APPENDIX E1. DEFINITIONS.

Adult: For the prior policy,[31] the term adult was used. However, a few studies with minor head injury in adults included some older adolescent aged patients, typically age 16 years and older. For this policy and for continuity with the previous policy, the term adult will refer to any older adolescent or young adult through the ages of older adulthood.

Antiplatelet: Any antiplatelet medication including the following examples: aspirin, clopidogrel, prasugrel, dipyridamole, ticlopidine.

Anticoagulant: Any anticoagulant medication including the following: coumarins (warfarin), heparins, or non-vitamin K antagonist oral anticoagulants (NOACs) such as direct thrombin inhibitors (dabigatran) and factor Xa inhibitors (rivaroxaban, apixaban, edoxaban, or betrixaban).

Baseline neurological exam: A normal baseline neurological status for the specific patient. For example, if a patient has had a prior cerebrovascular accident (CVA) and no acute neurological exam findings are noted during evaluation, then this would be considered the patient's baseline.

Clinically important findings: "Clinically significant" abnormalities on CT requiring procedural intervention or admission, presence of neurological deterioration, intubation for the head injury, or death due to head injury.

Clinical decision tools: Any decision rules, tools, instruments, or aids, but may also include other assessment tools including combinations of cognitive aids, decision support instruments, screening aids, or biomarkers.

Head CT: Non-contrast brain computed tomography.

Delayed traumatic intracranial hemorrhage: Traumatic intracranial hemorrhage on brain CT within 2 weeks after initial normal CT scan and without repeated head trauma history.[72]

Postconcussive syndrome (PCS): Any prolonged or delayed sequelae with physical, cognitive, or emotional symptoms associated with mTBI that last beyond the early period postinjury and typically last weeks to months.[95]

Minor head injury and mild traumatic brain injury (mTBI): Patients with blunt head injury with a GCS score of 14 or 15* (and improvement to GCS score of 15 at 2 hours postinjury if GCS score of 14) with or without a history of the following: LOC, amnesia, or disorientation.

There is no universally accepted definition. This policy, in staying consistent with the ACEP Clinical Policy in 2008, will address patients with a GCS score 14 or 15 since some experts and authors note a higher or moderate risk in patients with a GCS score of 13.[31]

Examples of other various definitions include:

- History of LOC, amnesia, or disorientation and a GCS score of 13 to 15.[47]

  or
- History of LOC, normal findings on brief neurological exam (normal CNs, normal strength and sensation in arms and legs), and a GCS of 15 on arrival [LOC defined as reported by witness or patient or patient could not remember event (amnesia)].[48]

  or
- Any blunt head injury regardless of LOC or amnesia.[72]

  or
- Head injury (any trauma to the head, other than superficial injuries to the face) and presenting with a GCS score of 14 to 15 regardless of LOC.[73]

*This was a joint policy involving ACEP and CDC. Subsequent reports from the CDC define a GCS score of 13 to 15 as mTBI. VA/DoD has now removed GCS in their definition of mTBI.[43]

Appendix E2. Literature classification schema.*

Design/ Class	Therapy†	Diagnosis‡	Prognosis§
1	Randomized, controlled trial or meta-analysis of randomized trials	Prospective cohort using a criterion standard or meta-analysis of prospective studies	Population prospective cohort or meta-analysis of prospective studies
2	Nonrandomized trial	Retrospective observational	Retrospective cohort Case control
3	Case series	Case series	Case series

*Some designs (eg, surveys) will not fit this schema and should be assessed individually.
†Objective is to measure therapeutic efficacy comparing interventions.
‡Objective is to determine the sensitivity and specificity of diagnostic tests.
§Objective is to predict outcome, including mortality and morbidity.

Appendix E3. Approach to downgrading strength of evidence.

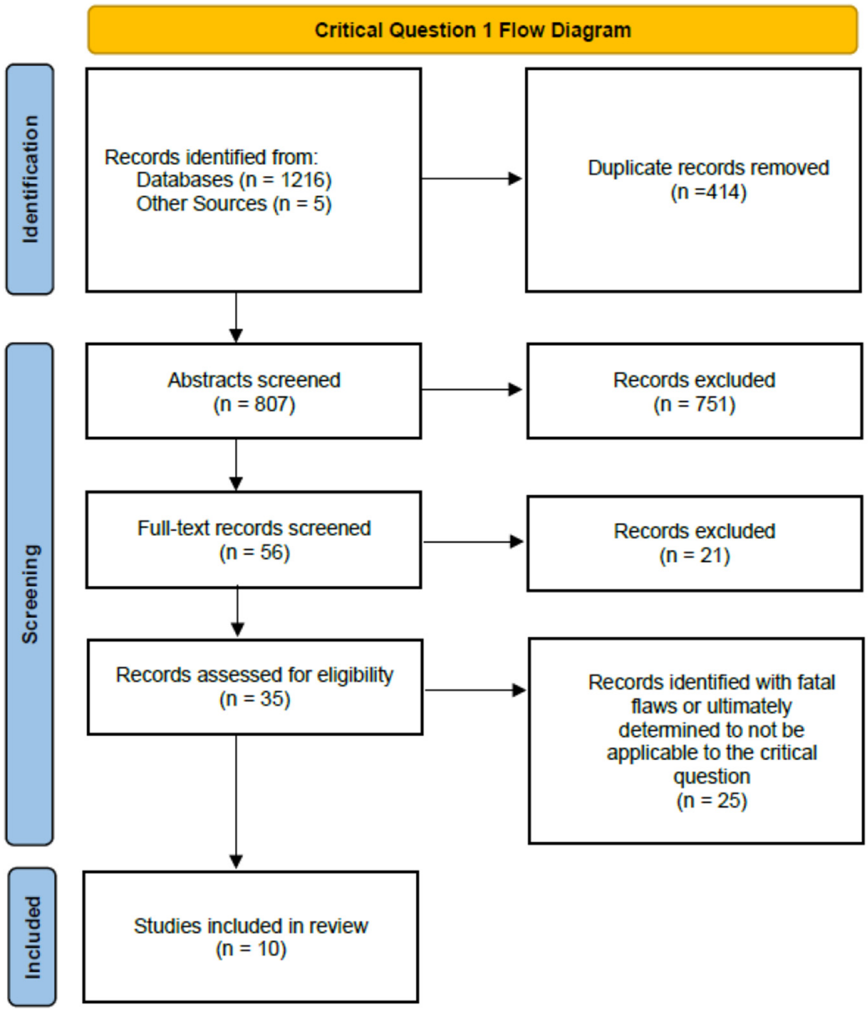
	Design/Class		
Downgrading	1	2	3
None	I	II	III
1 level	II	III	X
2 levels	III	X	X
Fatally flawed	X	X	X

