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Developing the Australian and New Zealand Guideline for Mild to Moderate Head Injuries in Children: An Adoption/Adaption Approach

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Abstract

Objective

The Paediatric Research in Emergency Departments International Collaborative network (PREDICT) released the Australian and New Zealand Guideline for Mild to Moderate Head Injuries in Children in 2021. We describe innovative methods used to develop this guideline by adopting or adapting recommendations from multiple high-quality guidelines or developing *de novo* recommendations.

Methods

A Guideline Steering Committee and a multidisciplinary Guideline Working Group (GWG) were formed. Informed by GRADE-ADOLOPMENT and ADAPTE frameworks, high-quality guidelines were identified and recommendations mapped to clinical questions. The choice of guideline recommendation, if more than one guideline addressed a question, was based on its appropriateness, currency of the literature, access to evidence, and relevance. Updated literature searches were undertaken, and key new evidence identified. The decision to develop adopted, adapted or de novo recommendations was based on the supporting evidence-base and its transferability to the local setting. The guideline underwent a 12-week consultation period.

Results

The GWG of 25 key stakeholder representatives formulated the guideline scope and developed 33 clinical questions. We identified four high-quality source guidelines, with an updated literature search identifying 440 new studies. The final guideline consisted of 35 evidence-informed and 17 consensus-based recommendations and 19 practice points. An algorithm to inform imaging and observation decision-making was also developed.

Conclusions

The PREDICT Head Injury Guideline was developed using an innovative, practical approach involving guideline adoption, adaption and development of new recommendations. The resulting process was an efficient and rigorous way to develop a guideline based on existing high-quality guidelines from different settings.

Introduction

Several international clinical guidelines exist to inform the management of paediatric head injuries. However, none have been specifically developed for the Australian and New Zealand setting (1). In instances where high-quality guidelines exist, guideline adaption can improve the efficiency of guideline production and contextualise content to improve uptake. Several guideline adaption frameworks exist (2). Although guidance is available for the widely used adaption frameworks e.g. ADAPTE (3) and GRADE (Grading of Recommendations, Assessment, Development and Evaluations) – ADOLOPMENT (4). These frameworks rely heavily on the selection of a single guideline and adapting its content, and are dependent upon high-quality source guidelines that use GRADE, with transparent accessible information. In comprehensive guidelines that aim to cover a wide scope, several high-quality guidelines may need to be considered and their recommendations adapted to cover the range of clinical questions. However, there is little guidance or examples of how to do this.

The Paediatric Research in Emergency Departments International Collaborative network (PREDICT) recently developed the Australian and New Zealand Guideline for Mild to Moderate Head Injuries in Children (PREDICT Head Injury Guideline) (5). It provides the highest-level evidence and accurate guidance for clinicians providing care for children with mild to moderate head injuries presenting to acute care settings in Australia and New Zealand. We describe an innovative and practical guideline development method of adopting/adapting recommendations from four high-quality international guidelines or developing *de novo* recommendations. We report on the specific guideline recommendations resulting from this process in a separate paper (5).

Methods

We used the following guideline development process, informed by steps in the GRADE-ADOLOPMENT (4) and ADAPTE guideline development frameworks (3).

Established a Guideline Steering Committee and Guideline Working Group.

A Guideline Steering Committee (GSC) of 7 members was established to plan and oversee the project and provide advice on both content and process related issues. This GSC developed governance processes including terms of reference and conflict of interest management processes. It formulated the draft scope of the guideline and advised on the formation of a multidisciplinary Guideline Working Group (GWG).

The GWG comprised 25 representatives from key stakeholder groups including: emergency

physicians, paediatricians, neurosurgeons, paediatric neurologists, sports medicine doctors, radiologists, nurse/nurse practitioners, neuropsychologists, general practitioners, paramedics, implementation scientists and consumers. All members of the GSC joined the GWG. Members were from a mixture of metropolitan and non-metropolitan centres and represented a wide geographical area across states of Australia (Victoria, New South Wales, South Australia, Northern Territory, Queensland, Western Australia) and New Zealand (see Appendix A). The GWG provided expert guidance, contextual information, interpretation of evidence syntheses and participated in two GWG meetings. Disclosures of conflict of interests were declared by each member and updated as required at each meeting and following completion of the guideline.

Confirmed Guideline scope and methods

The GSC formulated the draft scope of the PREDICT Head Injury Guideline, including key clinical questions based on committee expertise and qualitative and quantitative input (6, 7). The scope of the PREDICT Head Injury Guideline included the diagnosis and acute management of mild to moderate head injury (including early management of concussion) in children presenting to hospital in Australia and New Zealand within 72 hours of injury. The guideline addresses aspects of diagnosis and management: assessment, imaging versus observation, discharge disposition and discharge advice (see Appendix B for full scope).

The GWG conducted a face-to-face meeting in February 2019 to confirm the guideline scope and the clinical questions that would be included in the guideline. Three sub-groups were formed; working group 1 (WG1) focused on triage, working group 2 (WG2) focused on imaging and working group 3 (WG3) focused on discharge/concussion. Recommendations from existing guidelines were mapped to broad topic areas and questions generated during the working groups meetings. The working groups formulated 33 questions, in PICO (Patient/Population, Intervention/Indicator, Comparison, Outcome) format, regarding the management of mild to moderate head injury in children presenting to hospital in Australia and New Zealand: 2 questions for triage, 17 questions for imaging and 14 questions for discharge/concussion (see Appendix C for guideline questions).

Although we had initially envisaged using a standard GRADE-ADOLOPMENT process, it became evident that the existing evidence-based guidelines were themselves either not developed using GRADE or did not provide sufficient information to apply the GRADE-ADOLOPMENT process. Furthermore, not all clinical questions were addressed in the existing evidence-based guidelines to cover the required scope of the proposed PREDICT Head Injury Guideline. With the guideline having

such a wide scope, answering many clinical questions, it was unachievable to go back and undertake this level of detail from the original research due to the time and resources we had available.

We therefore used an approach whereby recommendations were adopted or adapted from existing evidence-based guidelines, or developed *de novo*, based on an updated systematic review of the literature.

Identified high-quality source guidelines

An online and database search was conducted for national and international guidelines relevant to the acute management of mild to moderate head injury in children. Head injury experts worldwide were consulted to identify any relevant guidelines that may not have been captured by the search (see Appendix D for full search strategy).

The guideline inclusion criteria were:

- Scope: mild to moderate head injuries in children. Guidelines solely focussed on severe head injury or adult only head injury were excluded.
- Setting: developed country with established trauma systems. Pre-hospital, community, sports field, rehabilitation or intensive care management only were excluded.
- Relevance: Published in the last 5 years (January 2013 onwards) and in English.

The quality of the guidelines that met the inclusion criteria was assessed by two appraisers using the Appraisal of Guidelines for Research & Evaluation II (AGREE II) tool. The AGREE II tool assesses the methodological rigour and transparency with which a guideline is developed; it does not assess the quality or suitability of the recommendations. Specifically, AGREE II questions 7 and 12 from the rigour of development domain were used to assess and screen source guidelines (8).

Mapped recommendations to clinical questions and considered source evidence

Information was collated about the scope of the source guidelines and relevant guideline recommendations were mapped to the 33 clinical questions. In instances where more than one guideline had recommendations relevant for a specific question, the most relevant recommendation was chosen based on its appropriateness to the individual questions, currency of the literature i.e. search date, access to evidence tables, context and relevance to Australia and New Zealand. Explicit evidence gaps with respect to the 33 questions and research recommendations were also identified.

For each recommendation we extracted the source evidence. Ideally this was in the format of data extraction tables. However, when evidence tables were unavailable, we used the evidence

summaries prepared by the guideline development authors.

