National Institute for Health and Care Excellence

Draft

Head Injury: assessment and early management (update)

[C] Evidence reviews for direct access from the community to imaging

NICE guideline <number>

Evidence reviews underpinning recommendations x to y and research recommendations in the NICE guideline

September 2022

Draft for Consultation

These evidence reviews were developed by Guideline Development Team NGC

Disclaimer

The recommendations in this guideline represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, professionals are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or service users. The recommendations in this guideline are not mandatory and the guideline does not override the responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or their carer or guardian.

Local commissioners and/or providers have a responsibility to enable the guideline to be applied when individual health professionals and their patients or service users wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with compliance with those duties.

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Contents

1 Direct access from the community to imaging

1.1 Review question

What is the clinical and cost effectiveness of providing direct access from the community to imaging?

1.1.1 Introduction

Head injuries are common and can present to a wide range of clinicians. Many people with head injuries will present to their general practitioner in a delayed fashion, having not had any reason to attend a hospital. Alternatively, many general practitioners will review patients who have fallen in a nursing or residential home. This evidence review sought to identify the available evidence for giving direct access to imaging i.e. head CT or MRI scans, to those working in the community or primary care.

The evidence review considered any evidence to show benefit of community access to imaging rather than attending hospital, in either clinical or cost effectiveness. Alongside the medical evidence, the committee considered the practical considerations for direct access to imaging. Specifically, if primary care processes could safely feedback urgent findings to referrers and whether referrers would be able to safely respond to these findings in a timely fashion.

1.1.2 Summary of the protocol

For full details see the review protocol in Appendix A.

Table 1: PICO characteristics of review question

Population	All adults, young people and children (including babies under 1 year) with a suspected or confirmed head injury, including: • delayed presentation to primary care following head injury and no indication for attending hospital • people residing in nursing/residential care homes being attended by a GP or advanced practitioner

Interventions	• Direct access from community to:
	  ○ Head CT imaging
	  ○ MR imaging of the head

Comparison	• Usual care (typically to cover referral to ED)
Outcomes	• Mortality from head injury at ≤30 days. • All-cause mortality at ≤30 days. • Objective measures of disability (including Glasgow Outcome Scale, King's Outcome Scale for Childhood Head Injury and Cerebral Performance Category scale, Rivermead Post-Concussion Syndrome Questionnaire). • Quality of life (validated quality of life scores only). • Length of hospital stay. • Serious adverse events

	• Referral to secondary care • Incidental findings (e.g. unruptured intracranial aneurysm)
Study design	• Systematic reviews of RCTs • RCTs • If no RCT evidence is available for any of the identified strata or interventions, non-randomised studies will be considered if they adjust for key confounders, starting with prospective cohort studies.

1.1.3 Methods and process

This evidence review was developed using the methods and process described in Developing NICE guidelines: the manual. Methods specific to this review question are described in the review protocol in appendix A and the methods document.

Declarations of interest were recorded according to NICE's conflicts of interest policy.

1.1.4 Effectiveness evidence

1.1.4.1 Included studies

No relevant clinical studies comparing direct access from community to usual care were identified.

See also the study selection flow chart in Appendix C, study evidence tables in Appendix D, forest plots in Appendix E and GRADE tables in Appendix F.

1.1.4.2 Excluded studies

See the excluded studies list in Appendix J.

1.1.5 Summary of studies included in the effectiveness evidence

No evidence was identified.

1.1.6 Summary of the effectiveness evidence

No evidence was identified.

1.1.7 Economic evidence

1.1.7.1 Included studies

No health economic studies were included.

1.1.7.2 Excluded studies

No relevant health economic studies were excluded due to assessment of limited applicability or methodological limitations.

See also the health economic study selection flow chart in Appendix G.

1.1.8 Summary of included economic evidence

None.

1.1.9 Economic model

Modelling was not undertaken for this question.

1.1.11 Evidence statements

Economic

- No relevant economic evaluations were identified.

1.1.12 The committee's discussion and interpretation of the evidence

1.1.12.1. The outcomes that matter most

The committee considered all outcomes as equally important for decision making and therefore have all been rated as critical: mortality from head injury at ≤30 days, all-cause mortality at ≤30 days, objective measures of disability (including Glasgow Outcome Scale, King's Outcome Scale for Childhood Head Injury and Cerebral Performance Category scale, Rivermead Post-Concussion Syndrome Questionnaire), quality of life (validated quality of life scores only), length of hospital stay, serious adverse events, referral to secondary care and incidental findings (e.g. unruptured intracranial aneurysm)

No evidence was identified for this question.

1.1.12.2 The quality of the evidence

No evidence was identified.

1.1.12.3 Benefits and harms

All adults, young people and children (including babies under 1 year) with a suspected or confirmed head injury

There was no evidence identified for direct access from community for head CT imaging or MR imaging of the head compared to usual care in people with suspected or confirmed head injury

The committee from their experience discussed the benefits and limitations of direct access from community to head CT imaging and MR imaging of the head. The committee discussed that imaging ordered in the community setting is mainly used to exclude intracranial bleeding and to provide re-assurance.

The committee noted that timing of the imaging depends on if there is an acute injury or if the person has post-concussion syndrome. If there is important traumatic brain injury (TBI) within 24 hours or people with impaired GCS, it is recommended to go the hospital.

They noted the logistical challenges in the acute phase in getting access to imaging and reporting of the images in a timely fashion. The committee noted the challenges faced by the primary care/GPs in interpreting complex neuroradiology reports. Specifically, the committee noted the following limitations of ordering imaging in the community setting:

- How to access imaging promptly
- How to interpret imaging accurately before a report is available.
- How to interpret imaging, even if reported, without specialist knowledge.
- If an important or dangerous finding is present, whether there are mechanisms in place to respond to these findings promptly, all year round.

With this in mind, the committee agreed to make a recommendation not to provide direct access to imaging from the community for people who have had a head injury within 24 hours and need referring to ED. The committee agreed that these recommendations are applicable to both adults and children/infants.

The committee highlighted the need for identifying specific group of people who would benefit from avoiding emergency department (ED) situations.

Delayed presentation to primary care following head injury and no indication for attending hospital

There was no evidence identified for this group. In people with delayed presentation who are referred directly for imaging, the committee discussed the challenges in interpreting results of the imaging reports and management of the condition in primary care, in such cases people are often referred back to the hospital.

People residing in nursing/residential care homes being attended by a GP or advanced practitioner

There was no evidence identified for this group. The committee discussed that people who are disabled or in residential care need not be sent directly to the hospital for imaging as they would need secondary care.

The committee discussed making a research recommendation limiting the population to people in residential and care homes. However, they noted the potential for harm due to visiting the hospital for imaging (for example, hospital-acquired infections). People in nursing/residential care homes are in a well-supported environment where they can be observed closely. The committee also noted the difficulty in identifying the health professional responsible for the person whilst they are waiting for imaging and for the results. In addition, the committee highlighted that it is a shared decision making process with the person, their carers and the family as to whether an ambulance should be called. A research recommendation was therefore not made.