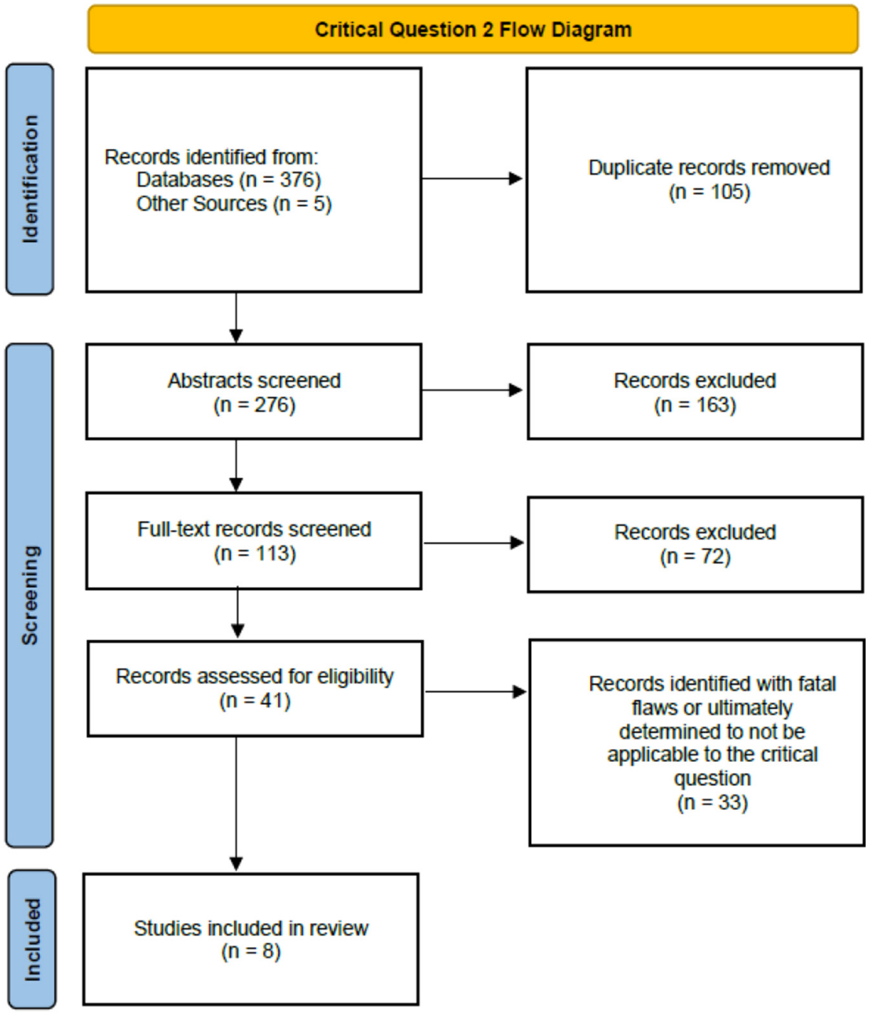
Appendix E4. Likelihood ratios and number needed to treat.*