Updated literature search and selected key evidence

An updated literature search, from the last search date of the source guidelines, was conducted in the following electronic databases: MEDLINE, Embase, PsycInfo, Pubmed, Cochrane Library to identify all new relevant head injury publications. The search strategy was kept deliberately broad and is available in Appendix E. Following removal of duplications, the title and abstracts were reviewed in duplicate by GSC members to identify possible relevance to the clinical questions. Full text papers were selected and reviewed in duplicate by GSC members for potential inclusion. We used Covidence for the screening of titles, abstracts and full-text reports (9).

The new evidence was appraised in light of the existing source evidence. The decision to include new evidence i.e. select key evidence, was driven by a number of factors including relevance of the new evidence to the overall body of evidence in existing evidence-based guidelines, and the Australian and New Zealand clinical setting. For example, if there was an existing strong recommendation supported by high quality evidence, the new evidence would need to inform the question, address the primary outcome and be high quality to be included in the overall body of evidence. However, if the evidence supporting an existing recommendation was weak, or there was uncertainty, or the existing evidence did not address the primary outcome, then the appraisers could decide to rely entirely on the new evidence to address the question. These decisions were made by WG leads with adjudication/consensus with the GSC when necessary. Once a decision was made to include a new study, data was extracted and tabulated for each key new study. Evidence tables and grouped summaries of evidence were then prepared.

Developed recommendations

i) Adoption, adaption or de novo recommendations?

Recommendations were developed through either adoption, adaptation or the development of entirely new (*de novo*) recommendations. The source recommendations were adopted (wording as source recommendation) or adapted (wording changed from source recommendation) depending upon agreement of the GWG, with the evidence synthesis from the relevant source guidelines and the new evidence tables/summaries. The distinction between an adopted and an adapted recommendation is not always obvious in the literature. The National Health and Medical Research Council (NHMRC) advises that minor editorial changes may be made to adopted recommendations to ensure they are consistent with the rest of the guideline (10). This process of distinction between

adoption and adaption was followed. The decision to adapt a recommendation rather than adopt it *verbatim* was often related to its transferability to the Australian and New Zealand clinical setting. Although there is some flexibility to amend the wording of an adopted recommendation to reflect local issues, needs and context, adopted recommendations must stay true to the evidence on the balance of benefits and harms in the relevant existing evidence-base guideline to be valid. It was therefore critical that the recommendations from the source guidelines were not considered in isolation of the underlying evidence base.

If no evidence or recommendation were available from the four source guidelines, a new recommendation was developed involving a consensus process. New recommendations were drafted based on the GWG's interpretation of the available evidence, considering the balance of benefits and harms between different courses of action. The net benefit over harm (clinical effectiveness) was considered. The assessment of net benefit was moderated by the importance placed on the outcomes (the group's values and preferences) and the confidence the group had in the evidence (evidence quality).

When evidence was of poor quality, conflicting or absent, the GWG drafted recommendations based on information available to them and their consensus expert opinion. The considerations for making consensus-based recommendations included the balance between potential harms and benefits, current practices, recommendations made in other relevant guidelines despite the lack of high-quality evidence, patient preferences and equity issues.

Each recommendation was accompanied by a rationale which detailed the existing relevant evidence and a description and rationale for the inclusion of key evidence. To ensure there was no key missing evidence, international and local subject matter experts were consulted on the recommendations, rationale, and key evidence selection.

A flow chart of the process used to develop recommendations in the PREDICT guideline is provided in Figure 1 and is also described in text below.

ii) Grade recommendations

Rather than applying a recommendation grading system, the strength of recommendations was captured in the wording, as advised in the National Institute for Health and Care Excellence's (NICE) *The Guidelines Manual* (11). The wording of final recommendations was agreed upon by the GWG

and reflected the 'strength' of the evidence behind the final recommendations. As with the GRADE approach, the criteria for determining the 'strength' of a recommendation used by the GWG was based on a consideration of the balance of desirable and undesirable consequences, quality of evidence, values and preferences of those affected, and resource use. A 'strong' recommendation applied to situations where the GWG believed that the benefits clearly outweigh the harms for most people and was supported by high quality evidence. Similarly, a "do not do" recommendation may have been appropriate if the harms clearly outweigh the benefits for most people.

iii) Classified recommendations

The guidance in the guideline was classified according to three criteria:

- Evidence-informed recommendations (based on evidence) (EIR);
- Consensus-based recommendations (based on consensus where evidence was limited or did not exist) (CBR); or
- Practice points (based on consensus where evidence was not sought) (PP).

Results

Identified high-quality source guidelines

We undertook an online and database search in October 2018 and identified 1,331 citations. Seven guidelines met the inclusion criteria: Scandinavian Guidelines for Initial Management of Minor and Moderate Head Trauma in Children (Scandinavian Guideline) (12), Consensus Statement on Concussion in Sport – the 5th International Conference on Concussion in Sport held in Berlin, October 2016 (Berlin Guideline) (13, 14), NICE Clinical Guideline for Head injury: Assessment and Early Management (NICE Guideline) (15), Italian Guidelines on the Assessment and Management of Pediatric Head Injury in the Emergency Department (Italian Guideline) (16), Guidelines for Diagnosing and Managing Pediatric Concussion (ONF Guideline) (17), Centers for Disease Control and Prevention Guideline on the Diagnosis and Management of Mild Traumatic Brain Injury among Children (CDC Guideline) (18) and American College of Radiology Appropriateness Criteria Head Trauma-Child (ACR Guideline) (19). None were developed for the Australian and New Zealand setting. Using the AGREE II tool, the seven guidelines were narrowed down to four source guidelines: Berlin Guideline (13, 14), Italian Guideline (16), CDC Guideline (18) and NICE Guideline (15). The search was re-run in February 2019 resulting in an additional 1,803 citations, although no further guidelines were identified.

Mapped recommendations to clinical questions and considered source evidence

Appendix F details the scope of each source guideline, literature search date and relevant PREDICT Head Injury Guideline clinical questions.

Updated literature search and selected key evidence

An updated literature search was conducted for the time period 1 Jan 2015 – 28 May 2019 and identified 23,701 citations. After removal of duplicates and screening of title/abstracts, 1,027 full text papers were reviewed. A total of 440 new studies met the inclusion criteria for the PREDICT Head Injury Guideline and of these, 295 studies were specifically relevant to the guideline questions; 29 relevant to WG1 (Triage) questions, 169 relevant to WG2 (Imaging) questions, and 97 to WG3 (Discharge and Concussion) questions. Several studies were relevant to more than one WG (see Appendix G for PRISMA Diagram). Evidence tables were prepared by the GSC for the 67 key studies.

Developed recommendations

Initial recommendations were developed by the respective WGs following the process detailed in the methods section. A second GWG meeting was held in September 2019 where all members had the opportunity to review and contribute to wording of the draft recommendations. Recommendations were grouped into three sections: Triage, Imaging, and Discharge/Concussion. The guideline consisted of 35 evidence-informed recommendations (9 adopted, 14 adapted and 12 new), 17 consensus-based recommendations (7 adapted and 10 new) and 19 practice points (1 adapted and 18 new). An algorithm was also developed to summarise the recommendations for imaging and observation decision-making. The recommendations, algorithm and supporting evidence is detailed in a separate paper (5).

In the process of developing recommendations on children with bleeding disorders, the GWG consulted with paediatric haematology experts. The Italian SIMEUP position statement on head injury in children with coagulation disorders was recommended as a source of information (20).