1.1.12.4 Cost effectiveness and resource use

There were no published economic evaluations found. In the absence of clinical evidence, cost-effectiveness modelling was not feasible.

The impact of direct access on resource use is uncertain but:

- If a scan is required urgently, then the logistical issues of accessing a scan directly would require staff at the referring centre to be available immediately to respond to the result of the scan.

- If a scan is not required urgently, then it is unclear what would be the benefit of the scan and therefore it might not be cost effective.

Direct access to imaging after a head injury is not commonly available in the NHS. The committee's decision to recommend against direct access is not likely to have an impact on resource use and ensures that patients enter a pathway that allows their treatment to be stepped up as required.

1.1.12.5 Other factors the committee took into account

None.

1.1.14 References

1. National Institute for Health and Care Excellence. Developing NICE guidelines: the manual [updated January 2022]. London. National Institute for Health and Care Excellence, 2014. Available from: https://www.nice.org.uk/process/pmg20/chapter/introduction

Appendices

Appendix A – Review protocols

Review protocol for direct access from the community to imaging

ID	Field	Content
0.	PROSPERO registration number	CRD42021273444
1.	Review title	What is the clinical and cost effectiveness of providing direct access from the community to imaging?
2.	Review question	What is the clinical and cost effectiveness of providing direct access from the community to imaging?
3.	Objective	To determine the clinical and cost-effectiveness of providing direct access from the community to imaging compared to usual care for people with suspected or confirmed traumatic head injury.
4.	Searches	The following databases (from inception) will be searched: • Cochrane Central Register of Controlled Trials (CENTRAL) • Cochrane Database of Systematic Reviews (CDSR) • Embase • MEDLINE • Epistemonikos Searches will be restricted by: • English language studies • Human studies • Letters and comments excluded

		Other searches: • Inclusion lists of systematic reviews The searches may be re-run 6 weeks before the final committee meeting and further studies retrieved for inclusion if relevant. The full search strategies will be published in the final review. Medline search strategy to be quality assured using the PRESS evidence-based checklist (see methods chapter for full details).
5.	Condition or domain being studied	Head Injury
6.	Population	Inclusion: All adults, young people and children (including babies under 1 year) with a suspected or confirmed head injury, including: • delayed presentation to primary care following head injury and no indication for attending hospital • people residing in nursing/residential care homes being attended by a GP or advanced practitioner. Stratified by: • Adults (aged ≥16 years) • Children (aged ≥1 to <16 years) • Babies (aged <1 year)

		Exclusion: Adults, young people and children (including babies under 1 year) with superficial injuries to the eye or face without suspected or confirmed head or brain injury.

7.	Intervention	• Direct access from community to:
		  ○ Head CT imaging
		  ○ MR imaging of the head
		
		Community to cover GP & advance practitioners.
		Imaging to be followed by appropriate treatment/ management.
		CT and MR imaging to be reviewed separately.

8.	Comparator	• Usual care (typically to cover referral to ED)
9.	Types of study to be included	• Systematic reviews of RCTs • RCTs • If no RCT evidence is available for any of the identified strata or interventions, non-randomised studies will be considered if they adjust for key confounders, starting with prospective cohort studies. Published IPDs will be considered for inclusion. Conference abstracts will be excluded as it is expected there will be sufficient full text published studies available. Confounding factors:

		• Age • GCS or pupillary responses at presentation • Severity of injury (intra/extracranial)
10.	Other exclusion criteria	Non-English language studies. Conference abstracts will be excluded as it is expected there will be sufficient full text published studies available.
11.	Context	Presentation of patients with confirmed or suspected head injury is a common occurrence for general practitioners or advanced practitioners operating in the community. This is particularly true for within care home settings. Current practice may see that these patients are referred to an emergency department for review and subsequent imaging. Direct access to secondary care imaging from community may be an option for a streamlined diagnostic pathway and reduce strain on emergency departments.
12.	Primary outcomes (critical outcomes)	All outcomes are considered equally important for decision making and therefore have all been rated as critical: • Mortality from head injury at ≤30 days. • All-cause mortality at ≤30 days. • Objective measures of disability (including Glasgow Outcome Scale, King's Outcome Scale for Childhood Head Injury and Cerebral Performance Category scale, Rivermead Post-Concussion Syndrome Questionnaire). • Quality of life (validated quality of life scores only). • Length of hospital stay. • Serious adverse events • Referral to secondary care • Incidental findings (e.g. unruptured intracranial aneurysm)

		Outcomes will be grouped at <30 days, 30 days-6 months, 6-12 months, and at yearly time-points thereafter.
14.	Data extraction (selection and coding)	EndNote will be used for reference management, sifting, citations and bibliographies. All references identified by the searches and from other sources will be screened for inclusion. Or use following text if using EPPI: All references identified by the searches and from other sources will be uploaded into EPPI reviewer and de-duplicated. 10% of the abstracts will be reviewed by two reviewers, with any disagreements resolved by discussion or, if necessary, a third independent reviewer. This review will make use of the priority screening functionality within the EPPI-reviewer software. The full text of potentially eligible studies will be retrieved and will be assessed in line with the criteria outlined above. A standardised form will be used to extract data from studies (see Developing NICE guidelines: the manual section 6.4). 10% of all evidence reviews are quality assured by a senior research fellow. This includes checking: • papers were included /excluded appropriately • a sample of the data extractions • correct methods are used to synthesise data • a sample of the risk of bias assessments Disagreements between the review authors over the risk of bias in particular studies will be resolved by discussion, with involvement of a third review author where necessary.

		Study investigators may be contacted for missing data where time and resources allow.
15.	Risk of bias (quality) assessment	Risk of bias will be assessed using the appropriate checklist as described in Developing NICE guidelines: the manual For Intervention reviews • Systematic reviews: Risk of Bias in Systematic Reviews (ROBIS) • Randomised Controlled Trial: Cochrane RoB (2.0) • Non randomised study, including cohort studies: Cochrane ROBINS-I
16.	Strategy for data synthesis	• Pairwise meta-analyses will be performed using Cochrane Review Manager (RevMan5). Fixed-effects (Mantel-Haenszel) techniques will be used to calculate risk ratios for the binary outcomes where possible. Continuous outcomes will be analysed using an inverse variance method for pooling weighted mean differences. • Heterogeneity between the studies in effect measures will be assessed using the I^2 statistic and visually inspected. An I^2 value greater than 50% will be considered indicative of substantial heterogeneity. Sensitivity analyses will be conducted based on pre-specified subgroups using stratified meta-analysis to explore the heterogeneity in effect estimates. If this does not explain the heterogeneity, the results will be presented pooled using random-effects. • GRADEpro will be used to assess the quality of evidence for each outcome, taking into account individual study quality and the meta-analysis results. The 4 main quality elements (risk of bias, indirectness, inconsistency and imprecision) will be appraised for each outcome. Publication bias is tested for when there are more than 5 studies for an outcome. • The risk of bias across all available evidence was evaluated for each outcome using an adaptation of the 'Grading of Recommendations Assessment, Development and Evaluation (GRADE) toolbox' developed by the international GRADE working group http://www.gradeworkinggroup.org/ • Where meta-analysis is not possible, data will be presented and quality assessed individually per outcome.