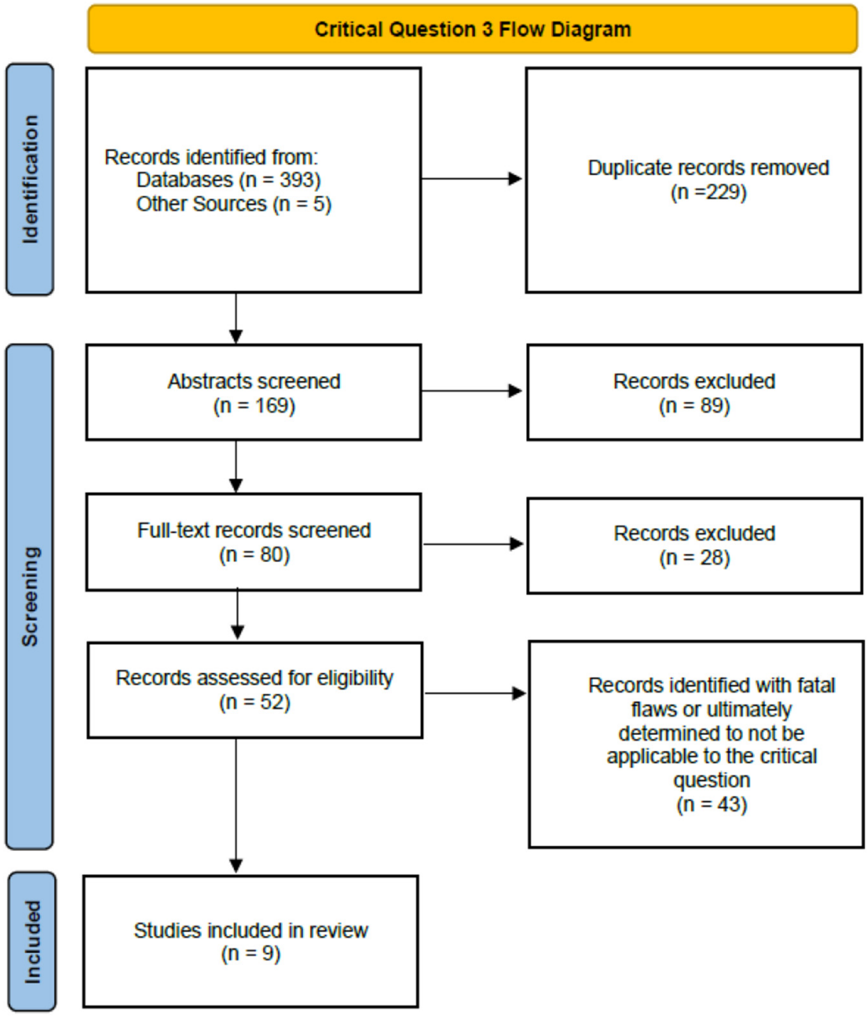
LR (+)	LR (–)	
1.0	1.0	Does not change pretest probability
1–5	0.5–1	Minimally changes pretest probability
10	0.1	May be diagnostic if the result is concordant with pretest probability
20	0.05	Usually diagnostic
100	0.01	Almost always diagnostic even in the setting of low or high pretest probability

LR, likelihood ratio.
*Number needed to treat (NNT): number of patients who need to be treated to achieve 1 additional good outcome; NNT=1/absolute risk reduction×100, where absolute risk reduction is the risk difference between 2 event rates (ie, experimental and control groups).

APPENDIX E5. PREFERRED REPORTING ITEMS FOR SYSTEMATIC REVIEWS AND META-ANALYSES (PRISMA) FLOW DIAGRAMS.[46]




Critical Question 2 Flow Diagram
Identification
Screening
Included
Records identified from:
Databases (n = 376)
Other Sources (n = 5)
Duplicate records removed
(n = 105)
Abstracts screened
(n = 276)
Records excluded
(n = 163)
Full-text records screened
(n = 113)
Records excluded
(n = 72)
Records assessed for eligibility
(n = 41)
Records identified with fatal flaws or ultimately determined to not be applicable to the critical question
(n = 33)
Studies included in review
(n = 8)


Critical Question 3 Flow Diagram
Identification
Screening
Included
Records identified from:
Databases (n = 393)
Other Sources (n = 5)
Duplicate records removed
(n =229)
Abstracts screened
(n = 169)
Records excluded
(n = 89)
Full-text records screened
(n = 80)
Records excluded
(n = 28)
Records assessed for eligibility
(n = 52)
Records identified with fatal flaws or ultimately determined to not be applicable to the critical question
(n = 43)
Studies included in review
(n = 9)

APPENDIX E6: CDC EDUCATIONAL TOOLS AND RESOURCES.

Appendix E6: CDC Educational Tools and Resources

Checklist to Assess for and Manage Mild Traumatic Brain Injury (mTBI) and Concussion

For Emergency Department Physicians Treating Patients 18 Years and Older

Assess.

- ☐ Conduct a physical examination to identify findings that may:
  - Suggest a more severe traumatic brain injury (e.g., hemotympanum)
  - Impact mTBI management (e.g., baseline deficits, oculomotor dysfunction)
- ☐ Assess symptoms using validated scales.
- ☐ Do not routinely image (including CT & MRI). Use clinical decision rules to determine need.
- ☐ **For patients on anticoagulation or antiplatelet therapy (except for aspirin):**
  - **Highly consider imaging.**
  - **Do not use clinical decision rules to exclude the need for head CT.**
  - **Do not routinely repeat imaging if CT showed no hemorrhage at baseline.**
  - **Do not routinely admit to hospital if CT is negative and no other medical criteria indicating admission are present.**

Examples of validated scales:

- Standardized Assessment of Concussion
- Post-Concussion Symptom Scale
- Acute Concussion Evaluation
- Sport Concussion Assessment Tool

Examples of validated decision rules:

- Canadian CT Head Rule
- New Orleans/Charity Head Trauma/ Injury Rule
- NEXUS

Educate.

- ☐ Provide discharge information about:
  - Rare symptoms of delayed hemorrhage
  - Typical recovery course
  - Gradual return to activity (e.g., work, driving)
- ☐ Offer clear instructions (preferably verbal and written) on return to activity customized to the patient's symptoms.

CDC patient discharge instructions: www.cdc.gov/TraumaticBrainInjury

Example return-to-activity instructions:

Within 2-3 days of injury, begin light activity and then gradually reintroduce regular non-sports-related activities that do not cause symptoms to get worse.

Refer.

- ☐ Instruct patient to follow-up with their regular healthcare professional within a few days post-injury.
- ☐ Consider referral to outpatient care for patient at high risk for post-concussive syndrome.
- ☐ **For patients on anticoagulation or antiplatelet therapy (except for aspirin) consider outpatient referral to assess:**
  - **Fall risk**
  - **Risks and benefits of anticoagulation therapy**

Female patients are more likely to experience post-concussive symptoms.