Stakeholder consultation and final guideline

Following a 12-week consultation period, the guideline was revised in response to feedback from a range of organisations (see Appendix H). GWG responses to consultation comments were tabulated and can be obtained on request from the author. The Guideline was finalised and launched on the PREDICT website (www.predict.org.au) in 2021. The Guideline will be disseminated through various channels including PREDICT distribution lists and website, medical and nursing training organisations such as Advanced Paediatric Life Support (APLS) to formally incorporate the recommendations into

clinical pathways and educational materials at major teaching hospitals and publication in relevant medical journals.

Discussion

This paper describes the method of developing the PREDICT Head Injury Guideline and is a valuable resource for those aiming to develop a clinical guideline that can be informed by several existing high-quality guidelines. Although we were not able to use a standard GRADE-ADOLOPMENT process, we believe that our guideline development approach was thorough, rigorous, transparent, and efficient and provides guidance for clinical guideline developers in how to navigate the challenges when existing guidelines do not clearly fit into ideal guideline development processes.

As part of this quality control process, in September 2019, the GWG became aware of an update of the Ontario Neurotrauma Foundation (ONF) Guidelines for Diagnosing and Managing Pediatric Concussion (21). The guideline was assessed as high quality and the wording of the recommendations and supporting evidence were checked for any potential discrepancies. It was deemed that the recommendations and supporting evidence of the ONF guideline were aligned with this guideline.

There are several strengths in our guideline development approach. The multidisciplinary GWG included all the key stakeholders including a consumer and clinicians were from a wide range of settings in Australia and New Zealand. A rigorous process was used to identify high quality guidelines, assess the evidence supporting source guideline recommendations, consider the generalisability and applicability of this evidence for the Australasian setting and how new evidence might contribute to the content and strength of guideline recommendations. The feasibility of these recommendations was also considered i.e. would the recommendations result in a change in practice, were there resource implications and barriers to the implementation of these guideline recommendations. This information will inform the implementation methods for the guideline.

The publication of this detailed guideline development paper answers the call for more explicit reporting of guideline adaption methods. The Reporting Items of Practice Guidelines in Healthcare (RIGHT) statement is currently being extended to cover the reporting of adapted guidelines and will help with future reporting (22).

Conclusion

The PREDICT Head Injury Guideline was developed by adopting or adapting recommendations from four high-quality international guidelines or developing *de novo* recommendations. This detailed methods paper is of value to those wanting to develop a guideline efficiently and rigorously when several high-quality source guidelines from different settings already exist.

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Appendix A: Guideline Working Group

Name	Expertise	Affiliation
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Prof Stuart Dalziel (co-chair) (Steering Committee)	Emergency Physician	Paediatric Emergency Medicine Specialist Director of Emergency Medicine Research Children's Emergency Department Starship Children's Hospital, Auckland, New Zealand Cure Kids Chair of Child Health Research Dept of Paediatrics: Child and Youth Health, University of Auckland
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Dr Jo Cole	Emergency Physician (mixed regional)	Emergency Department, Tauranga Hospital, New Zealand
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Dr David Perry	Paediatric and Obstetric Radiologist	Radiology, Auckland City Hospital, New Zealand
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Dr Anna Lithgow	Paediatrician (Indigenous Health)	Royal Darwin Hospital, Northern Territory
A/Prof Karen Barlow	Concussion and Rehabilitation	Consultant Paediatric Neurologist, Queensland Children's Hospital, Queensland Child Health Research Centre

Name	Expertise	Affiliation
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Dr Dustin Ballard (Steering Committee)	Emergency Physician (USA)	Kaiser Permanente, Northern California, USA Visiting scholar, University of Auckland School of Medicine, New Zealand
Dr Emma Tavender (Steering Committee)	Knowledge Translation Co-ordinator	Clinical Sciences Research, Murdoch Children's Research Institute, Melbourne, Victoria
Cate Wilson	PREDICT Research Co-ordinator	Clinical Sciences Research, Murdoch Children's Research Institute, Melbourne, Victoria
Michelle Paproth	Consumer	Consumer Representative

Appendix B: Scope of the PREDICT Head Injury Guideline

Guideline Objectives

To develop an evidence-based clinical practice guideline for the acute management of mild to moderate head injury (including concussion) in children.

Specific objectives of this Guideline are to:
1. Improve outcomes for children who present with mild to moderate head injury;
2. Identify all paediatric patients who have a clinically-important intracranial injury in need of intervention, such as neurosurgery and/or intensive care (***critical patient-important outcome***); and
3. Promote consistency of management (standardisation of observation criteria and duration of ED stay), and in doing so reduce unnecessary interventions including inappropriate use of head computed tomography (CT) scans in children at very low risk of intracranial injury.
4.Improve discharge and follow-up of children with mild to moderate head injuries.

Target audience of the guideline
Clinicians involved in the assessment and management of paediatric acute mild to moderate head injury in hospitals in Australia and New Zealand. While targeted to hospital-based clinicians who have access to CT scanners, the guideline will remain relevant to those clinicians, pre-hospital or at sites without CT scanners, who may refer into hospitals with CT scanning facilities.

Scope of the guideline
Diagnosis and acute management of mild to moderate head injury (including concussion) in children presenting to hospital in Australia and New Zealand within 72 hours of injury. The guideline addresses aspects of diagnosis and management: assessment, imaging vs observation, discharge disposition and discharge advice (including concussion).

Target population
Children less than 18 years of age.

Healthcare setting
Emergency departments and acute assessment areas of rural, regional and tertiary hospitals in Australia and New Zealand.

Exclusions
1. Neurosurgical management of children identified with an intracranial injury.
2. Management within the intensive care unit of children identified with an intracranial injury.
3. Management of children with severe intracranial injury.
4. Management of concussion in the community.
5. Long-term rehabilitation.

Summary

	Inclusion	Exclusion
Population	Children and infants (aged <18 years of age) Mild to moderate head injury (including concussion)	Adults 18 years and over Acquired Brain Injury (ABI), penetrating trauma Moderate to severe head injuries (GCS <13) with abnormal head CT scan
Time of presentation	Initial and repeat presentations (< 72 hours after injury)	Initial and repeat presentation (>72 hours after injury)

Setting	Pre-hospital Emergency Department and acute assessment areas of rural, regional and tertiary hospitals in Australia and New Zealand	Intensive Care Unit (ICU) Rehabilitation* General Practice* Sports Field Community*
Management	Initial triage/diagnosis (including biomarkers) Neuroimaging (including computed tomography, x-ray, magnetic resonance imaging) Observation criteria and time Discharge Information including concussion return to school/play Discharge disposition Conditions requiring special consideration (suspected abusive head trauma, bleeding disorders, ventricular shunts)	Pre-hospital management ICU management Neurosurgical management Rehabilitation including post-concussion syndrome

* There may be instances where guideline recommendations inform settings that flow from acute management e.g. discharge advice on GP follow-up or school concussion policies.