17.	Analysis of sub-groups	Subgroups that will be investigated if heterogeneity is present: • Care home resident • Pre-existing cognitive impairment Care home resident vs non-care home residents. Pre-existing cognitive impairment to be classified as per study. Categories to include those with and those without pre-existing cognitive impairment	
18.	Type and method of review	☒	Intervention
		☐	Diagnostic
		☐	Prognostic
		☐	Qualitative
		☐	Epidemiologic
		☐	Service Delivery
		☐	Other (please specify)
19.	Language	English	
20.	Country	England	
21.	Anticipated or actual start date	[For the purposes of PROSPERO, the date of commencement for the systematic review can be defined as any point after completion of a protocol but before formal screening of the identified studies against the eligibility criteria begins. A protocol can be deemed complete after sign-off by the NICE team with responsibility for quality assurance.]	

<table>
<tr><td>22.</td><td>Anticipated completion date</td><td colspan="3">[Give the date by which the guideline is expected to be published. This field may be edited at any time. All edits will appear in the record audit trail. A brief explanation of the reason for changes should be given in the Revision Notes facility.]</td></tr>
<tr><td rowspan="7">23.</td><td rowspan="7">Stage of review at time of this submission</td><td>Review stage</td><td>Started</td><td>Completed</td></tr>
<tr><td>Preliminary searches</td><td>☐</td><td>☐</td></tr>
<tr><td>Piloting of the study selection process</td><td>☐</td><td>☐</td></tr>
<tr><td>Formal screening of search results against eligibility criteria</td><td>☐</td><td>☐</td></tr>
<tr><td>Data extraction</td><td>☐</td><td>☐</td></tr>
<tr><td>Risk of bias (quality) assessment</td><td>☐</td><td>☐</td></tr>
<tr><td>Data analysis</td><td>☐</td><td>☐</td></tr>
<tr><td>24.</td><td>Named contact</td><td colspan="3">5a. Named contact
National Guideline Centre

5b Named contact e-mail
[Guideline email]@nice.org.uk
[Developer to check with Guideline Coordinator for email address]

5e Organisational affiliation of the review</td></tr>
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		National Institute for Health and Care Excellence (NICE) and [National Guideline Alliance / National Guideline Centre / NICE Guideline Updates Team / NICE Public Health Guideline Development Team] [Note it is essential to use the template text here and one of the centre options to enable PROSPERO to recognise this as a NICE protocol]
25.	Review team members	[Give the title, first name, last name and the organisational affiliations of each member of the review team. Affiliation refers to groups or organisations to which review team members belong.] From the National Guideline Centre: [Guideline lead] [Senior systematic reviewer] Systematic reviewer [Health economist] [Information specialist] [Others]
26.	Funding sources/sponsor	This systematic review is being completed by the National Guideline Centre which receives funding from NICE.
27.	Conflicts of interest	All guideline committee members and anyone who has direct input into NICE guidelines (including the evidence review team and expert witnesses) must declare any potential conflicts of interest in line with NICE's code of practice for declaring and dealing with conflicts of interest. Any relevant interests, or changes to interests, will also be declared publicly at the start of each guideline committee meeting. Before each meeting, any potential conflicts of interest will be considered by the guideline committee Chair and a senior member of the development team. Any decisions to exclude a person from all or part of a meeting will be documented. Any changes to a member's declaration of interests will be recorded in the minutes of the meeting. Declarations of interests will be published with the final guideline.
28.	Collaborators	Development of this systematic review will be overseen by an advisory committee who will use the review to inform the development of evidence-based recommendations in line with section 3 of

		Developing NICE guidelines: the manual. Members of the guideline committee are available on the NICE website: [NICE guideline webpage].	
29.	Other registration details	[Give the name of any organisation where the systematic review title or protocol is registered (such as with The Campbell Collaboration, or The Joanna Briggs Institute) together with any unique identification number assigned. If extracted data will be stored and made available through a repository such as the Systematic Review Data Repository (SRDR), details and a link should be included here. If none, leave blank.]	
30.	Reference/URL for published protocol	[Give the citation and link for the published protocol, if there is one.]	
31.	Dissemination plans	NICE may use a range of different methods to raise awareness of the guideline. These include standard approaches such as: • notifying registered stakeholders of publication • publicising the guideline through NICE's newsletter and alerts • issuing a press release or briefing as appropriate, posting news articles on the NICE website, using social media channels, and publicising the guideline within NICE. [Add in any additional agree dissemination plans.]	
32.	Keywords	[Give words or phrases that best describe the review.]	
33.	Details of existing review of same topic by same authors	[Give details of earlier versions of the systematic review if an update of an existing review is being registered, including full bibliographic reference if possible. NOTE: most NICE reviews will not constitute an update in PROSPERO language. To be an update it needs to be the same review question/search/methodology. If anything has changed it is a new review]	
34.	Current review status	☐	Ongoing
		☐	Completed but not published
		☐	Completed and published
		☐	Completed, published and being updated
		☐	Discontinued

35..	Additional information	[Provide any other information the review team feel is relevant to the registration of the review.]
36.	Details of final publication	www.nice.org.uk

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Table 2: Health economic review protocol

Review question	All questions – health economic evidence
Objectives	To identify health economic studies relevant to any of the review questions.
Search criteria	• Populations, interventions and comparators must be as specified in the clinical review protocol above. • Studies must be of a relevant health economic study design (cost–utility analysis, cost-effectiveness analysis, cost–benefit analysis, cost–consequences analysis, comparative cost analysis). • Studies must not be a letter, editorial or commentary, or a review of health economic evaluations. (Recent reviews will be ordered although not reviewed. The bibliographies will be checked for relevant studies, which will then be ordered.) • Unpublished reports will not be considered unless submitted as part of a call for evidence. • Studies must be in English.
Search strategy	A health economic study search will be undertaken using population-specific terms and a health economic study filter – see appendix B below. The search covered all years
Review strategy	Studies not meeting any of the search criteria above will be excluded. Studies published before 2006, abstract-only studies and studies from non-OECD countries or the USA will also be excluded. Studies published in 2006 or later that were included in the previous guidelines will be reassessed for inclusion and may be included or selectively excluded based on their relevance to the questions covered in this update and whether more applicable evidence is also identified. Each remaining study will be assessed for applicability and methodological limitations using the NICE economic evaluation checklist which can be found in appendix H of Developing NICE guidelines: the manual (2014).[1] **Inclusion and exclusion criteria** • If a study is rated as both 'Directly applicable' and with 'Minor limitations' then it will be included in the guideline. A health economic evidence table will be completed, and it will be included in the health economic evidence profile. • If a study is rated as either 'Not applicable' or with 'Very serious limitations' then it will usually be excluded from the guideline. If it is excluded, then a health economic evidence table will not be completed, and it will not be included in the health economic evidence profile. • If a study is rated as 'Partially applicable', with 'Potentially serious limitations' or both then there is discretion over whether it should be included.

