med.* 2017.

COMPONENT 2: EXAMINATION AND EVALUATION

Systems to be Examined

- Broglio SP, Kontos AP, Levin H, et al. National Institute of Neurological Disorders and Stroke and Department of Defense Sport-Related Concussion Common Data Elements Version 1.0 Recommendations. *J Neurotrauma.* 2018;35(23):2776-2783.
- Gagnon I, Friedman D, Beauchamp MH, et al. The Canadian Pediatric Mild Traumatic Brain Injury Common Data Elements Project: Harmonizing Outcomes to Increase Understanding of Pediatric Concussion. *J Neurotrauma.* 2018;35(16):1849-1857.
- Makdissi M, Schneider KJ, Feddermann-Demont N, et al. Approach to investigation and treatment of persistent symptoms following sport-related concussion: a systematic review. *Br J Sports Med.* 2017;51(12):958-968.
- Marshall S, Bayley M, McCullagh S, et al. Updated clinical practice guidelines for concussion/mild traumatic brain injury and persistent symptoms. *Brain Inj.* 2015;29(6):688-700.
- McCrory P, Meeuwisse W, Dvorak J, et al. Consensus statement on concussion in sport-the 5th international conference on concussion in sport held in Berlin, October 2016. *Br J Sports Med.* 2017.
- McCulloch KL, Goldman S, Lowe L, et al. Development of clinical recommendations for progressive return to activity after military mild traumatic brain injury: guidance for rehabilitation providers. *J Head Trauma Rehabil.* 2015;30(1):56-67.

Sequencing of Examination Based on Levels of Irritability

- Cheever K, Kawata K, Tierney R, Galgon A. Cervical Injury Assessments for Concussion Evaluation: A Review. *J Athl Train.* 2016;51(12):1037-1044.
- Ellis MJ, Leddy JJ, Willer B. Physiological, vestibulo-ocular and cervicogenic post-concussion disorders: an evidence-based classification system with directions for treatment. *Brain Inj.* 2015;29(2):238-248.
- Kennedy E, Quinn D, Tumilty S, Chapple CM. Clinical characteristics and outcomes of treatment of the cervical spine in patients with persistent post-concussion symptoms: A retrospective analysis. *Musculoskelet Sci Pract.* 2017;29:91-98.
- Kuczynski A, Crawford S, Bodell L, Dewey D, Barlow KM. Characteristics of post-traumatic headaches in children following mild traumatic brain injury and their response to treatment: a prospective cohort. *Dev Med Child Neurol.* 2013;55(7):636-641.

- Leddy JJ, Baker JG, Merchant A, et al. Brain or strain? Symptoms alone do not distinguish physiologic concussion from cervical/vestibular injury. *Clin J Sport Med*. 2015;25(3):237-242.
- Marshall CM, Vernon H, Leddy JJ, Baldwin BA. The role of the cervical spine in post-concussion syndrome. *Phys Sportsmed*. 2015;43(3):274-284.
- Morin M, Langevin P, Fait P. Cervical Spine Involvement in Mild Traumatic Brain Injury: A Review. *J Sports Med (Hindawi Publ Corp)*. 2016;2016:1590161.
- Reneker JC, Cheruvu V, Yang J, et al. Differential diagnosis of dizziness after a sports-related concussion based on descriptors and triggers: an observational study. *Inj Epidemiol*. 2015;2(1):22.
- Reneker JC, Cheruvu VK, Yang J, James MA, Cook CE. Physical examination of dizziness in athletes after a concussion: A descriptive study. *Musculoskelet Sci Pract*. 2018;34:8-13.
- Reneker JC, Clay Moughiman M, Cook CE. The diagnostic utility of clinical tests for differentiating between cervicogenic and other causes of dizziness after a sports-related concussion: An international Delphi study. *J Sci Med Sport*. 2015;18(4):366-372.
- Schneider KJ, Meeuwisse WH, Palacios-Derflinger L, Emery CA. Changes in Measures of Cervical Spine Function, Vestibulo-ocular Reflex, Dynamic Balance, and Divided Attention Following Sport-Related Concussion in Elite Youth Ice Hockey Players. *J Orthop Sports Phys Ther*. 2018;48(12):974-981.
- van der Walt K, Tyson A, Kennedy E. How often is neck and vestibulo-ocular physiotherapy treatment recommended in people with persistent post-concussion symptoms? A retrospective analysis. *Musculoskelet Sci Pract*. 2019;39:130-135.