Appendix C: Guideline questions

Question	Clinical question
Triage	
TRIAGE Q1	In infants and children with mild to moderate head injury presenting within 72 hours of injury, are there pre-hospital clinical criteria to determine which children should be assessed in a hospital setting?
TRIAGE Q2	In infants and children presenting with mild to moderate head injury within 72 hours of injury and a radiologically proven traumatic intracranial lesion, which patients require (i) a neurosurgical consultation and/or (ii) transfer?
Imaging	
IMAGING Q1	In infants and children with mild to moderate head injury presenting i) within 24 hours, or ii) between 24 and 72 hours, of injury what are the clinical criteria and/or clinical decision rule(s) that best determine who needs/ does not need a cranial CT?
IMAGING Q2	In infants and children with a ventricular shunt and mild to moderate head injury presenting within 72 hours of injury, which should undergo i) a cranial CT and/or ii) a shunt series and/or iii) a period of observation?
IMAGING Q3	In infants and children on anticoagulant or antiplatelet therapy, or with a known bleeding disorder and mild to moderate head injury presenting within 72 hours of injury, which should undergo a i) cranial CT and/or ii) a period of observation?
IMAGING Q4	In infants and children with a neurodevelopmental disorder and mild to moderate head injury presenting within 72 hours of injury, which should undergo a i) cranial CT and/or ii) a period of observation?
IMAGING Q5	In children with mild to moderate head injury who are drug or alcohol intoxicated presenting within 72 hours of injury, which should undergo a i) cranial CT and/or ii) a period of observation?
IMAGING Q6 (a)	In infants and children with mild to moderate head injury presenting within 72 hours of injury who does/does not require an initial cranial CT, what are the clinical criteria and/or clinical decision rule(s) that best determine who needs/does not need a period of observation?
IMAGING Q6 (b)	In infants and children with mild to moderate head injury presenting within 72 hours of injury who do not receive an initial cranial CT, but received a period of observation, what is the optimal frequency of reassessment and duration of observation?
IMAGING Q7 (a)	In infants and children with mild to moderate head injury presenting within 72 hours of injury and a negative initial cranial CT for radiologically proven traumatic intracranial lesion, what are the clinical criteria and/or clinical decision rule(s) that best determine who needs/does not need a period of observation?
IMAGING Q7 (b)	In infants and children with mild to moderate head injury presenting within 72 hours of injury and a negative initial cranial CT for a radiologically proven traumatic intracranial lesion, who received a period of observation, what is the optimal frequency of reassessment and duration of observation?
IMAGING Q8	In infants and children with mild to moderate head injury and a negative initial cranial CT or MRI for an intracranial injury with persistent symptoms, who should undergo repeat neuroimaging?

Question	Clinical question
IMAGING Q9	In infants and children with mild to moderate head injury, presenting within 72 hours of injury with suspected non-accidental injury, i) who should undergo cranial imaging and ii) which modality should be used for initial imaging?
IMAGING Q10	In infants and children with mild to moderate head injury presenting within 72 hours of injury, what are the clinical criteria and/or clinical decision rule(s) that best determine who should undergo a skull x-ray prior to, or in lieu of a cranial CT?
IMAGING Q11	In infants and children with mild to moderate head injury presenting within 72 hours of injury, what are the clinical criteria and/or clinical decision rule(s) that best determine who should undergo ultrasound of the skull in the ED prior to, or in lieu of, a cranial CT?
IMAGING Q12	In infants with mild to moderate head injury presenting within 72 hours of injury, what are the clinical criteria and/or clinical decision rule(s) that best determine who should undergo a transfontanelle cerebral ultrasound in the ED prior to, or in lieu of a cranial CT?
IMAGING Q13	In infants and children with mild to moderate head injury presenting within 72 hours of injury, what are the clinical criteria and/or clinical decision rule(s) that best determine who should undergo MRI in lieu of a cranial CT?
IMAGING Q14	In infants and children with mild to moderate head injury presenting within 72 hours of injury, what are the clinical criteria and/or clinical decision rule(s) that best determine who should undergo biomarker testing prior to a cranial CT?
IMAGING Q15	In infants and children with mild to moderate head injury presenting within 72 hours of injury who undergo a cranial CT scan, what are the i) appropriate CT protocols/techniques and/or ii) to what extent should the cervical spine be included in the imaging?
Discharge	
DISCHARGE Q1	In infants and children with mild to moderate head injury presenting within 72 hours of injury, what are the clinical criteria and pragmatic considerations (distance/time to travel, capacity to contact hospital) required for safe discharge from the ED or hospital?
DISCHARGE 2(a)	In infants and children with mild to moderate head injury discharged from the ED or hospital presenting within 72 hours of injury, what discharge advice should be provided concerning an acute intracranial injury?
DISCHARGE 2(b)	In infants and children with mild to moderate head injury discharged from the ED or hospital presenting within 72 hours of injury, what discharge advice should be provided concerning possible post concussive symptoms?
DISCHARGE Q3	In infants and children with mild to moderate head injury presenting within 72 hours of injury and discharged from the ED or hospital without evidence of radiologically proven traumatic intracranial lesion, which require follow-up for an acute intracranial injury?
DISCHARGE Q4 (a)	In infants and children with mild to moderate head injury presenting within 72 hours of injury and discharged from the ED or hospital, which require follow-up for post concussive symptoms?
DISCHARGE Q4 (b)	In infants and children with mild to moderate head injury presenting within 72 hours of injury and discharged from the ED or hospital, that require follow up for post concussive symptoms, what type of follow-up should it be?
DISCHARGE Q4 (c)	In infants and children with mild to moderate head injury presenting within 72 hours of injury and discharged from the ED or hospital, that require follow up for post concussive symptoms, when should they be followed-up?

Question	Clinical question
DISCHARGE Q5 (a)	In infants and children with mild to moderate head injury discharged from the ED or hospital, what discharge advice concerning return to sport should be provided to children and their caregivers?
DISCHARGE Q5 (b)	In infants and children with mild to moderate head injury discharged from the ED or hospital, what discharge advice concerning physical activity or play should be provided to children and their caregivers?
DISCHARGE Q5 (c)	In infants and children with mild to moderate head injury discharged from the ED or hospital, what discharge advice concerning return to school and cognitive activity should be provided to children and their caregivers?
DISCHARGE Q5 (d)	In infants and children with mild to moderate head injury discharged from the ED or hospital, what discharge advice concerning screen time should be provided to children and their caregivers?
DISCHARGE Q5 (e)	In infants and children with mild to moderate head injury discharged from the ED or hospital, what discharge advice concerning return to driving/operating machinery should be provided to children and their caregivers?
DISCHARGE Q5 (f)	In infants and children with mild to moderate head injury discharged from the ED or hospital, what information/advice should be provided to the child's school?
DISCHARGE Q5 (g)	In children diagnosed with repeat concussion who are discharged from the ED or hospital, what distinct discharge advice should be provided to children and their caregivers?

ED emergency department

CT computed tomography

MRI magnetic resonance imaging

Appendix D: Search Parameters for Head Injury and Concussion Clinical Practice Guidelines

The aim of the search for clinical practice guidelines was to identify high quality clinical practice guidelines (CPGs) for the initial management of mild and moderate head injury in children to identify potential questions/recommendations for new adapted guideline.

Search parameters
Clinical practice guideline (CPG) or equivalent
2013 onwards
Available in English
Freely accessible
Electronic sources as below
Targeting countries with developed trauma systems (First world)

Data Sources
Electronic health databases
MEDLINE
EMBASE
The Cochrane Library
PsycINFO

Websites
National Guideline Clearinghouse
National Health and Medical Research Council (NHMRC) (Australia)
NHMRC Clinical Guideline Portal and Emergency Care Portal (Australia)
The National Electronic Library for Health (UK)
Guidelines International Network
Therapeutic Guidelines (Australia)
National Institute for Health and Clinical Excellence (England／Wales)
Medical Journal of Australia Clinical Guidelines (Australia)
Joanna Briggs Institute (Australia)
Guidelines Advisory Committee (Canada)
TRIP database (UK)
Canadian Medical Association Clinical Guidelines (Canada)
Australian College for Emergency Medicine (ACEM) (Australia)
Canadian Association of Emergency Physicians (CAEP) (Canada)
College of Emergency Medicine (UK)
Eastern Association for the Surgery of Trauma (EAST) (United States)
Society of Critical Care Medicine (SCCM) (United States)

Websites
Department of Veterans Affairs (Australia)
International Council of Nurses
Nursing Best Practice Guidelines (Canada)
Royal College of Nursing (UK)
American Academy of Pediatrics (United States)
National Health Service (NHS) Evidence (UK)
New Zealand Guidelines Group (New Zealand)
Scottish Intercollegiate Guidelines Network (Scotland)
Brain Trauma Foundation (United States)
American College of Radiology (United States)
American College of Emergency Physicians (United States)
World Health Organization
Australian Government Department of Health and Ageing (Australia)
Australian State Departments of Health and Ageing (Australia)

Internet search engines
• Google
• Google Scholar

Appendix E: Search Parameters for new evidence on Head Injury and Concussion

All head injury papers restricted to those published after 2015.