Where there is discretion

The health economist will decide based on the relative applicability and quality of the available evidence for that question, in discussion with the guideline committee if required. The aim is to include health economic studies that are helpful for decision-making in the context of the guideline and the current NHS setting. If several studies are considered of sufficiently high applicability and methodological quality that they could all be included, then the health economist, in discussion with the committee if required, may decide to include only the most applicable studies and to selectively exclude the remaining studies. All studies excluded based on applicability or methodological limitations will be listed with explanation in the excluded health economic studies appendix below.

The health economist will be guided by the following hierarchies.

Setting:

- UK NHS (most applicable).
- OECD countries with predominantly public health insurance systems (for example, France, Germany, Sweden).
- OECD countries with predominantly private health insurance systems (for example, Switzerland).
- Studies set in non-OECD countries or in the USA will be excluded before being assessed for applicability and methodological limitations.

Health economic study type:

- Cost–utility analysis (most applicable).
- Other type of full economic evaluation (cost–benefit analysis, cost-effectiveness analysis, cost–consequences analysis).
- Comparative cost analysis.
- Non-comparative cost analyses including cost-of-illness studies will be excluded before being assessed for applicability and methodological limitations.

Year of analysis:

- The more recent the study, the more applicable it will be.
- Studies published in 2006 or later (including any such studies included in the previous guidelines) but that depend on unit costs and resource data entirely or predominantly from before 2006 will be rated as 'Not applicable'.
- Studies published before 2006 (including any such studies included in the previous guidelines) will be excluded before being assessed for applicability and methodological limitations.

Quality and relevance of effectiveness data used in the health economic analysis:

- The more closely the clinical effectiveness data used in the health economic analysis match with the outcomes of the studies included in the clinical review the more useful the analysis will be for decision-making in the guideline.

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Appendix B – Literature search strategies

The literature searches for this review are detailed below and complied with the methodology outlined in Developing NICE guidelines: the manual.[1]

For more information, please see the Methodology review published as part of the accompanying documents for this guideline.

B.1 Clinical search literature search strategy

Searches were constructed using a PICO framework where population (P) terms were combined with Intervention (I) and in some cases Comparison (C) terms. Outcomes (O) are rarely used in search strategies as these concepts may not be indexed or described in the title or abstract and are therefore difficult to retrieve.

Table 3: Database parameters, filters and limits applied

Database	Dates searched	Search filter used
Medline (OVID)	1946 – 22 June 2022	Randomised controlled trials Systematic review studies Observational studies Exclusions (animal studies, letters, comments, editorials, case studies/reports) English language
Embase (OVID)	1974 – 22 June 2022	Randomised controlled trials Systematic review studies Observational studies Exclusions (animal studies, letters, comments, editorials, case studies/reports, conference abstracts) English language
The Cochrane Library (Wiley)	Cochrane Reviews to 2022 Issue 6 of 12 CENTRAL to 2022 Issue 6 of 12	
Epistemonikos (The Epistemonikos Foundation)	Inception to 22 June 2022	Exclusions (Cochrane reviews)

Medline (Ovid) search terms

1.	craniocerebral trauma/ or exp brain injuries/ or coma, post-head injury/ or exp head injuries, closed/ or head injuries, penetrating/ or exp intracranial hemorrhage, traumatic/ or exp skull fractures/
2.	((skull or cranial) adj3 fracture*).ti,ab.
3.	((head or brain or craniocerebral or cranial or cerebral or skull) adj4 (injur* or trauma*)).ti,ab.
4.	(trauma* and ((subdural or intracranial) adj2 (h?ematoma* or h?emorrhage* or bleed*))).ti,ab.

5.	or/1-4
6.	letter/
7.	editorial/
8.	news/
9.	exp historical article/
10.	Anecdotes as Topic/
11.	comment/
12.	case report/
13.	(letter or comment*).ti.
14.	or/6-13
15.	randomized controlled trial/ or random*.ti,ab.
16.	14 not 15
17.	animals/ not humans/
18.	exp Animals, Laboratory/
19.	exp Animal Experimentation/
20.	exp Models, Animal/
21.	exp Rodentia/
22.	(rat or rats or mouse or mice or rodent*).ti.
23.	or/16-22
24.	5 not 23
25.	limit 24 to English language
26.	tomography/
27.	magnetic resonance imaging/ or exp diffusion magnetic resonance imaging/ or echo-planar imaging/ or fluorine-19 magnetic resonance imaging/ or magnetic resonance angiography/ or magnetic resonance imaging, cine/ or multiparametric magnetic resonance imaging/
28.	exp tomography, emission-computed/
29.	exp tomography, x-ray/
30.	(compute* adj2 tomograph*).ti,ab.
31.	(CT or CAT or PET or SPECT).ti,ab.
32.	((MR or magnetic resonance or NMR) adj2 (imag* or tomograph* or angiograph*)).ti,ab.
33.	MRI.ti,ab.
34.	((echo-planar or echoplanar or EPI) adj2 (imag* or sequenc*)).ti,ab.
35.	or/26-34
36.	25 and 35
37.	randomized controlled trial.pt.
38.	controlled clinical trial.pt.
39.	randomi#ed.ti,ab.
40.	placebo.ab.
41.	randomly.ti,ab.
42.	Clinical Trials as topic.sh.
43.	trial.ti.
44.	or/37-43
45.	Meta-Analysis/
46.	exp Meta-Analysis as Topic/

47.	(meta analy* or metanaly* or metaanaly* or meta regression).ti,ab.
48.	((systematic* or evidence*) adj3 (review* or overview*)).ti,ab.
49.	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.
50.	(search strategy or search criteria or systematic search or study selection or data extraction).ab.
51.	(search* adj4 literature).ab.
52.	(medline or pubmed or cochrane or embase or psychlit or psyclit or psychinfo or psycinfo or cinahl or science citation index or bids or cancerlit).ab.
53.	cochrane.jw.
54.	((multiple treatment* or indirect or mixed) adj2 comparison*).ti,ab.
55.	or/45-54
56.	Epidemiologic studies/
57.	Observational study/
58.	exp Cohort studies/
59.	(cohort adj (study or studies or analys* or data)).ti,ab.
60.	((follow up or observational or uncontrolled or non randomi#ed or epidemiologic*) adj (study or studies or data)).ti,ab.
61.	((longitudinal or retrospective or prospective or cross sectional) and (study or studies or review or analys* or cohort* or data)).ti,ab.
62.	Controlled Before-After Studies/
63.	Historically Controlled Study/
64.	Interrupted Time Series Analysis/
65.	(before adj2 after adj2 (study or studies or data)).ti,ab.
66.	exp case control study/
67.	case control*.ti,ab.
68.	Cross-sectional studies/
69.	(cross sectional and (study or studies or review or analys* or cohort* or data)).ti,ab.
70.	or/56-70
71.	36 and (44 or 55 or 70)