Potential risk factors for post-concussive syndrome also include:

- Psychiatric history
- GCS<15
- Etiology of assault
- Alcohol intoxication
- Loss of consciousness following injury
- Pre-injury psychological history (e.g., anxiety, depression)

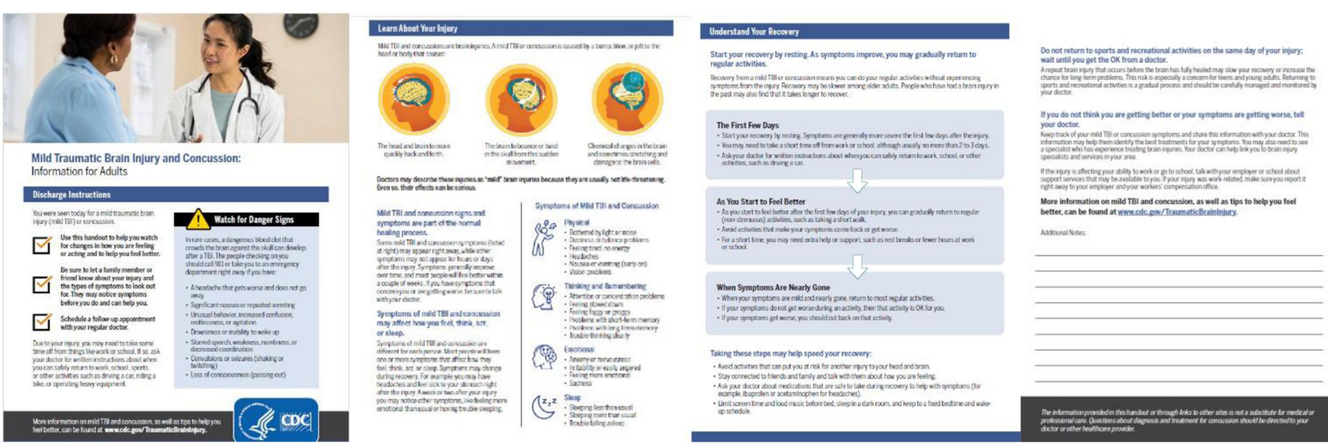
CDC older adult fall prevention tools: www.cdc.gov/STEADI

All of the clinical recommendations and education tools related to the American College of Emergency Physicians mTBI Guideline are available at www.cdc.gov/TraumaticBrainInjury.

Appendix E6. CDC educational tools and resources. (continued)

Algorithm for Fall Risk Screening, Assessment and Intervention
Link to Resources: https://www.cdc.gov/steadi/pdf/steadi-algorithm-508.pdf

Mild Traumatic Brain Injury and Concussion: Information for Adults
Link to Resources: https://www.cdc.gov/traumaticbraininjury/pdf/tbi_patient_instructions-a.pdf



Stay Independent Brochure

Link to Resources: https://www.cdc.gov/steadi/pdf/STEADI-Brochure-StayIndependent-508.pdf

Check Your Risk for Falling

Circle "Yes" or "No" for each statement below			Why it matters
Yes (2)	No (0)	I have fallen in the past year.	People who have fallen once are likely to fall again.
Yes (2)	No (0)	I use or have been advised to use a cane or walker to get around safely.	People who have been advised to use a cane or walker may already be more likely to fall.
Yes (1)	No (0)	Sometimes I feel unsteady when I am walking.	Unsteadiness or needing support while walking are signs of poor balance.
Yes (1)	No (0)	I steady myself by holding onto furniture when walking at home.	This is also a sign of poor balance.
Yes (1)	No (0)	I am worried about falling.	People who are worried about falling are more likely to fall.
Yes (1)	No (0)	I need to push with my hands to stand up from a chair.	This is a sign of weak leg muscles, a major reason for falling.
Yes (1)	No (0)	I have some trouble stepping up onto a curb.	This is also a sign of weak leg muscles.
Yes (1)	No (0)	I often have to rush to the toilet.	Rushing to the bathroom, especially at night, increases your chance of falling.
Yes (1)	No (0)	I have lost some feeling in my feet.	Numbness in your feet can cause stumbles and lead to falls.
Yes (1)	No (0)	I take medicine that sometimes makes me feel light-headed or more tired than usual.	Side effects from medicines can sometimes increase your chance of falling.
Yes (1)	No (0)	I take medicine to help me sleep or improve my mood.	These medicines can sometimes increase your chance of falling.
Yes (1)	No (0)	I often feel sad or depressed.	Symptoms of depression, such as not feeling well or feeling slowed down, are linked to falls.
Total ____		Add up the number of points for each "yes" answer. If you scored 4 points or more, you may be at risk for falling.	

What You can do to Prevent Falls

Link to Resources: https://www.cdc.gov/steadi/pdf/STEADI-Brochure-WhatYouCanDo-508.pdf

Postural Hypotension: What it is & How to Manage it
Link to Resources: https://www.cdc.gov/steadi/pdf/STEADI-Brochure-Postural-Hypotension-508.pdf

Evidentiary Table.