Database(s): Ovid MEDLINE(R) ALL 1946 to May 24, 2019

Search Strategy:

#	Searches	Results
1	craniocerebral trauma/ or brain injuries/ or exp brain hemorrhage, traumatic/ or exp brain injuries, diffuse/ or exp brain injuries, traumatic/ or epilepsy, post-traumatic/ or pneumocephalus/ or shaken baby syndrome/ or Coma, Post-Head Injury/ or exp Head Injuries, Closed/ or exp intracranial hemorrhage, traumatic/ or exp Skull Fractures/	110930
2	(intracranial-hemorrhage* or intracranial-haemorrhage* or tbi or tbis or concuss* or post-concuss* or postconcuss* or mtbi or mtbis or brain-contusion* or brain-trauma or brain-laceration* or cranio-cerebral-trauma or craniocerebral-trauma or traumatic-brain or commotion-cerebri or post-commotion or post-contusion or post-head-injur*).tw,kf.	59156
3	((head or brain or cerebral or craniocerebral or intracranial) adj3 (injur* or trauma or contusion)).tw,kf.	106959
4	(Skull adj3 (injur* or fracture*)).tw,kf.	4994
5	(infan* or toddler* or pre-schooler* or preschooler* or boy or boys or girl or girls or child or children or childhood or pediatric* or paediatric* or adolescen* or youth or youths or teen or teens or teenage* or school-age* or schoolage* or school-child* or schoolchild* or school-girl* or schoolgirl* or school-boy* or schoolboy*).af.	4336688
6	(1 or 2 or 3 or 4) and 5	56613
7	(warfare or armed-conflict* or war or wars or operation-iraqi-freedom or afghan-campaign or operation-enduring-freedom or military or battlefield or army or armed-forces or marine or marines or troop or troops or servicem#n or service-m#n or servicewom#n or service-wom#n or service-personnel or air-force or soldier or soldiers or OIF or OEF or combat-related or combat-disorder* or veteran* or active-duty or service-member*).tw,kf.	219793
8	exp "Warfare and Armed Conflicts"/ or Military Personnel/ or Military Medicine/ or Veterans/ or Combat Disorders/	104048
9	(7 or 8) not (military.tw,kf. and ((civilian* or sports or athlete* or sport-related or sports-related).tw,kf. or exp sports/ or athletes/))	249941
10	6 not 9	56064
11	exp animals/ not human*.sh.	4581079
12	10 not 11	53992
13	limit 12 to (case reports or comment or editorial or letter)	10023
14	12 not 13	43969
15	limit 14 to yr="2015 -Current"	9056

Database(s): Embase 1974 to 2019 May 24

Search date: 28/5/19

Search Strategy:

#	Searches	Results
1	head injury/ or brain injury/ or acquired brain injury/ or brain concussion/ or brain contusion/ or postconcussion syndrome/ or shaken baby syndrome/ or brain damage/ or traumatic brain injury/ or skull injury/ or skull fracture/ or skull base fracture/ or exp brain hemorrhage/ or second impact syndrome/ or concussion/	318734

2 (intracranial-hemorrhage* or intracranial-haemorrhage* or tbi or tbis or concuss* or post-concuss* or postconcuss* or mtbi or mtbis or brain-contusion* or brain-trauma or brain-laceration* or cranio-cerebral-trauma or craniocerebral-trauma or traumatic-brain or commotion-cerebri or post-commotion or post-contusion or post-head-injur*).tw,kw,dq. 89690

3 ((head or brain or cerebral or craniocerebral or intracranial) adj3 (injur* or trauma or contusion)).tw,kw,dq. 141982

4 (Skull adj3 (injur* or fracture*)).tw,kw,dq. 5506

5 (infan* or toddler* or pre-schooler* or preschooler* or boy or boys or girl or girls or child or children or childhood or pediatric* or paediatric* or adolescen* or youth or youths or teen or teens or teenage* or school-age* or schoolage* or school-child* or schoolchild* or school-girl* or schoolgirl* or school-boy* or schoolboy*).af. 4291985

6 (1 or 2 or 3 or 4) and 5 85097

7 (warfare or armed-conflict* or war or wars or operation-iraqi-freedom or afghan-campaign or operation-enduring-freedom or military or battlefield or army or armed-forces or marine or marines or troop or troops or servicem#n or service-m#n or servicewom#n or service-wom#n or service-personnel or air-force or soldier or soldiers or OIF or OEF or combat-related or combat-disorder* or veteran* or active-duty or service-member*).tw,kw,dq. 236112

8 exp military phenomena/ or soldier/ or military medicine/ or veteran/ or posttraumatic stress disorder/ 163277

9 (7 or 8) not (exp military phenomena/ and ((civilian* or sports or athlete* or sport-related or sports-related).tw,kw,dq. or exp Sport/ or Athlete/)) 315041

10 6 not 9 84043

11 exp animal/ not human*.sh. 4500549

12 10 not 11 79167

13 limit 12 to (conference abstract or conference paper or "conference review" or editorial or letter or note or short survey) 18414

14 12 not 13 60753

15 limit 14 to yr="2015 -Current" 13959

Ovid PsycInfo

Search date: 27/5/19

Search Strategy:

Searches Results

1 exp head injuries/ or exp traumatic brain injury/ or brain damage/ or cerebral hemorrhage/ or subarachnoid hemorrhage/ 40278

2 (intracranial-hemorrhage* or intracranial-haemorrhage* or tbi or tbis or concuss* or post-concuss* or postconcuss* or mtbi or mtbis or brain-contusion* or brain-trauma or brain-laceration* or cranio-cerebral-trauma or craniocerebral-trauma or traumatic-brain or commotion-cerebri or post-commotion or post-contusion or post-head-injur*).ti,ab,id. 19815

3 ((head or brain or cerebral or craniocerebral or intracranial) adj3 (injur* or trauma or contusion)).ti,ab,id. 34327

4 (Skull adj3 (injur* or fracture*)).ti,ab,id. 275

5 (infan* or toddler* or pre-schooler* or preschooler* or boy or boys or girl or girls or child or children or childhood or pediatric* or paediatric* or adolescen* or youth or youths or teen or teens or teenage* or school-age* or schoolage* or school-child* or schoolchild* or school-girl* or schoolgirl* or school-boy* or schoolboy*).af. 1797132

6 (1 or 2 or 3 or 4) and 5 21252

7 (warfare or armed-conflict* or war or wars or operation-iraqi-freedom or afghan-campaign or operation-enduring-freedom or military or battlefield or army or armed-forces or marine or marines or troop or troops or servicem#n or service-m#n or servicewom#n or service-wom#n or service-personnel or air-force or soldier or soldiers or OIF or OEF or combat-related or combat-disorder* or veteran* or active-duty or service-member*).ti,ab,id. 81468

8 exp war/ or exp military personnel/ or military veterans/ or exp posttraumatic stress disorder/ 61547

9 (7 or 8) not (military.ti,ab,id. and ((civilian* or sports or athlete* or sport-related or sports-related).ti,ab,id. or exp Sports/ or Athletes/)) 102140