13 **Embase (Ovid) search terms**

1.	head injury/
2.	exp brain injury/
3.	skull injury/ or exp skull fracture/
4.	((head or brain or craniocerebral or cranial or cerebral or skull) adj4 (injur* or trauma*)).ti,ab.
5.	((skull or cranial) adj3 fracture*).ti,ab.
6.	(trauma* and ((subdural or intracranial) adj2 (h?ematoma* or h?emorrhage* or bleed*))).ti,ab.
7.	or/1-6
8.	letter.pt. or letter/
9.	note.pt.
10.	editorial.pt.
11.	(conference abstract or conference paper).pt.
12.	case report/ or case study/
13.	(letter or comment*).ti.
14.	or/8-13

15.	randomized controlled trial/ or random*.ti,ab.
16.	14 not 15
17.	animal/ not human/
18.	nonhuman/
19.	exp Animal Experiment/
20.	exp Experimental Animal/
21.	animal model/
22.	exp Rodent/
23.	(rat or rats or mouse or mice or rodent*).ti.
24.	or/16-23
25.	7 not 24
26.	limit 25 to english language
27.	tomography/
28.	brain tomography/
29.	exp computer assisted tomography/
30.	exp emission tomography/
31.	exp x-ray tomography/
32.	exp nuclear magnetic resonance imaging/
33.	(compute* adj2 tomograph*).ti,ab.
34.	(CT or CAT or PET or SPECT).ti,ab.
35.	((MR or magnetic resonance or NMR) adj2 (imag* or tomograph* or angiograph*)).ti,ab.
36.	MRI.ti,ab.
37.	((echo-planar or echoplanar or EPI) adj2 (imag* or sequenc*)).ti,ab.
38.	or/27-37
39.	26 and 38
40.	random*.ti,ab.
41.	factorial*.ti,ab.
42.	(crossover* or cross over*).ti,ab.
43.	((doubl* or singl*) adj blind*).ti,ab.
44.	(assign* or allocat* or volunteer* or placebo*).ti,ab.
45.	crossover procedure/
46.	single blind procedure/
47.	randomized controlled trial/
48.	double blind procedure/
49.	or/40-48
50.	systematic review/
51.	Meta-Analysis/
52.	(meta analy* or metanaly* or metaanaly* or meta regression).ti,ab.
53.	((systematic* or evidence*) adj3 (review* or overview*)).ti,ab.
54.	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.
55.	(search strategy or search criteria or systematic search or study selection or data extraction).ab.
56.	(search* adj4 literature).ab.

57.	(medline or pubmed or cochrane or embase or psychlit or psyclit or psychinfo or psycinfo or cinahl or science citation index or bids or cancerlit).ab.
58.	cochrane.jw.
59.	((multiple treatment* or indirect or mixed) adj2 comparison*).ti,ab.
60.	or/50-59
61.	Clinical study/
62.	Observational study/
63.	Family study/
64.	Longitudinal study/
65.	Retrospective study/
66.	Prospective study/
67.	Cohort analysis/
68.	Follow-up/
69.	cohort*.ti,ab.
70.	68 and 69
71.	(cohort adj (study or studies or analys* or data)).ti,ab.
72.	((follow up or observational or uncontrolled or non randomi#ed or epidemiologic*) adj (study or studies or data)).ti,ab.
73.	((longitudinal or retrospective or prospective or cross sectional) and (study or studies or review or analys* or cohort* or data)).ti,ab.
74.	(before adj2 after adj2 (study or studies or data)).ti,ab.
75.	exp case control study/
76.	case control*.ti,ab.
77.	cross-sectional study/
78.	(cross sectional and (study or studies or review or analys* or cohort* or data)).ti,ab.
79.	or/61-67,70-78
80.	39 and (49 or 60 or 79)

14 Cochrane Library (Wiley) search terms

#1.	MeSH descriptor: [Craniocerebral Trauma] this term only
#2.	MeSH descriptor: [Brain Injuries] explode all trees
#3.	MeSH descriptor: [Coma, Post-Head Injury] this term only
#4.	MeSH descriptor: [Head Injuries, Closed] explode all trees
#5.	MeSH descriptor: [Head Injuries, Penetrating] this term only
#6.	MeSH descriptor: [Intracranial Hemorrhage, Traumatic] explode all trees
#7.	MeSH descriptor: [Skull Fractures] explode all trees
#8.	((skull or cranial) near/3 fracture*):ti,ab
#9.	((head or brain or craniocerebral or cranial or skull) near/3 (injur* or trauma*)):ti,ab
#10.	(trauma* and ((subdural or intracranial) near/2 (h?ematoma* or h?emorrhage* or bleed*))):ti,ab
#11.	#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10
#12.	MeSH descriptor: [Tomography] this term only
#13.	MeSH descriptor: [Tomography, Emission-Computed] explode all trees
#14.	MeSH descriptor: [Tomography, X-Ray] explode all trees
#15.	MeSH descriptor: [Magnetic Resonance Imaging] this term only
#16.	MeSH descriptor: [Diffusion Magnetic Resonance Imaging] explode all trees
#17.	MeSH descriptor: [Echo-Planar Imaging] this term only

#18.	MeSH descriptor: [Fluorine-19 Magnetic Resonance Imaging] this term only
#19.	MeSH descriptor: [Magnetic Resonance Angiography] this term only
#20.	MeSH descriptor: [Magnetic Resonance Imaging, Cine] this term only
#21.	MeSH descriptor: [Multiparametric Magnetic Resonance Imaging] this term only
#22.	(compute* near/2 tomograph*):ti,ab
#23.	(CT or CAT or PET or SPECT):ti,ab
#24.	((MR or magnetic resonance or NMR) near/2 (imag* or tomograph* or angiograph*)):ti,ab
#25.	MRI:ti,ab
#26.	((echo-planar or echoplanar or EPI) near/2 (imag* or sequenc*)):ti,ab
#27.	#12 or #13 or #14 or #15 or #16 or #17 or #18 or #19 or #20 or #21 or #22 or #23 or #24 or #25 or #26
#28.	#11 and #27

Epistemonikos search terms

1.	(advanced_title_en:(((skull OR cranial) AND fracture*)) OR advanced_abstract_en:(((skull OR cranial) AND fracture*))) OR (advanced_title_en:(((head OR brain OR craniocerebral OR cranial OR cerebral OR skull) AND (injur* OR trauma*))) OR advanced_abstract_en:(((head OR brain OR craniocerebral OR cranial OR cerebral OR skull) AND (injur* OR trauma*)))) AND (advanced_title_en:((tomograph* OR magnetic resonance OR echoplanar OR echo-planar OR neuroimag* OR MRI OR CT OR CAT OR PET OR SPECT OR EPI)) OR advanced_abstract_en:((tomograph* OR magnetic resonance OR echoplanar OR echo-planar OR neuroimag* OR MRI OR CT OR CAT OR PET OR SPECT OR EPI)))

B.2 Health Economics literature search strategy

Health economic evidence was identified by conducting searches using terms for a broad Head Injury population. The following databases were searched: NHS Economic Evaluation Database (NHS EED - this ceased to be updated after 31st March 2015), Health Technology Assessment database (HTA - this ceased to be updated from 31st March 2018) and The International Network of Agencies for Health Technology Assessment (INAHTA). Searches for recent evidence were run on Medline and Embase from 2014 onwards for health economics, and all years for quality-of-life studies.

