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BRIEF REPORT

# Systematic Search and Review Procedures: Results of the International Collaboration on Mild Traumatic Brain Injury Prognosis

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**Abstract**

**Objectives:** To update the last best-evidence synthesis conducted by the World Health Organization Collaborating Centre for Neurotrauma, Prevention, Management and Rehabilitation in 2002; and to describe the course, identify prognostic factors, determine long-term sequelae, identify effects of interventions for mild traumatic brain injury (MTBI), identify knowledge gaps in the literature, and make recommendations for future research.

**Data Sources:** MEDLINE, Embase, PsycINFO, Cumulative Index to Nursing and Allied Health, and SPORTDiscus were searched between 2001 and 2012. Inclusion criteria included published peer-reviewed articles in English and 5 other languages. References were also identified from relevant reviews and meta-analyses and the bibliographies of eligible articles.

**Study Selection:** Controlled trials and cohort and case-control studies were selected according to predefined inclusion/exclusion criteria. Studies had to have at least 30 MTBI cases and assess outcomes relevant to prognosis after MTBI.

**Data Extraction:** Eligible studies were critically appraised using modified Scottish Intercollegiate Guidelines Network (SIGN) criteria. Two reviewers independently reviewed each study and extracted data from accepted articles (ie, with a low risk of bias) into evidence tables.

**Data Synthesis:** The evidence was synthesized qualitatively according to modified SIGN criteria and prioritized according to design as exploratory or confirmatory. The evidence was organized into separate articles according to population (eg, adults, children, and athletes) and outcomes (eg, risk of dementia after MTBI).

**Conclusions:** After 77,914 records were screened, 299 articles were eligible and reviewed. Of these, 101 (34%) were accepted as scientifically admissible and form the basis of our findings, which are organized into 10 articles in this supplement. These reviews present the best available evidence on MTBI prognosis, but more research is needed.

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The findings and conclusions in this research are those of the authors alone and do not necessarily represent the official views or policies of the Centers for Disease Control and Prevention or any agency of the United States government. Inclusion of individuals, programs, or organizations in this article does not constitute endorsement by the United States government.

The first systematic review to look at mild traumatic brain injury (MTBI) prognosis, the World Health Organization (WHO) Collaborating Centre for Neurotrauma, Prevention, Management and Rehabilitation Task Force,[1] found very few good quality studies addressing MTBI. Given their call for better quality research and the increasing amount of attention surrounding the long-term sequelae of MTBI, the International Collaboration on MTBI Prognosis (ICoMP) was formed to update the findings.

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The objectives of this review are to describe the course and identify prognostic factors after MTBI, describe the long-term sequelae, evaluate the effectiveness of clinical interventions, and make clinical and methodologic recommendations for future research.

## Methods

The review was conducted and reported in compliance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement.[2] Our protocol was registered in the international prospective register of systematic reviews[3] on July 11, 2011, and was last updated on November 2, 2012 (registration no. CRD42011001410). We also published the detailed protocol.[4]

### Literature search

The search strategy was developed in consultation with an information specialist. The electronic databases MEDLINE (OVID), PsycINFO (OVID), Embase (OVID), Cumulative Index to Nursing and Allied Health (EBSCO), and SPORTDiscus were systematically searched from January 1, 2001, to June 30, 2011. These searches were updated on February 10, 2012 (appendix 1). We used 3 search filters (prognosis filter, systematic review filter, and therapy filter), which are a combination of published Health Information Research Unit (at McMaster University) filters and unpublished University Health Network filters. The reference lists of all reviews and meta-analyses related to MTBI and articles meeting the eligibility criteria were screened for additional potentially relevant articles. ICoMP members also undertook 3 original research studies.[5-7]

### Eligibility criteria

Articles were screened for eligibility according to the following predefined criteria: language (articles written in English, French, Swedish, Norwegian, Danish, and Spanish), publication type (original research published in peer-reviewed journals), study design (controlled trials, case-control studies, and cohort studies with a minimum of 30 MTBI cases), study population (participants [no age limit] may consist of a mixed group of traumatic brain injury severity [eg, mild, moderate, or severe] only if the results are stratified by severity and the MTBI subjects can be clearly identified), and case definition (studies must clearly state a case definition for MTBI that falls within the definitions provided by the WHO Collaborating Centre Task Force and the Centers for Disease Control and Prevention). The WHO Collaborating Centre Task Force states the following:

> MTBI is an acute brain injury resulting from mechanical energy to the head from external physical forces. Operational criteria for clinical identification include: (i) one or more of the following: confusion or disorientation, loss of consciousness for 30 minutes or less, post-traumatic amnesia for less than 24 hours, and/or other transient neurological abnormalities such as focal signs, seizure, and intracranial lesion not requiring surgery; and (ii) Glasgow Coma Scale score of 13 − 15 after 30 minutes post-injury or later upon presentation for healthcare. These manifestations of MTBI must not be due to drugs, alcohol, medications, caused by other injuries or treatment for other injuries (e.g. systemic injuries, facial injuries or intubation), caused by other problems (e.g. psychological trauma, language barrier or coexisting medical conditions) or caused by penetrating craniocerebral injury.[8(p115)]

Persons with fractured skulls will be included if they fit this case definition.

As per the Centers for Disease Control and Prevention, MTBI is recognized among persons with an Abbreviated Injury Score of 2 for the head region or among persons who are assigned certain *International Classification of Diseases, 9th Revision, Clinical Modification* diagnostic codes (table 1).[9]

Studies must also have included the study outcomes of self-rated recovery, functional recovery, and improvement in clinical outcomes and risk of long-term sequelae; and have examined modifiable prognostic factors (eg, comorbid conditions, litigation, injury-related pain, stress) and clinical prediction rules for diagnosis or triage of patients with MTBI.

Exclusion criteria included the following: (1) publication type of narrative reviews, letters, editorials, commentaries, unpublished manuscripts, dissertations, government reports, books and book chapters, conference proceedings, meeting abstracts, lectures and addresses, and consensus development statements (including guideline statements); (2) study design of cross-sectional studies; case reports and series; qualitative studies; reviews and meta-analyses; and cadaveric, biomechanical, and laboratory studies (although we screened reviews and meta-analyses for primary studies, we did not review them); (3) study population of animals; (4) case definition of neck fractures and open or penetrating head injury, nontraumatic brain injury, MTBI because of violence/assault in the civilian population, or child abuse (eg, shaken baby syndrome); (5) outcomes where the frequency of intracranial lesions in MTBI was not viewed as an outcome, but rather as part of the diagnosis; therefore, studies examining only this aspect are considered irrelevant to the prognosis after MTBI for the purposes of this review; and (6) all studies that included any intentional cases of MTBI in the civilian population (eg, from assault). In our view, recovery from assault is complicated by victimization and legal proceedings and to understand their prognosis would require stratifying results by intentional injuries. We excluded studies that did not stratify intentional from unintentional injuries.

### Screening

For the first level of screening, 1 reviewer read the titles of all the citations retrieved from the electronic database searches and removed all those that were clearly not related to traumatic brain injury. The second level of screening involved abstract review. Full text articles were obtained for all abstracts except for those that clearly did not meet the eligibility criteria. If after analyzing the full text the eligibility of an article was still uncertain, a second reviewer undertook a full text analysis to determine eligibility. A third reviewer was consulted in the event of any disagreements.

***List of abbreviations:***

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| **ICoMP** | **International Collaboration on MTBI Prognosis** |
| **MTBI** | **mild traumatic brain injury** |
| **SIGN** | **Scottish Intercollegiate Guidelines Network** |
| **WHO** | **World Health Organization** |