10 6 not 9 20394

11 exp animals/ not human*.sh. 335803

12 10 not 11 18934

13 limit 12 to (chapter or "comment/reply" or dissertation or editorial or letter or review-book or review-media) 2894

14 12 not 13 16040

15 limit 14 to yr="2015 -Current" 3647

PubMed

Search date: 28/5/19

#1

(tbi OR tbis OR concuss* OR postconcuss* OR mtbi OR mtbis OR brain-contusion* OR brain-trauma OR brain-laceration* OR cranio-cerebral-trauma OR craniocerebral-trauma OR traumatic-brain OR commotion-cerebri OR post-commotion OR post-contusion OR post-head-injur* OR intracranial-hemorrhage* OR intracranial-haemorrhage* OR ((head OR brain OR cerebral OR craniocerebral OR intracranial) AND (injur* OR trauma OR contusion)) OR (Skull AND (injur* OR fracture*))) AND (infan* OR toddler* OR pre-schooler* OR preschooler* OR boy OR boys OR girl OR girls OR child OR children OR childhood OR pediatric* OR paediatric* OR adolescen* OR youth OR youths OR teen OR teens OR teenage* OR school-age* OR schoolage* OR school-child* OR schoolchild* OR school-girl* OR schoolgirl* OR school-boy* OR schoolboy*) AND (*NOTNLM OR publisher[sb] OR inprocess[sb] OR pubmednotmedline[sb] OR indatareview[sb] OR pubstatusaheadofprint)*

#2

(warfare OR armed-conflict* OR war OR wars OR operation-iraqi-freedom OR afghan-campaign OR operation-enduring-freedom OR military OR battlefield OR army OR armed-forces OR marine OR marines OR troop OR troops OR serviceman OR servicemen OR service-man OR service-men OR servicewoman OR servicewomen OR service-woman OR service-women OR service-personnel OR air-force OR soldier OR soldiers OR OIF OR OEF OR combat-related OR combat-disorder* OR veteran* OR active-duty OR service-member*) NOT (military AND (civilian* OR sport OR sports OR athlete*))

#3 #1 NOT #2

NOT (Letter OR editorial OR Comments OR Case report)

Limit to 2015 onwards = 11025

Cochrane Library

Search date: 27/5/19

ID Search

#1 MeSH descriptor: [Craniocerebral Trauma] this term only

#2 MeSH descriptor: [Brain Injuries] this term only

#3 MeSH descriptor: [Brain Hemorrhage, Traumatic] explode all trees

#4 MeSH descriptor: [Brain Injuries, Diffuse] explode all trees

#5 MeSH descriptor: [Brain Injuries, Traumatic] explode all trees

#6 MeSH descriptor: [Epilepsy, Post-Traumatic] this term only

#7 MeSH descriptor: [Pneumocephalus] this term only

#8 MeSH descriptor: [Shaken Baby Syndrome] this term only

#9 MeSH descriptor: [Coma, Post-Head Injury] this term only

#10 MeSH descriptor: [Head Injuries, Closed] explode all trees

#11 MeSH descriptor: [Intracranial Hemorrhage, Traumatic] explode all trees

#12 MeSH descriptor: [Skull Fractures] explode all trees

#13 (tbi OR tbis OR concuss* OR postconcuss* OR mtbi OR mtbis OR brain-contusion* OR brain-trauma OR brain-laceration* OR cranio-cerebral-trauma OR craniocerebral-trauma OR traumatic-brain OR commotion-cerebri OR post-commotion OR post-contusion OR post-head-injur* OR intracranial-hemorrhage* OR intracranial-haemorrhage*)

#14 ((head OR brain OR cerebral OR craniocerebral OR intracranial) NEAR/3 (injur* OR trauma OR contusion))

#15 (Skull NEAR/3 (injur* OR fracture*))

#16 (infan* OR toddler* OR pre-schooler* OR preschooler* OR boy OR boys OR girl OR girls OR child OR children OR childhood OR pediatric* OR paediatric* OR adolescen* OR youth OR youths OR teen OR teens OR teenage* OR school-age* OR schoolage* OR school-child* OR schoolchild* OR school-girl* OR schoolgirl* OR school-boy* OR schoolboy*)

#17 (#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15) AND #16

#18 ((warfare OR armed-conflict* OR war OR wars OR operation-iraqi-freedom OR afghan-campaign OR operation-enduring-freedom OR military OR battlefield OR army OR armed-forces OR marine OR marines OR troop OR troops OR serviceman OR servicemen OR service-man OR service-men OR servicewoman OR servicewomen OR service-woman OR service-women OR service-personnel OR air-force OR soldier OR soldiers OR OIF OR OEF OR combat-related OR combat-disorder* OR veteran* OR active-duty OR service-member*))

#19 MeSH descriptor: [Warfare and Armed Conflicts] explode all trees

#20 MeSH descriptor: [Military Personnel] this term only

#21 MeSH descriptor: [Military Medicine] this term only

#22 MeSH descriptor: [Veterans] this term only

#23 MeSH descriptor: [Combat Disorders] this term only

#24 (#18 or #19 or #20 or #21 or #22 or #23)

#25 (military)

#26 (civilian* or sports or athlete* or sport-related or sports-related)

#27 MeSH descriptor: [Sports] explode all trees

#28 MeSH descriptor: [Athletes] this term only

#29 (#25 and (#26 or #27 or #28))

#30 (#24 NOT #29)

#31 (#17 NOT #30) 2502

Limited from 2015-current=947 (116 Reviews; 21 Protocols; 810 Trials)