Study & Year Published	Class of Evidence	Setting & Study Design	Methods & Outcome Measures	Results	Limitations & Comments
Stiell et al[47] (2001)	II for Q1	Prospective cohort in 10 Canadian hospitals (community and academic) from 1996 to 1999	Patients ≥16 y with mTBI and GCS score of 13 to 15 had predictor variable applied and then univariate analyses and then logistic regression to develop model with outcome of need for neurologic intervention (secondary outcome of CIBI)	3,121 patients, 8% had CIBI; 44 (1%) required neurologic intervention; the high-risk factors were 100% sensitive (95% CI 92% to 100%) for predicting need for neurologic intervention, and would require only 32% of patients to undergo CT; the medium-risk factors were 98.4% sensitive (95% CI 96% to 99%) and 49.6% specific for predicting CIBI, and would require only 54% of patients to undergo CT	Derivation study with only internal validation; not yet externally validated (at the point when this article was published); otherwise, very strong methods, inclusive of robust follow-up
Haydel et al[48] (2000)	III for Q1	Prospective cohort	Patients >3 y with minor head injury who received CT; recursive partitioning applied to derive high-risk criteria in phase 1 then applied to second phase of patients looking for positive CT	520 patients in the first phase, 36 (6.9%) had positive scans; all patients with positive CT scans had 1 or more of 7 findings; among the 909 patients in the second phase, 57 (6.3 %) had positive scans; in this group of patients, the sensitivity of the 7 findings combined was 100% (95 % CI 95% to 100%); all patients with positive CT scans had at least 1 of the findings	Essentially an internal validation as the validation cohort, albeit separate from the derivation cohort, but validation occurred at same clinical site; also, minor concern about spectrum/selection as patients without LOC were not included; possible workup bias

Evidentiary Table (continued).

Mower et al[49] (2017)	II for Q1	Prospective cohort study from 4 academic Eds from 2006 through 2015	All patients with mTBI who received head CT; NEXUS criteria applied; primary outcome need for neurosurgical intervention; secondary outcome: clinically significant head injury by CT imaging	12,696 patients with criteria assessment completed for N=11,817; primary outcome occurred in 420 (3.6%) patients; secondary outcome occurred in 767 (6.5%); sensitivity: 100% (95% CI 99.1% to 100%); specificity of 24.9% (95% CI 24.1% to 25.7%)	Potential spectrum bias, which may affect specificity estimates; potential verification bias as not all patients received criterion standard imaging
Stiell et al[50] (2005)	II for Q1	Prospective cohort in 9 Canadian community and academic EDs from 2000 to 2002	Patients ≥16 y with mTBI had CCHR and NOC applied with outcome of neurosurgical intervention and CIBI	1,822 patients; 8 (0.4%) required neurosurgical intervention and 97 (5.3%) had CIBI; the NOC and the CCHR both had 100% sensitivity, but the CCHR was more specific (76.3% vs 12.1%, *P*<.001) for predicting need for neurosurgical intervention; for CIBI, the CCHR and the NOC had similar sensitivity (100% vs 100%; 95% CI 96% to 100%) but the CCHR was more specific (50.6% vs 12.7%, *P*<.001), and would result in lower CT rates (52.1% vs 88.0%, *P*<.001	The CCHR was applied in some of the EDs for which it was derived; small proportion (≈10%) of lost to follow-up for outcome proxy assessment

Evidentiary Table (continued).

Smits et al[51] (2005)	II for Q1	Prospective observational study in 4 academic EDs in the Netherlands from 2002 to 2004	Patients ≥16 y with mTBI, head computed tomography and a GCS score of 13 to 15 with at least 1 risk factor; used variables from prior decision instruments and performed multivariable logistic regression analysis; outcome of any traumatic intracranial finding	3,181 patients, 243 (7.6%) had intracranial traumatic CT findings and 17 (0.5%) underwent neurosurgical intervention; a detailed prediction rule was developed from which a simple rule was derived; sensitivity of both rules was 100% for neurosurgical interventions, with an associated specificity of 23% to 30%; for intracranial traumatic CT findings, sensitivity and specificity were 94% to 96% and 25% to 32%, respectively	Outcome assessments were not blinded or independent; no chart review methods; all patients were evaluated in the ED by a neurologist
Easter et al[25] (2015)	II for Q1	Systematic review	Structured literature review, including MEDLINE database (1966 to August 2015) and the Cochrane Library identified English-language studies that evaluated the identification of traumatic brain injuries using history and physical examination characteristics; patients ≥18 y of age, GCS score of 13 to 15 were included	2,760 studies identified, 14 included with 23,079 patients; when the CCHR was applied to patients with GCS scores of 13 to 15 and LOC, amnesia, or disorientation, the rule identified patients presenting with minor head trauma at low risk of severe intracranial injury, LR=0.04; (95% CI 0 to 0.65); using the summary prevalence of 7.1%, the absence of all the features on the CCHR lowers the probability of a severe intracranial injury to 0.31% (95% CI 0% to 4.7%); the NOC also accurately identified patients at lower risk of intracranial injury, LR=0.08 (95% CI 0.01 to 0.84); using the summary prevalence of 7.1%, the absence of any of the NOC lowers the probability of a severe intracranial injury to 0.61%	Evaluated both adults and adolescents, although clinical decision instruments were developed in cohorts with differing inclusion criteria, which made it difficult to compare performances directly; varying quality of included studies; varied outcome measures of included studies; potential spectrum bias, which may affect specificity estimates; potential verification bias as not all patients received criterion standard imaging

Evidentiary Table (continued).