Examination for Vestibulo-oculomotor Impairments

- Anzalone AJ, Blueitt D, Case T, et al. A Positive Vestibular/Ocular Motor Screening (VOMS) Is Associated With Increased Recovery Time After Sports-Related Concussion in Youth and Adolescent Athletes. *Am J Sports Med*. 2017;45(2):474-479.
- Capo-Aponte JE, Beltran TA, Walsh DV, Cole WR, Dumayas JY. Validation of Visual Objective Biomarkers for Acute Concussion. *Mil Med*. 2018;183(suppl_1):9-17.
- Capo-Aponte JE, Tarbett AK, Urosevich TG, Temme LA, Sanghera NK, Kalich ME. Effectiveness of computerized oculomotor vision screening in a military population: pilot study. *J Rehabil Res Dev*. 2012;49(9):1377-1398.
- Corwin DJ, Wiebe DJ, Zonfrillo MR, et al. Vestibular Deficits following Youth Concussion. *J Pediatr*. 2015;166(5):1221-1225.
- Cheever K, Kawata K, Tierney R, Galgon A. Cervical Injury Assessments for Concussion Evaluation: A Review. *J Athl Train*. 2016;51(12):1037-1044.
- Cheever KM, McDevitt J, Tierney R, Wright WG. Concussion Recovery Phase Affects Vestibular and Oculomotor Symptom Provocation. *Int J Sports Med*. 2018;39(2):141-147.
- Elbin RJ, Sufrinko A, Anderson MN, et al. Prospective Changes in Vestibular and Ocular Motor Impairment After Concussion. *J Neurol Phys Ther*. 2018;42(3):142-148.
- Ellis MJ, Leddy JJ, Willer B. Physiological, vestibulo-ocular and cervicogenic post-concussion disorders: an evidence-based classification system with directions for treatment. *Brain Inj*. 2015;29(2):238-248.

- Goodrich GL, Martinsen GL, Flyg HM, et al. Development of a mild traumatic brain injury-specific vision screening protocol: a Delphi study. *J Rehabil Res Dev*. 2013;50(6):757-768.
- Heyer GL, Young JA, Fischer AN. Lightheadedness After Concussion: Not All Dizziness is Vertigo. *Clin J Sport Med*. 2018;28(3):272-277.
- Hunt AW, Mah K, Reed N, Engel L, Keightley M. Oculomotor-Based Vision Assessment in Mild Traumatic Brain Injury: A Systematic Review. *J Head Trauma Rehabil*. 2016;31(4):252-261.
- Jozefowicz-Korczynska M, Pajor A, Skora W. Benign paroxysmal positional vertigo in patients after mild traumatic brain injury. *Adv Clin Exp Med*. 2018;27(10):1355-1359.
- Leddy JJ, Baker JG, Merchant A, et al. Brain or strain? Symptoms alone do not distinguish physiologic concussion from cervical/vestibular injury. *Clin J Sport Med*. 2015;25(3):237-242.
- Lei-Rivera L, Sutera J, Galatioto JA, Hujsak BD, Gurley JM. Special tools for the assessment of balance and dizziness in individuals with mild traumatic brain injury. *NeuroRehabilitation*. 2013;32(3):463-472.
- 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 Pediatr*. 2018:e182853.
- Makdissi M, Schneider KJ, Feddermann-Demont N, et al. Approach to investigation and treatment of persistent symptoms following sport-related concussion: a systematic review. *Br J Sports Med*. 2017;51(12):958-968.
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- Master CL, Scheiman M, Gallaway M, et al. Vision Diagnoses Are Common After Concussion in Adolescents. *Clin Pediatr (Phila)*. 2016;55(3):260-267.
- Matuszak JM, McVige J, McPherson J, Willer B, Leddy J. A Practical Concussion Physical Examination Toolbox. *Sports health*. 2016;8(3):260-269.
- McDevitt J, Appiah-Kubi KO, Tierney R, Wright WG. Vestibular and Oculomotor Assessments May Increase Accuracy of Subacute Concussion Assessment. *Int J Sports Med*. 2016;37(9):738-747.
- Morin M, Langevin P, Fait P. Cervical Spine Involvement in Mild Traumatic Brain Injury: A Review. *J Sports Med (Hindawi Publ Corp)*. 2016;2016:1590161.
- Mucha A, Collins MW, Elbin RJ, et al. A Brief Vestibular/Ocular Motor Screening (VOMS) assessment to evaluate concussions: preliminary findings. *Am J Sports Med*. 2014;42(10):2479-2486.
- Murray NG, Ambati VN, Contreras MM, Salvatore AP, Reed-Jones RJ. Assessment of oculomotor control and balance post-concussion: a preliminary study for a novel approach to concussion management. *Brain Inj*. 2014;28(4):496-503.
- Reneker JC, Cheruvu V, Yang J, et al. Differential diagnosis of dizziness after a sports-related concussion based on descriptors and triggers: an observational study. *Inj Epidemiol*. 2015;2(1):22.