Appendix F: Scope of Source Guidelines

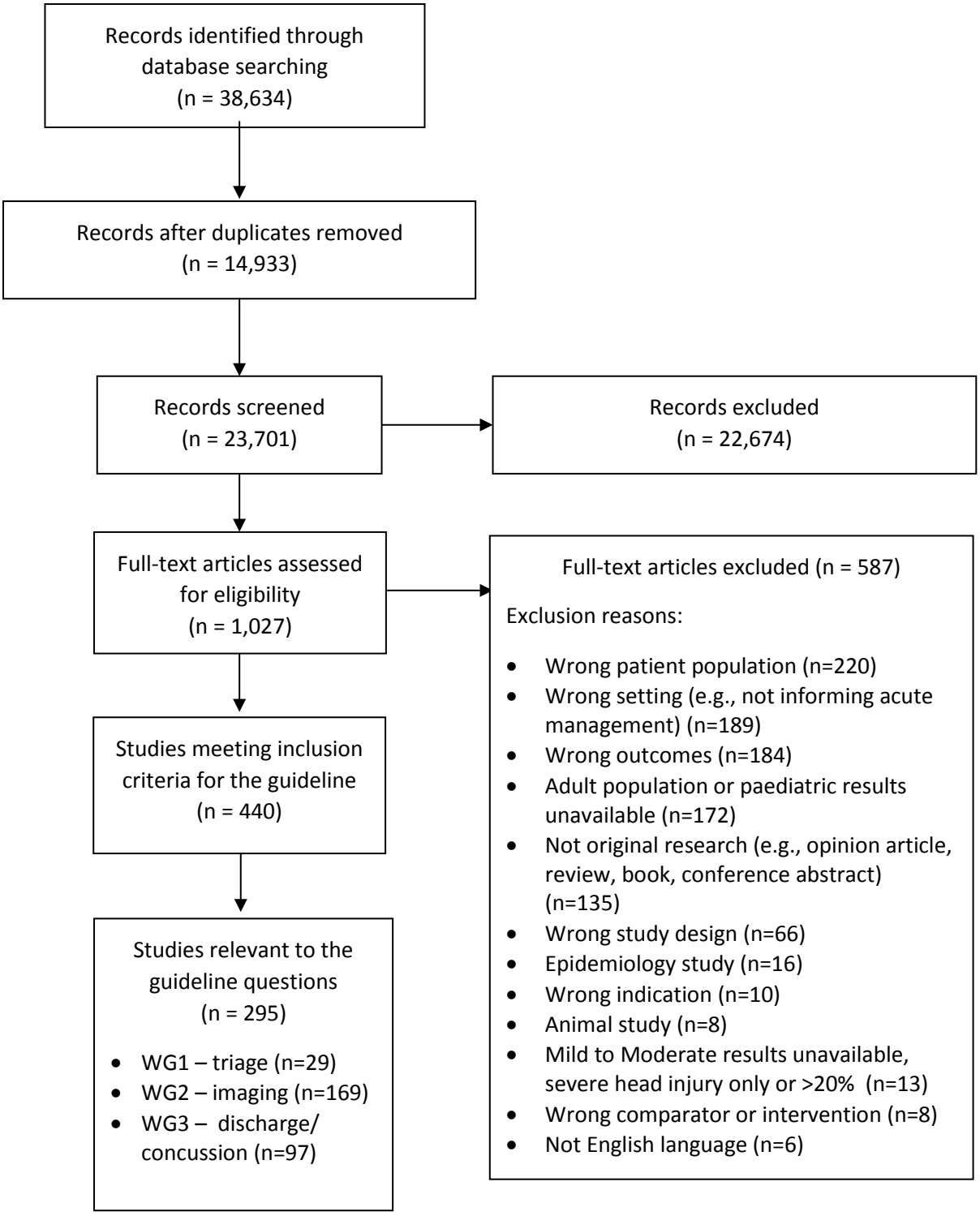
	Italian Guideline	CDC Guideline	Berlin Guideline	NICE Guideline
Title of Guideline	Italian guidelines on the assessment and management of pediatric head injury in the Emergency Department	Centers for Disease Control and Prevention guideline on the diagnosis and management of Mild Traumatic Brain Injury among children	Consensus statement on concussion in sport – the 5th international conference on concussion in sport held in Berlin, October 2016	Head injury triage, assessment and early management of head injury in children, young people and adults
Publication Year	2018	2018	2017	2017
Dates of literature search	15 Feb 2005-15 Feb 2015	1 Jan 1990 – 31 Jul 2015	1985 - May 2016 (Davis 2017)	31 May 2013-27 Oct 2016
Description /Aims	Assessment and management of children who present to ED with a blunt head trauma.	Diagnosis, prognosis and management /treatment of paediatric mild traumatic brain injury (mTBI)	To provide an overview of issues of importance to healthcare providers involved in the management of sports related concussion (at a recreational, elite or professional level).	Triage, assessment, investigation and early management of head injury in children, young people and adults
Definition of head injury/ concussion	Blunt head trauma with no suspicion of non-accidental injury (all severities – mild GCS 14-15, moderate GCS 9-13, severe GCS ≤8.	mTBI or concussion – GCS 13 to 15 with or without the complication of intracranial injury on neuroimaging and regardless of the potential need for a hospital admission and/or neurosurgical intervention.	Sport related concussion (SRC) is a traumatic brain injury induced by biomechanical forces. Several common features that may be utilised in clinically defining the nature of a concussive head injury include: - SRC may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an impulsive force transmitted to the head. - SRC typically results in the rapid onset of short-lived	Head injury is defined as any trauma to the head other than superficial injuries to the face.

			impairment of neurological function that resolves spontaneously. However, in some cases, signs and symptoms evolve over a number of minutes to hours. - SRC may result in neuropathological changes, but the acute clinical signs and symptoms largely reflect a functional disturbance rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies. - SRC results in a range of clinical signs and symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive features typically follows a sequential course. However, in some cases symptoms may be prolonged. The clinical signs and symptoms cannot be explained by drug, alcohol, or medication use, other injuries (such as cervical injuries, peripheral vestibular dysfunction, etc) or other comorbidities (eg, psychological factors or coexisting medical conditions).	

Definition of Paediatric	Less than 16 years – searches limited birth to 18 years.	18 years of age and younger.	Children aged 5 years to 18 years.	Children are defined as patients less than 16, and infants less than one year of age at the time of presentation to hospital with head injury.
Source guideline scope/ questions	▪ Computed Tomography (CT) decision making (who, what algorithm, and when to observe). ▪ CT decision making children with ventricular shunts and a minor blunt head trauma. ▪ Repeat CT in children with positive initial CT for a non-significant intracranial (IC) injury ▪ Skull x-rays ▪ Trans-fontanelle cerebral ultrasound ▪ Point of care ultrasound ▪ Near infrared technology ▪ Observation vs CT (minor head trauma) ▪ Observation (duration, monitoring) ▪ Neurosurgical consult decision incl children with a minor head trauma + history of neurosurgical intervention ▪ Transfer decision (no CT, CT no neurosurgery) ▪ Modality of neurosurgical consult with minor HT and IC injury on CT ▪ Transfer decision child minor HT	▪ Specific tools vs reference standard for diagnosing mTBI? How often does routine head imaging identify important intracranial injury? ▪ Which features identify patients at risk of intracranial injury? ▪ What factors identify patients at increased risk for ongoing impairment (<1yr)? Which factors identify patients at increased risk of long term sequelae (>1 yr)? ▪ With ongoing symptoms, which mTBI treatments improve outcomes?	▪ In which age groups should children be managed differently from adults? ▪ Which symptoms and signs are most accurate for the diagnosis of concussion in children? ▪ Is computerised neuropsychological testing accurate for diagnosing and assessing recovery of concussion in children? ▪ What is the 'normal' duration for recovery of concussion in children? ▪ What are the predictors of prolonged recovery of concussion in children? ▪ How long should children with concussion rest? ▪ What factors must be considered in 'return to school' following concussion and what strategy or accommodations should be followed? ▪ When should children with concussion return to sport?	▪ What is the effectiveness of pre-hospital assessment tools for selecting adults, infants and children with head injury, for transport direct to specialist neuroscience care or a major trauma centre with neuroscience if the nearest hospital does not provide these? ▪ What is the best clinical decision rule for selecting adults, infants and children with head injury for CT head scan? ▪ What is the best clinical decision rule for selecting adults, infants and children with head injury for CT head scan who have no history of amnesia or loss of consciousness who are on anticoagulant or antiplatelet therapy? ▪ What is the diagnostic accuracy of biomarkers (S100B, NSE, GFAP) in the emergency department for selecting adults, infants and children with head injury for CT head scan? ▪ What is the best clinical decision rule for selecting adults,

	needing observation, needing sedation for CT. ▪ Safe discharge criteria ▪ Discharge info			infants and children with head injury for initial imaging with plain X-rays or CT scan for cervical spine injury? ▪ What is the best clinical decision rule for selecting adults, infants and children with head injury, who have received a negative X-ray of the cervical spine, for further imaging with CT or MR imaging for cervical spine injury? ▪ What is the best clinical decision rule for selecting adults, infants and children with head injury, who have received a negative CT cervical spine scan, for further imaging with MR imaging for cervical spine injury? ▪ What information and support do patients with head injury say they want? ▪ What discharge information should be given to patients with head injury?
Mapping to PREDICT Guideline questions	TRIAGE: 2 IMAGING: 1,2,3,6,7,8,9,10,11,12,13,14 DISCHARGE: 2a,5a,5b,5f	IMAGING: 1,4,6,7,8,9,10,13,14 DISCHARGE: 2a, 2b, 4, 5a,5b,5f	DISCHARGE: 2a, 2b, 4, 5a,5b,5f	TRIAGE: 1,2 IMAGING: 1,3,5,6,7,8,9,10,13,14 DISCHARGE: 1,2a,2b,3,4