Ro et al[52] (2011)	III for Q1	Prospective observational cohort from 2008 to 2009 at 5 academic EDs in South Korea	Patient's entry criteria were exactly the same as defined by each individual decision instrument (CCHR, NOC, NEXUS), and each rule was applied to consecutive patients with the outcome traumatic finding identified on CT scan that required hospital admission and neurosurgical follow-up	7,131 patients were prospectively enrolled, including 692 (9.7%) with clinical traumatic brain injury; among the enrolled population, patients eligible for CCHR, NOC, and NEXUS-II totaled 696,677, and 2,951, respectively; the sensitivity and specificity for CIBI were asfollows: CCHR, 112 of 144 (79.2%, 95% CI 70.8% to 86%) and 228 of 552 (41.3%, 95% CI 37.3% to 45.5%); NOC, 91 of 99 (91.9%, 95% CI 84.7% to 96.5%) and 125 of 558 (22.4%, 95% CI 19% to 26.1%); and NEXUS-II, 511 of 576 (88.7%, 95% CI 85.8% to 91.2%) and 1,104 of 2,375 (46.5%, 95% CI 44.5% to 48.5%); the sensitivity and specificity for neurosurgical intervention were as follows: CCHR, 100% (95% CI 59% to 100%) and 38.3% (95% CI 34.5% to 41.9%); NOC, 100% (95% CI 54.1% to 100%) and 20.4% (95% CI 17.4% to 23.7%); and NEXUS-II, 95.1% (95% CI 90.1% to 98%) and 41.4% (95% CI 39.5% to 43.2%); among the enrolled population, intersection patients of CCHR, NOC, and NEXUS-II totaled 588; the sensitivity and specificity for CIBI were as follows: CCHR, 73 of 98 (74.5%, 95% CI 64.7% to 82.8%) and 201 of 490 (41%, 95% CI 36.6% to 45.5%); NOC, 89 of 98 (90.8%, 95% CI 83.3% to 95.7%) and 112 of 490 (22.9%, 95% CI 19.2% to 26.8%); and NEXUS-II, 82 of 98 (83.7%, 95% CI 74.8% to 90.4%) and 172 of 490 (35.1%, 95% CI 30.9% to 39.5%)	Selection/spectrum bias as <10% of all patients screened were included in analysis

Evidentiary Table (continued).

Bouida et al[53] (2013)	III for Q1	Observational cohort from 2008 to 2011 in teaching and non-teaching EDs in Tunisia	Patients with mild head injury age >10 y defined by blunt head trauma, GCS scores of 13 to 15 and 1 other risk factor, primary outcome was need for neurosurgical intervention, defined as either death or craniotomy, or need of intubation within 15 days of the traumatic event; secondary outcome was the presence of traumatic lesions on head CT scan	1,582 patients enrolled; neurosurgical intervention was performed in 34 patients (2.1%) and positive CT findings were demonstrated in 218 patients (13.8%); sensitivity and specificity for need for neurosurgical intervention were 100% (95% CI 90% to 100%) and 60% (95% CI 44% to 76%) for the CCHR and 82% (95% CI 69% to 95%) and 26% (95% CI 24% to 28%) for the NOC; negative predictive values for the above mentioned clinical decision rules were 100% and 99% and positive values were 5% and 2%, respectively, for the CCHR and NOC; sensitivity and specificity for clinically significant head CT findings were 95% (95% CI 92% to 98%) and 65% (95% CI 62% to 68%) for the CCHR and 86% (95% CI 81% to 91%) and 28% (95% CI 26% to 30%) for the NOC	≈30% did not receive head CT and proportion followed up not described; thus, major limitation from Design 1 to Design 3
Probst et al[54] (2020)	III for Q1	Multicenter prospective cohort study	Adult patients with blunt head trauma who underwent neuroimaging in the ED; primary outcome was significant intracranial injury; secondary outcome was neurosurgical intervention	N=9,070; 1,323 patients (15%) were anticoagulated; relative risk of significant intracranial injury was 1.3 (95% CI 0.9 to 1.9) for patients using aspirin alone, 0.8 (95% CI 0.2 to 2.3) for those using clopidogrel alone, and 1.9 (95% CI 1.3 to 2.8) for those using warfarin alone	Planned secondary analysis; concern for workup bias as CT ordered by physicians but not stipulated by protocol; potential for selection/spectrum bias

Evidentiary Table (continued).

Easter et al[57] (2013)	III for Q1	Prospective cohort study at 1 urban academic ED	Consecutive adult patients (18 y or older) with intoxication and minor head injury; all participants received head CT; primary outcome was clinically important intracranial injury; secondary outcome neurosurgical intervention	N=283; clinically important injuries were identified in 23 patients (8%) with 1 patient (0.4%) requiring neurosurgical intervention; NEXUS criteria and the CCHR had sensitivities of 83% and 70%, respectively	Limited sample size and indirectly applicable to question population; although described as consecutive, potential selection/workup bias
Nishijima et al[72] (2012)	II for Q2	Multicenter prospective observation al study	≥18 y patients with blunt head trauma on warfarin or clopidogrel regardless of LOC; looked for delayed ICH at 14-day follow-up; in 930 patients with initial normal head CT, delayed ICH occurred 4 of 687 (0.6%, 95% CI 0.2 to 1.5%) for warfarin, and 0 of 243 (0%, 95% CI 0 to 1.5%) for clopidogrel; of the 4, 2 died, none had neurosurgical intervention	83% of eligible patients were enrolled; 43 of 1,064 patients were on aspirin; 1 patient who died in clopidogrel group lost to follow-up	Delayed hemorrhage was only in warfarin patients; although a few patients had delayed hemorrhage, and 2 of 930 died, none received neurosurgical intervention
Menditto et al[73] (2012)	III for Q2	Prospective case series at a Level II trauma center	>14 y with minor head injury with initial negative CT head, repeat before CT at 24 h	5 of 87 (6%) patients had positive second CT, 1 had craniotomy	No blinded outcome assessment or adjudication of outcomes; small sample; single institution; ≈10% refused second CT head

Evidentiary Table (continued).