Table 4: Database parameters, filters and limits applied

Database	Dates searched	Search filters and limits applied
Medline (OVID)	Health Economics 1 January 2014 – 22 June 2022	Health economics studies Quality of life studies Exclusions (animal studies, letters, comments, editorials, case studies/reports) English language
	Quality of Life 1946 – 22 June 2022	
Embase (OVID)	Health Economics 1 January 2014 – 22 June 2022	Health economics studies Quality of life studies

Database	Dates searched	Search filters and limits applied
	Quality of Life 1974 – 22 June 2022	Exclusions (animal studies, letters, comments, editorials, case studies/reports, conference abstracts) English language
NHS Economic Evaluation Database (NHS EED) (Centre for Research and Dissemination - CRD)	Inception –31st March 2015	
Health Technology Assessment Database (HTA) (Centre for Research and Dissemination – CRD)	Inception – 31st March 2018	
The International Network of Agencies for Health Technology Assessment (INAHTA)	Inception – 22 June 2022	English language

25 **Medline (Ovid) search terms**

1.	craniocerebral trauma/ or exp brain injuries/ or coma, post-head injury/ or exp head injuries, closed/ or head injuries, penetrating/ or exp intracranial hemorrhage, traumatic/ or exp skull fractures/
2.	((skull or cranial) adj3 fracture*).ti,ab.
3.	((head or brain or craniocerebral or intracranial or cranial or skull) adj3 (injur* or trauma*)).ti,ab.
4.	(trauma* and ((subdural or intracranial or brain) adj2 (h?ematoma* or h?emorrhage* or bleed*))).ti,ab.
5.	or/1-4
6.	letter/
7.	editorial/
8.	news/
9.	exp historical article/
10.	Anecdotes as Topic/
11.	comment/
12.	case report/
13.	(letter or comment*).ti.
14.	or/6-13
15.	randomized controlled trial/ or random*.ti,ab.
16.	14 not 15
17.	animals/ not humans/
18.	exp Animals, Laboratory/
19.	exp Animal Experimentation/
20.	exp Models, Animal/
21.	exp Rodentia/
22.	(rat or rats or mouse or mice or rodent*).ti.

23.	or/16-22
24.	5 not 23
25.	limit 24 to English language
26.	economics/
27.	value of life/
28.	exp "costs and cost analysis"/
29.	exp Economics, Hospital/
30.	exp Economics, medical/
31.	Economics, nursing/
32.	economics, pharmaceutical/
33.	exp "Fees and Charges"/
34.	exp budgets/
35.	budget*.ti,ab.
36.	cost*.ti.
37.	(economic* or pharmaco?economic*).ti.
38.	(price* or pricing*).ti,ab.
39.	(cost* adj2 (effectiv* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.
40.	(financ* or fee or fees).ti,ab.
41.	(value adj2 (money or monetary)).ti,ab.
42.	or/26-41
43.	quality-adjusted life years/
44.	sickness impact profile/
45.	(quality adj2 (wellbeing or well being)).ti,ab.
46.	sickness impact profile.ti,ab.
47.	disability adjusted life.ti,ab.
48.	(qal* or qtime* or qwb* or daly*).ti,ab.
49.	(euroqol* or eq5d* or eq 5*).ti,ab.
50.	(qol* or hql* or hqol* or h qol* or hrqol* or hr qol*).ti,ab.
51.	(health utility* or utility score* or disutilit* or utility value*).ti,ab.
52.	(hui or hui1 or hui2 or hui3).ti,ab.
53.	(health* year* equivalent* or hye or hyes).ti,ab.
54.	discrete choice*.ti,ab.
55.	rosser.ti,ab.
56.	(willingness to pay or time tradeoff or time trade off or tto or standard gamble*).ti,ab.
57.	(sf36* or sf 36* or short form 36* or shortform 36* or shortform36*).ti,ab.
58.	(sf20 or sf 20 or short form 20 or shortform 20 or shortform20).ti,ab.
59.	(sf12* or sf 12* or short form 12* or shortform 12* or shortform12*).ti,ab.
60.	(sf8* or sf 8* or short form 8* or shortform 8* or shortform8*).ti,ab.
61.	(sf6* or sf 6* or short form 6* or shortform 6* or shortform6*).ti,ab.
62.	or/42-61

63.	25 and (42 or 62)

26 **Embase (Ovid) search terms**

1.	head injury/
2.	exp brain injury/
3.	skull injury/ or exp skull fracture/
4.	((head or brain or craniocerebral or intracranial or cranial or skull) adj3 (injur* or trauma*)).ti,ab.
5.	((skull or cranial) adj3 fracture*).ti,ab.
6.	(trauma* and ((subdural or intracranial or brain) adj2 (h?ematoma* or h?emorrhage* or bleed*))).ti,ab.
7.	or/1-6
8.	letter.pt. or letter/
9.	note.pt.
10.	editorial.pt.
11.	(conference abstract or conference paper).pt.
12.	case report/ or case study/
13.	(letter or comment*).ti.
14.	or/8-13
15.	randomized controlled trial/ or random*.ti,ab.
16.	14 not 15
17.	animal/ not human/
18.	nonhuman/
19.	exp Animal Experiment/
20.	exp Experimental Animal/
21.	animal model/
22.	exp Rodent/
23.	(rat or rats or mouse or mice or rodent*).ti.
24.	or/16-23
25.	7 not 24
26.	limit 25 to English language
27.	health economics/
28.	exp economic evaluation/
29.	exp health care cost/
30.	exp fee/
31.	budget/
32.	funding/
33.	budget*.ti,ab.
34.	cost*.ti.
35.	(economic* or pharmaco?economic*).ti.
36.	(price* or pricing*).ti,ab.
37.	(cost* adj2 (effectiv* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.
38.	(financ* or fee or fees).ti,ab.
39.	(value adj2 (money or monetary)).ti,ab.