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- Skora W, Stanczyk R, Pajor A, Jozefowicz-Korczynska M. Vestibular system dysfunction in patients after mild traumatic brain injury. *Ann Agric Environ Med.* 2018;25(4):665-668.
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Examination for Exertional Tolerance

- Broglia SP, Kontos AP, Levin H, et al. National Institute of Neurological Disorders and Stroke and Department of Defense Sport-Related Concussion Common Data Elements Version 1.0 Recommendations. *J Neurotrauma.* 2018;35(23):2776-2783.
- Cordingley D, Girardin R, Reimer K, et al. Graded aerobic treadmill testing in pediatric sports-related concussion: safety, clinical use, and patient outcomes. *J Neurosurg Pediatr.* 2016;25(6):693-702.
- Darling SR, Leddy JJ, Baker JG, et al. Evaluation of the Zurich Guidelines and exercise testing for return to play in adolescents following concussion. *Clin J Sport Med.* 2014;24(2):128-133.
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COMPONENT 3: PLAN OF CARE DEVELOPMENT AND IMPLEMENTATION

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Appendix E—Levels of Evidence Table

LEVELS OF EVIDENCE TABLE*

Level	Intervention/Prevention	Pathoanatomic/Risk/Clinical Course/Prognosis/Differential Diagnosis	Diagnosis/Diagnostic Accuracy	Prevalence of Condition/Disorder	Examination/Outcomes
I	Systematic review of high-quality RCTs High-quality RCT [†]	Systematic review of prospective cohort studies High-quality prospective cohort study [‡]	Systematic review of high-quality diagnostic studies High-quality diagnostic study [§] with validation	Systematic review, high-quality cross-sectional studies High-quality cross-sectional study	Systematic review of prospective cohort studies High-quality prospective cohort study
II	Systematic review of high-quality cohort studies High-quality cohort study [‡] Outcomes study or ecological study Lower-quality RCT [†]	Systematic review of retrospective cohort study Lower-quality prospective cohort study High-quality retrospective cohort study Consecutive cohort Outcomes study or ecological study	Systematic review of exploratory diagnostic studies or consecutive cohort studies High-quality exploratory diagnostic studies Consecutive retrospective cohort	Systematic review of studies that allows relevant estimate Lower-quality cross-sectional study	Systematic review of lower-quality prospective cohort studies Lower-quality prospective cohort study
III	Systematic reviews of case-control studies High-quality case-control study Lower-quality cohort study	Lower-quality retrospective cohort study High-quality cross-sectional study Case-control study	Lower-quality exploratory diagnostic studies Nonconsecutive retrospective cohort	Local nonrandom study	High-quality cross-sectional study
IV	Case series	Case series	Case-control study	...	Lower-quality cross-sectional study
V	Expert opinion	Expert opinion	Expert opinion	Expert opinion	Expert opinion

Abbreviation: RCT, randomized clinical trial.

*Adapted from Phillips et al⁹¹ (<http://www.cebm.net/index.aspx?o=1025>). See also **APPENDIX G**.

[†]High quality includes RCTs with greater than 80% follow-up, blinding, and appropriate randomization procedures.

[‡]High-quality cohort study includes greater than 80% follow-up.

[§]High-quality diagnostic study includes consistently applied reference standard and blinding.

^{||}High-quality prevalence study is a cross-sectional study that uses a local and current random sample or censuses.

[¶]Weaker diagnostic criteria and reference standards, improper randomization, no blinding, and less than 80% follow-up may add bias and threats to validity.

Appendix F—Procedures for Assigning Levels of Evidence

PROCEDURES FOR ASSIGNING LEVELS OF EVIDENCE

- Level of evidence is assigned based on the study design using the Levels of Evidence table (**APPENDIX F**), assuming high quality (eg, for intervention, randomized clinical trial starts at level I)
- Study quality is assessed using the critical appraisal tool, and the study is assigned 1 of 4 overall quality ratings based on the critical appraisal results
- Level of evidence assignment is adjusted based on the overall quality rating:
 - High quality (high confidence in the estimate/results): study remains at assigned level of evidence (eg, if the randomized clinical trial is rated high quality, its final assignment is level I). High quality should include:
 - Randomized clinical trial with greater than 80% follow-up, blinding, and appropriate randomization procedures
 - Cohort study includes greater than 80% follow-up
 - Diagnostic study includes consistently applied reference standard and blinding
 - Prevalence study is a cross-sectional study that uses a local and current random sample or censuses
 - Acceptable quality (the study does not meet requirements for high quality and weaknesses limit the confidence in the accuracy of the estimate): downgrade 1 level
 - Based on critical appraisal results
 - Low quality: the study has significant limitations that substantially limit confidence in the estimate: downgrade 2 levels
 - Based on critical appraisal results
 - Unacceptable quality: serious limitations: exclude from consideration in the guideline
 - Based on critical appraisal results

Appendix H—Appraisals

Tables in progress—Completed tables will provide critical appraisal process summaries for all included articles