Kaen et al[74] (2010)	III for Q2	Prospective at single center	Mild head injury patients on anticoagulation with initial CT negative	2 of 137 (1.4%) patients showed hemorrhagic changes but did not need surgery or treatment	Small sample; unclear selection; single institution
Cipriano et al[75] (2018)	III for Q2	Single center prospective observational study	Patients with mTBI age >18 y on oral anticoagulants	3 of 178 (1.7%) showed delayed ICH, 1 died (0.6%), no interventions	Small sample; small lost to follow-up; not generalizable
Covino et al[76] (2021)	III for Q2	Retrospective observational study performed at a single institution	Consecutive ED patients with mTBI (defined as TBI with GCS score of 13 or greater, LOC <30 minutes, and posttraumatic amnesia <24 h) as chief compliant with initial negative CT head and repeated at 24 h; propensity score matching to compare anticoagulated vs nonanticoagulated patients; outcome: ICH	N=685; 15 (2.2%) developed ICH; after propensity score match, incidence of ICH was 2.3% for anticoagulated vs 0.6% for nonanticoagulated (*P*=.4); among 111 on vitamin K antagonists, 5 (4.5%) had late ICH vs 4 (4.0%) for those on direct oral anticoagulants (*P*=.9)	Retrospective; selection bias; single institution; small sample size limiting subgroup analyses
Duarte-Batista et al[77] (2021)	III for Q2	Prospective observational study performed at 4 institutions	Adult anticoagulated patients with mTBI (GCS score of 13 or greater) within 24 hours with a normal initial CT head; outcomes: delayed ICH, hospitalization, complications	N=178; 4 (2.3%) had delayed ICH; 3 (1.7%) were hospitalized; 0 (0%) required surgery	Selection bias; small sample limiting precision and subgroup analyses

Evidentiary Table (continued).

Turcato et al[78] (2022)	III for Q2	Retrospective observational study performed at 5 institutions	All patients using direct oral anticoagulants evaluated in the ED and undergoing repeat CT head after initial negative CT head after mTBI; outcome: delayed ICH	N=1,426; 916 (68.3%) underwent repeat CT head after initial negative CT and 24 h of observation; 14 (1.5%) had delayed ICH, 0 (0%) required neurosurgery or died	Retrospective; selection bias; repeat CT was not performed on all patients; workup bias
Tauber et al[79] (2009)	III for Q2	Prospective observational study performed at a single institution	Consecutive patients 65 y or older presenting after mTBI (defined as GCS score of 15) with low-dose acetylsalicylate acid prophylaxis; patients underwent repeat CT head at 12 to 24 h; outcome: delayed ICH	N=100; mean age 81, 84% level fall mechanism; 4 (4%) had delayed ICH; 2 (2%) had major delayed ICH with fatal outcome in 1 and need for neurosurgical intervention in the other	Selection bias; small sample limiting precision of estimates

Evidentiary Table (continued).

Subbian et al[85] (2016)	III for Q3	Prospective observational study of mTBI patients presenting to an urban ED	A chief complaint of head injury within the preceding 24 h were screened for inclusion from March 2013 to April 2014; the enrollment criteria were as follows: 1) age of 18 y or greater, 2) ability and willingness to provide written informed consent, 3) blunt head trauma and clinical diagnosis of isolated mTBI by the treating physician, and 4) blood alcohol level of <100 mg/dL; eligible mTBI patients were enrolled and their neuromotor function was assessed in the ED using a battery of 5 tests that cover a range of proprioceptive, visuomotor, visuospatial, and executive function performance metrics; at 3 wks postinjury, participants were contacted through telephone to complete the RPQ to assess the presence of significant PCS	A total of 66 mTBI patients were enrolled in the study with 42 of them completing both the ED assessment and the follow-up; 40 patients were included in the analyses; the AUC for the entire test battery was 0.72 (95% CI 0.54 to 0.90); the AUC for tests that primarily measure visuomotor and proprioceptive performance were 0.80 (95% CI 0.65 to 0.95) and 0.71 (95% CI 0.53 to 0.89), respectively	Good methodology, but very small single center study

Evidentiary Table (continued).

Sheedy et al[87] (2009)	III for Q3	Prospective caseseries from single hospital inAustralia	Brief measures of neuropsychological functioning, acute pain, and postural stability were collected in the ED; telephone follow-up at 3 mos using the RPQ was undertaken	Neuropsychological deficits, acute pain, and postural instability in the ED were significantly associated with postconcussive symptoms at 3-mo follow-up; a regression formula using 3 easily obtainable measures obtained during acute stage of injury— immediate and delayed memory for 5 words and a VAS score of acute headache—provided 80% sensitivity and 76% specificity for the prediction of clinically significant symptoms at 3 mos postinjury	Small single center study, mainly a convenience sample
Booker et al[88] (2019)	III for Q3	Observational cohort study of larger database	SHEFfield Brain Injury after Trauma (SHEFBIT) cohort with mTBI in the ED were analyzed aspart of the study; persistent PCS and long-term disability were measured using the RPQ and the RPQ	647 patients were recruited with a follow-up rate of 89%; non-attenders were older (*P*=<.001), a greater proportion were retired (*P*=<.001) and had a greater burden of comorbidity (*P*=.009); multivariate analysis identified that female gender, previous psychiatric history, GCS score of <15, etiology of assault and alcohol intoxication, were associated with worse recovery	Data dredged study derived from larger database and different primary study

Evidentiary Table (continued).