Appendix G: PRISMA Diagram: new evidence on Head Injury and Concussion



Appendix H: Organisations that participated in the guideline stakeholder consultation

Organisation
Agency for Clinical Innovation
Advanced Paediatric Life Support (APLS) Australia
Advanced Paediatric Life Support (APLS) New Zealand
Australasian College for Emergency Medicine (ACEM)
Australian College of Nurse Practitioners (ACNP)
Australian College of Nursing
Australasian College of Paramedicine
Australian College of Rural and Remote Medicine
Australian Haemophilia Centre Directors' Organisation (AHCDO)
Australian Society of Medical Imaging and Radiation Therapy (ASMIRT)
College of Emergency Nurses Australasia
College of Emergency Nurses New Zealand (CENNZ)
Council of Ambulance Authorities Inc.
Neurosurgical Society of Australasia
New Zealand Emergency Medicine Network
New Zealand Institute of Medical Radiation Technology (NZIMRT)
Paediatric Society of New Zealand
Royal Australasian College of Physicians (RACP)
Royal Australasian College of Surgeons (RACS)
Royal Australian and New Zealand College of Radiologists (RANZCR)
Royal Australian College of General Practitioners (RACGP)
Royal Flying Doctor Service (Retrieval)
Sports Medicine Australia
Victorian State Dept of Education, Australia

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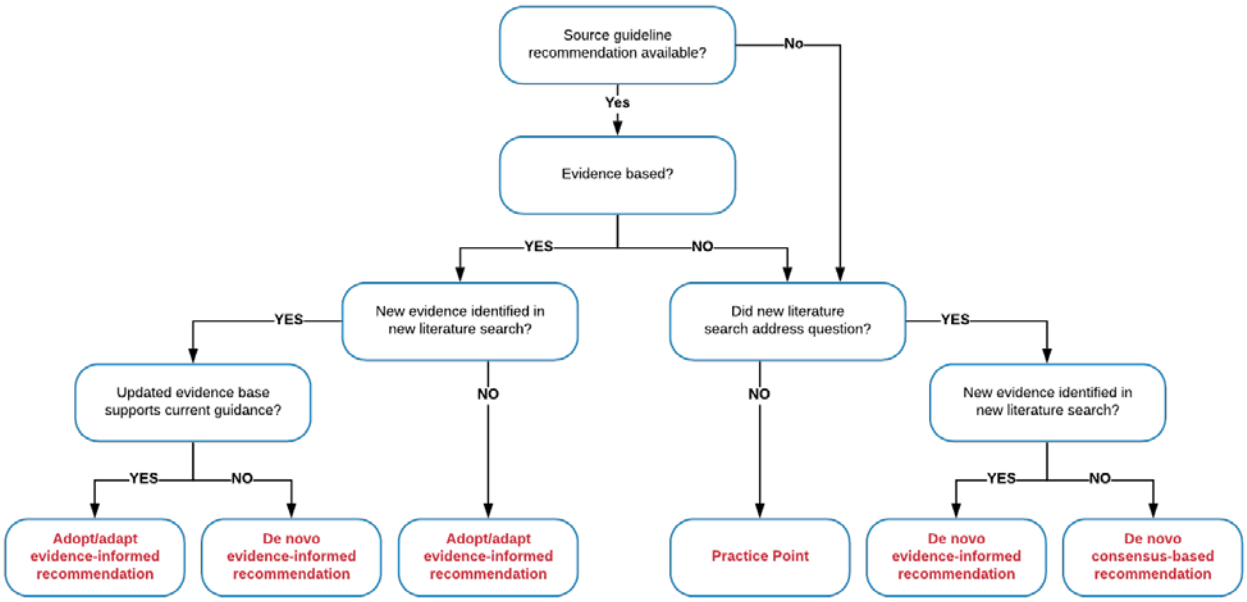
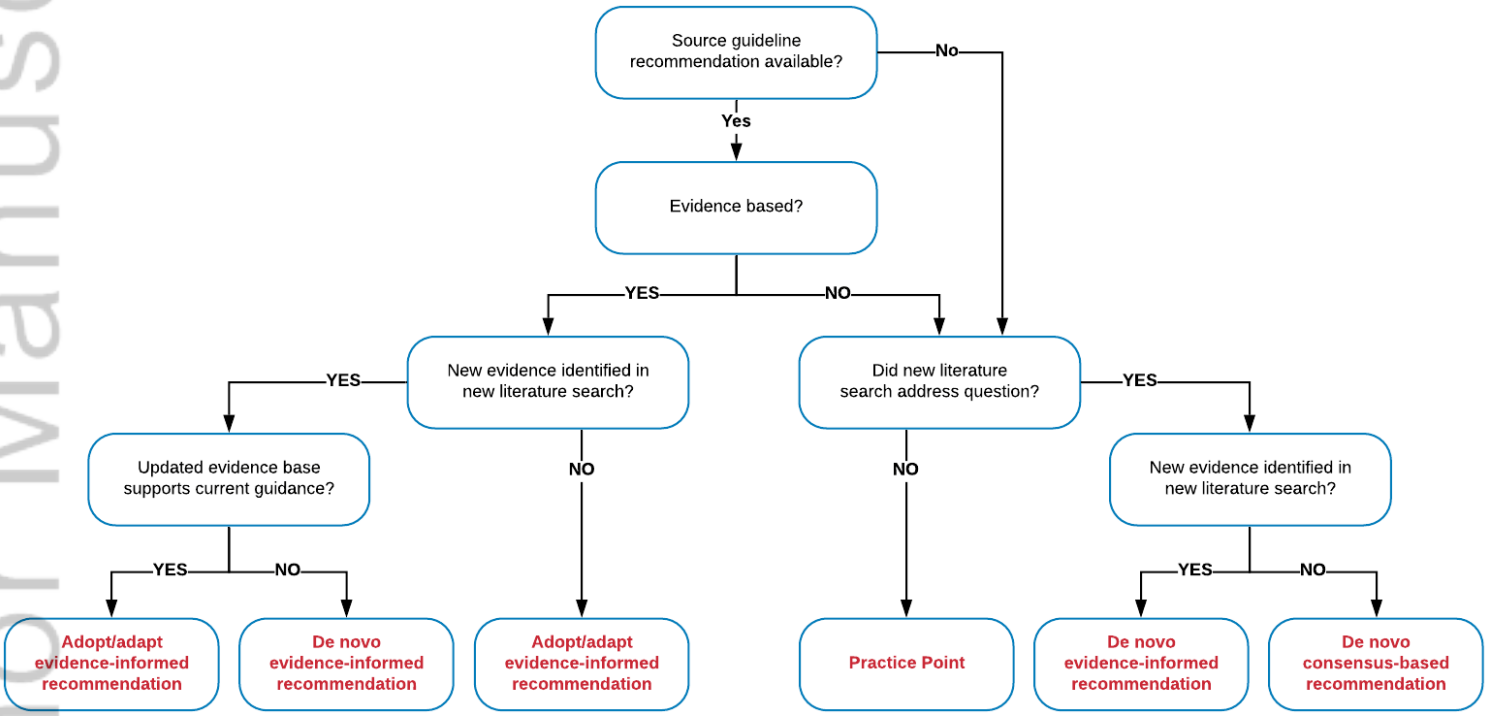
FIGURE 1: Process of classifying guideline recommendations





EMM_13716_EMM_13716_Flow chart for Type of guidance - Horizontal flow.png