40.	or/27-39
41.	quality-adjusted life years/
42.	"quality of life index"/
43.	short form 12/ or short form 20/ or short form 36/ or short form 8/
44.	sickness impact profile/
45.	(quality adj2 (wellbeing or well being)).ti,ab.
46.	sickness impact profile.ti,ab.
47.	disability adjusted life.ti,ab.
48.	(qal* or qtime* or qwb* or daly*).ti,ab.
49.	(euroqol* or eq5d* or eq 5*).ti,ab.
50.	(qol* or hql* or hqol* or h qol* or hrqol* or hr qol*).ti,ab.
51.	(health utility* or utility score* or disutilit* or utility value*).ti,ab.
52.	(hui or hui1 or hui2 or hui3).ti,ab.
53.	(health* year* equivalent* or hye or hyes).ti,ab.
54.	discrete choice*.ti,ab.
55.	rosser.ti,ab.
56.	(willingness to pay or time tradeoff or time trade off or tto or standard gamble*).ti,ab.
57.	(sf36* or sf 36* or short form 36* or shortform 36* or shortform36*).ti,ab.
58.	(sf20 or sf 20 or short form 20 or shortform 20 or shortform20).ti,ab.
59.	(sf12* or sf 12* or short form 12* or shortform 12* or shortform12*).ti,ab.
60.	(sf8* or sf 8* or short form 8* or shortform 8* or shortform8*).ti,ab.
61.	(sf6* or sf 6* or short form 6* or shortform 6* or shortform6*).ti,ab.
62.	or/41-61
63.	26 and (40 or 62)

27 NHS EED and HTA (CRD) search terms

#1.	MeSH DESCRIPTOR Brain Injuries EXPLODE ALL TREES
#2.	MeSH DESCRIPTOR Craniocerebral Trauma
#3.	MeSH DESCRIPTOR Coma, Post-Head Injury
#4.	MeSH DESCRIPTOR Head Injuries, Closed EXPLODE ALL TREES
#5.	MeSH DESCRIPTOR Head Injuries, Penetrating
#6.	MeSH DESCRIPTOR Intracranial Hemorrhage, Traumatic EXPLODE ALL TREES
#7.	MeSH DESCRIPTOR Skull Fractures EXPLODE ALL TREES
#8.	(((skull or cranial) adj3 fracture*))
#9.	(((head or brain or craniocerebral or intracranial or cranial or skull) adj3 (injur* or trauma*)))
#10.	((trauma* and ((subdural or intracranial or brain) adj2 (h?ematoma* or h?emorrhage* or bleed*))))
#11.	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10

28 INAHTA search terms

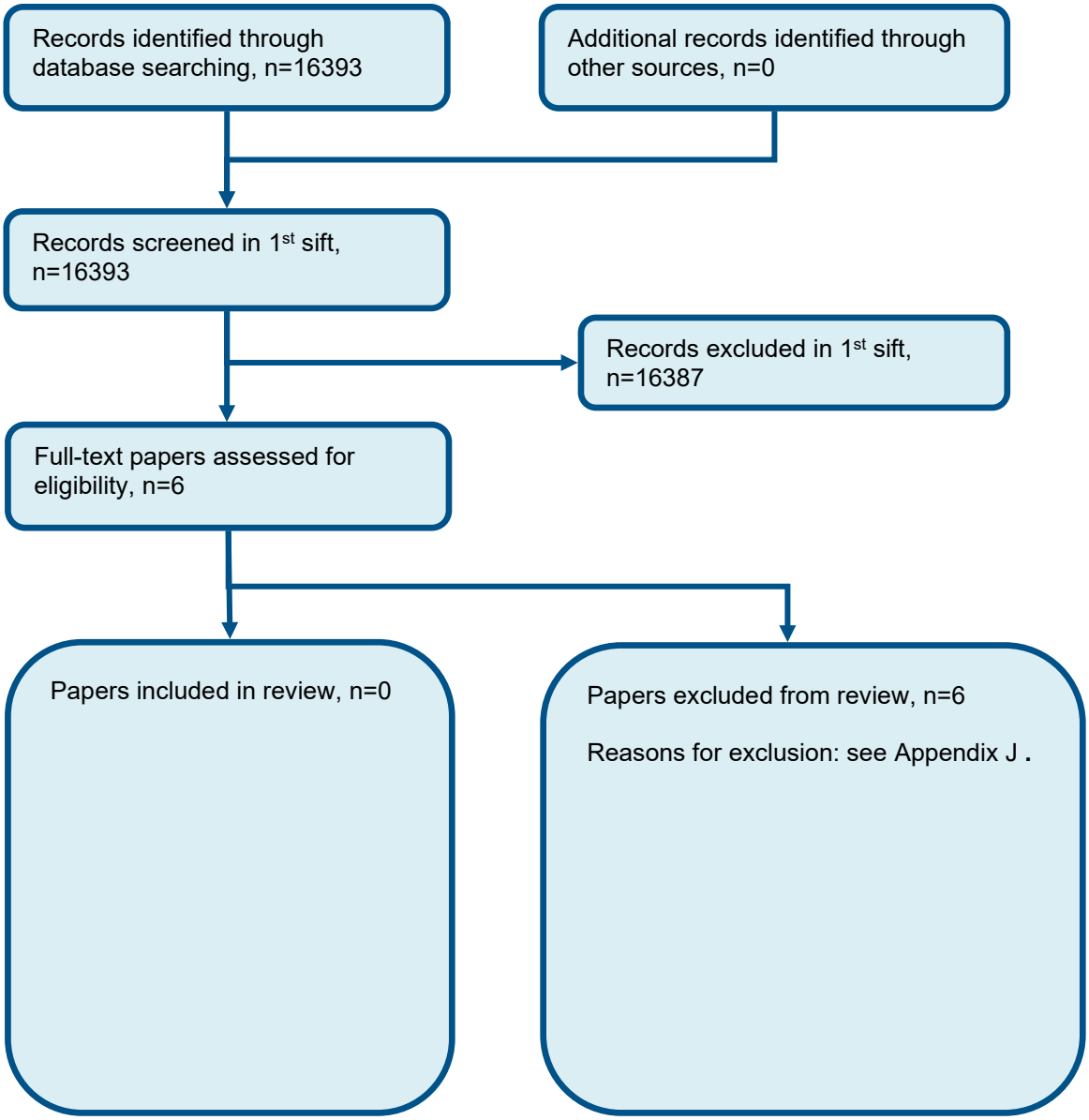
1.	((((trauma* and ((subdural or intracranial or brain) and (haematoma* or hematoma* or haemorrhage* or hemorrhage* or bleed*))))[Title]) AND (((trauma* and ((subdural or intracranial or brain) and (haematoma* or hematoma* or haemorrhage* or hemorrhage* or bleed*))))[Title])) OR ((((skull or cranial) and fracture*))[Title] OR (((skull or cranial) and fracture*))[abs]) OR ((((head or brain or craniocerebral or intracranial or cranial or skull) and (injur* or trauma*)))[Title] OR (((head or brain or

	craniocerebral or intracranial or cranial or skull) and (injur* or trauma*)))[abs]) OR ("Skull Fractures"[mhe]) OR ("Intracranial Hemorrhage, Traumatic"[mhe]) OR ("Head Injuries, Penetrating"[mh]) OR ("Head Injuries, Closed"[mhe]) OR ("Coma, Post-Head Injury"[mh]) OR ("Brain Injuries"[mhe]) OR ("Craniocerebral Trauma"[mh])