Kraus et al[89] (2009)	III for Q3	Prospective cohort 5 hospitals in Southern California	2 cohorts, 1 with mTBI (N=689 at initial assessment) and another with non–head injuries (N=1,318); RPQ and Pittsburgh Sleep Quality Index at 3 mos postinjury	Postconcussion symptom rates and summary RPQ scores were significantly higher for persons with mTBI than for the comparison cohort; women reported significantly more symptoms than men; complaints about sleep quality overall (and also sleep latency and daytime dysfunction subcomponents) were significantly more frequent among those with mTBI	Primarily descriptive
Ponsford et al[90] (2019)	III for Q3	NET trial examined the effectiveness of an implementation intervention to increase uptake of 3 recommendations for management of mTBI patients in EDs: (*i*) prospective assessment of posttraumatic amnesia using a validated tool; (*ii*) use of guideline-developed criteria to determine use and timing of CT imaging; and (*iii*) provision of written patient information on discharge from the ED; this is a "brief overview" of the NET-Plus component; 31 Australian EDs	343 individuals with mTBI completed the RPQ, Hospital Anxiety Depression Scale–Anxiety Scale, and Quality of Life–Short Form an average 7 mos postinjury	18.7% of participants reported 3 or more postconcussion symptoms, most commonly fatigue (17.2%) and forgetfulness (14.6%); clinically significant anxiety was reported by 12.8% of patients, and was significantly associated with symptom reporting, as were mental and physical quality of life scores; significant predictors of postconcussion symptoms at follow-up were preinjury psychological issues, experiencing LOC, and having no recall of receiving information about brain injury in the ED	Incomplete methodology, analysis of subcomponent of larger trial

Evidentiary Table (continued).

Ponsford et al[91] (2012)	III for Q3	Secondary analysis of an ongoing prospective study examining use of a revised version of the Westmead Post-traumatic Amnesia Scale as a screening tool in patients with mTBI	123 patients with mTBI and 100 trauma patient controls recruited and assessed in the ED and followed up 1 wk and 3 mos postinjury; outcome was measured in terms of reported postconcussion symptoms; measures included the ImPACT Post-Concussion Symptom Scale and cognitive concussion battery, including Attention, Verbal and Visual memory, Processing Speed and Reaction Time modules, pre- and postinjury SF-36 and MINI Psychiatric status ratings, VAS Pain Inventory, Hospital Anxiety and Depression Scale, PTSD Checklist–Specific, and Revised Social Readjustment Scale	mTBI predicted postconcussion symptoms 1 wk postinjury, along with being female and premorbid psychiatric history, with elevated HADS anxiety a concurrent indicator; however, at 3 mos, preinjury physical or psychiatric problems but not mTBI most strongly predicted continuing symptoms, with concurrent indicators including HADS anxiety, PTSD symptoms, other life stressors and pain; HADS anxiety and age predicted 3-mo PCS in the mTBI group, whereas PTSD symptoms and other life stressors were most significant for the controls; cognitive measures were not predictive of PCS at 1 wk or 3 mos	Inadequate methodology, secondary analysis of larger study, no generalizability, data dredged

Scheenen et al[92] (2017)	III for Q3	Sub-study of a larger prospective cohort study from 3 Level 1 trauma centers in the Netherlands	Study aimed to compare patient characteristics and their associations with persistent PCS; endpoints were collected at 2 wks after injury and included standardized instruments	N=820; gender, psychiatric history, and psychological illness, including depression and anxiety, as well as posttraumatic stress were associated with PCS	Sub-study, but prospective; 2 wks follow-up may be limited
Su et al[93] (2014)	III for Q3	Prospective cohort study from 4 institutions in China	mTBI patients; plasma high-sensitivity C-reactive protein levels measured at baseline, 1-, 2-, and 3-mos follow-up; endpoints included persistent PCS, psychological problems (depression and anxiety), physiological problems (frequent headache, nausea, insomnia, dizziness and fatigue), and cognitive impairment as measured by standardized instruments	N=213; multiple regression demonstrated significant associations between C-reactive protein and PCS, psychological problems, and cognitive impairment	Small sample; <10% lost to follow-up
Lange et al[94] (2015)	III for Q3	Prospective cohort study performed at Level 1 Trauma Center in Canada	Goal of this study was to estimate relationships between white matter changes, as measured by diffusion tensor imagining and postconcussion symptom reporting	N=108; 72 with mTBI and 36 trauma controls; no significant differences in diffusion tensor imaging measures and outcomes	Small sample but with comparative, control, group; diagnostic modality likely not available in ED setting

CCHR, Canadian Head CT Rule; *CI*, confidence interval; *CIBI*, clinically important brain injury; *CT*, computed tomography; *ED*, emergency department; *GCS*, Glasgow Coma Scale; *HADS*, Hospital Anxiety and Depression Scale; *ICH*, intracranial hemorrhage; *LOC*, loss of consciousness; *mo*, month; *mTBI*, mild traumatic brain injury; *NOC*, New Orleans Criteria; *PCS*, postconcussive syndrome; *PTSD*, posttraumatic stress disorder; RPQ, Rivermead Postconcussion Symptoms Questionnaire; *vs*, versus; *wk*, week; *y*, year.