29

Appendix C – Effectiveness evidence study selection

Figure 1: Flow chart of clinical study selection for the review of direct access from the community to imaging



Appendix D – Effectiveness evidence

No clinical evidence identified

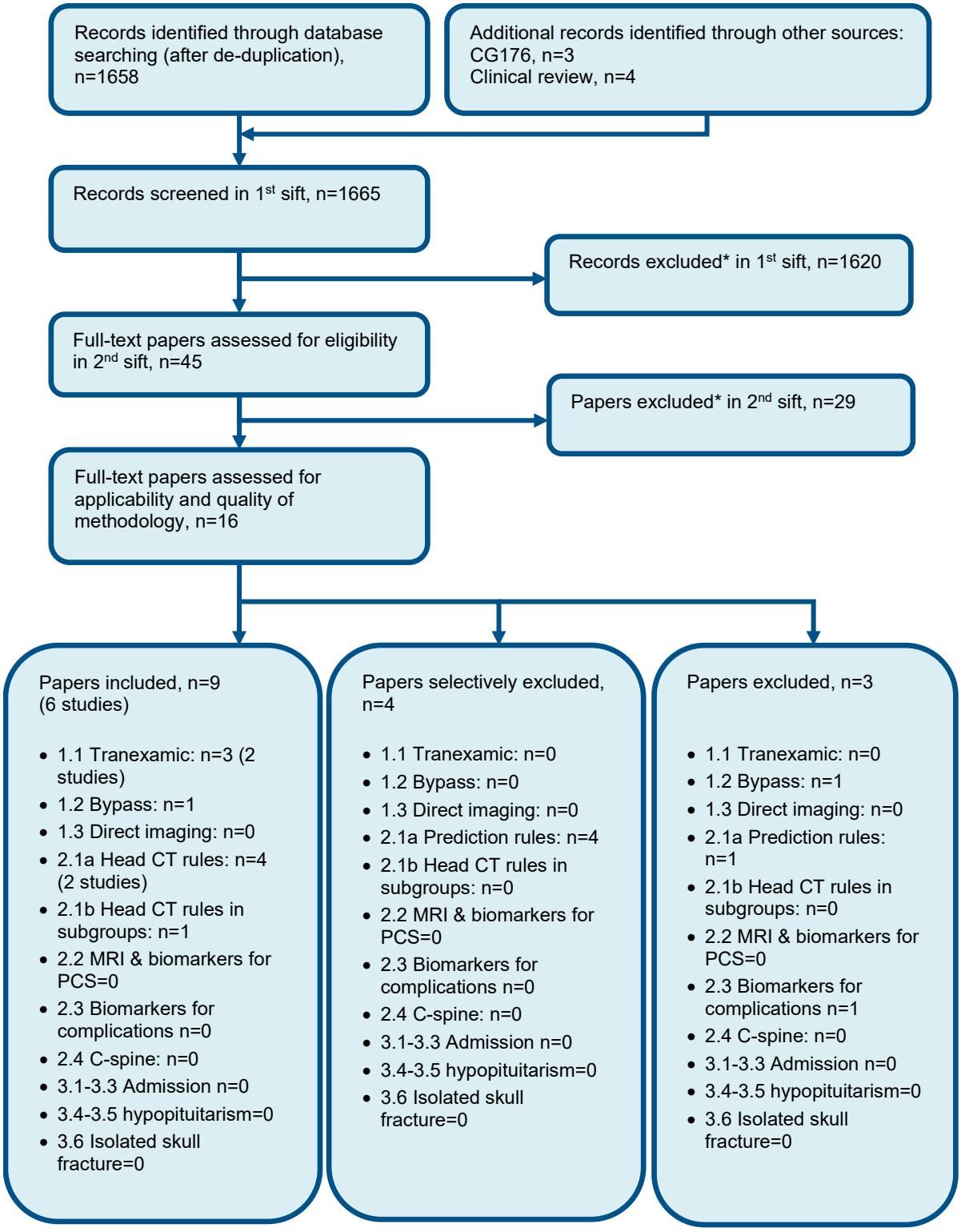
Appendix E – Forest plots

No clinical evidence identified

Appendix F – GRADE tables

No clinical evidence identified

Appendix G – Economic evidence study selection



* Non-relevant population, intervention, comparison, design or setting; non-English language

Appendix H – Economic evidence tables

None.

Appendix I – Health economic model

No modelling was undertaken.

Appendix J – Excluded studies

Clinical studies

Table 4: Studies excluded from the clinical review

Study	Reason
Boeke, A. J. P., Van Randwijck-Jacobze, M. E., De Lange-Klerk, E. M. S. et al. (2010) Effectiveness of GPs in accident and emergency departments. British Journal of General Practice 60(579): e378-e387	- Population not relevant to this review protocol
Calland, J. F., Ingraham, A. M., Martin, N. et al. (2012) Evaluation and management of geriatric trauma: An eastern association for the surgery of trauma practice management guideline. Journal of Trauma and Acute Care Surgery 73(5suppl4): S345-S350	- Study does not contain an intervention relevant to this review protocol
Kutcher, J. S., McCrory, P., Davis, G. et al. (2013) What evidence exists for new strategies or technologies in the diagnosis of sports concussion and assessment of recovery?. British Journal of Sports Medicine 47(5): 299-303	- Study does not contain an intervention relevant to this review protocol
Richless, L. K., English, K., Heller, M. B. et al. (1993) A prospective evaluation of radiologic criteria for head injury patients in a community emergency department. American Journal of Emergency Medicine 11(4): 327-30	- Study does not contain an intervention relevant to this review protocol
Skandsen, T., Nilsen, T. L., Einarsen, C. et al. (2019) Incidence of Mild Traumatic Brain Injury: A Prospective Hospital, Emergency Room and General Practitioner-Based Study. Frontiers in neurology [electronic resource]. 10: 638	- Study does not contain an intervention relevant to this review protocol
Van Winkle, P. J., Ho, N. J., Rodriguez, C. A. et al. (2012) Blunt head trauma in children in a community health care setting: outcomes and variables associated with the use of computed tomography. Journal of Pediatrics 161(3): 547-553.e1	- Study does not contain an intervention relevant to this review protocol

Health Economic studies

Published health economic studies that met the inclusion criteria (relevant population, comparators, economic study design, published 2006 or later and not from non-OECD country or USA) but that were excluded following appraisal of applicability and methodological quality are listed below. See the health economic protocol for more details.

None.

Appendix K – Research recommendations – full details

None.