

Costing report

**Head injury: triage, assessment,
investigation and early
management of head injury in
children, young people and
adults**

Published: January 2014

<http://guidance.nice.org.uk/CG176>

This costing report accompanies the clinical guideline: 'Head injury: triage, assessment, investigation and early management of head injury in children, young people and adults' (available online at <http://guidance.nice.org.uk/CG>).

Issue date: January 2014

This report is written in the following context

This report represents the view of NICE, which was arrived at after careful consideration of the available data and through consulting with healthcare professionals. It should be read in conjunction with the NICE guideline. The report and template are implementation tools and focus on the recommendations that were considered to have a significant impact on national resource utilisation.

The cost and activity assessments in the report are estimates based on a number of assumptions. They provide an indication of the likely impact and are not absolute figures. Assumptions used in the report are based on assessment of the national average. Local practice may be different from this, and the template can be amended to reflect local practice.

Implementation of the guidance is the responsibility of local commissioners and/or providers. Commissioners and providers are reminded that it is their responsibility to implement the guidance, in their local context, in light of their duties to have due regard to the need to eliminate unlawful discrimination, advance equality of opportunity and foster good relations. Nothing in this costing tool should be interpreted in a way that would be inconsistent with compliance with those duties.

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Executive summary

This costing report looks at the resource impact of implementing the NICE guideline 'Head injury: triage, assessment, investigation and early management of head injury in children, young people and adults' in England. The costing method adopted is outlined in appendix A; it uses the most accurate data available, was produced in conjunction with key clinicians, and reviewed by clinical and financial professionals.

The guideline is an update of NICE clinical guideline 56 (published 2007) and will replace it. NICE clinical guideline 56 updated and replaced NICE clinical guideline 4 (published 2003). The costs of implementing NICE clinical guideline 56 are assumed to have been incurred and the costing work for the new guideline focused on areas that were identified as being changes to current practice.

There has been a reconfiguration of trauma services in England since the last guideline was published. This costing report does not cover any costs associated with this reconfiguration.

Significant¹ resource-impact recommendations

This report focuses on the recommendations that are considered to have the greatest resource impact nationally, and therefore require the most additional resources to implement or can potentially generate the biggest savings. They are:

- Revised criteria for imaging of the head in children [**recommendation 1.4.11**]
- Revised criteria for imaging of the head – patients having warfarin treatment [**recommendation 1.4.12**]

¹ The following impacts have been defined as significant:

- where the number of people affected by the guidance recommendations is estimated to be over 300 (equivalent to 1 patient per 170,000; in practice, smaller populations may have no patients or possibly more than one, particularly if it is a disease that runs in families and there is a cluster in one area)
- where initial costing work indicates that the national cost is more than £1 million (equivalent to £2000 per 100,000 population).

- Revised criteria for imaging of the cervical spine in adults
[recommendation 1.5.8]

Net resource impact

The annual change in resource use per 500,000 population arising from implementing the recommendations considered in the costing analysis is summarised below.

Resource impact area	Cost impact per 500,000 population (£'000)
Criteria for performing a CT head scan – observing children for a minimum of 4 hours after the head injury	4.1
Criteria for performing a CT head scan – patients having warfarin treatment	5.9
Criteria for performing a CT cervical spine scan in adults	9.7
Total	19.7

Costs

- It is not expected that there will be a significant delay in implementing the new imaging recommendations. It is therefore assumed that costs will be incurred following publication of the guidance.
- Where a patient is admitted to hospital following an emergency department attendance, both the relevant accident and emergency (A&E) and non-elective tariffs are payable by commissioning organisations (Clinical Commissioning Groups). In line with payment by results (PbR) guidance for 2013/14, a marginal rate of 30% of the relevant published tariff will continue to apply for increases in the value of emergency admissions above the set baseline.
- The A&E tariffs in the PbR national tariff include the costs of imaging, including CT scans. Commissioners will bear the cost of any increased admissions.

Benefits and savings

Implementing the clinical guideline may result in the following savings and benefits:

- A reduction in the number of clinically important brain injuries and cervical spine injuries that are undetected following initial investigations. As well as the obvious benefit to patients, this may also reduce treatment costs due to earlier identification of injuries. People admitted to hospital may have features suggesting skull fracture or have evidence of brain damage. Most recover without specific or specialist intervention, but others experience long-term disability or even die from the effects of complications that could potentially be minimised or avoided with early detection and appropriate treatment.
- A reduction in the number of incorrect diagnosis of important brain injuries and cervical spine injuries (which would lead to clinical management of head injury) could prevent future emergency admissions for head injury. This could save commissioners between £400 and £3,100 per admission.

Local costing template

The costing template produced to support this guideline enables organisations in England, Wales and Northern Ireland to estimate the impact locally and replace variables with ones that depict the current local position. A sample calculation using this template showed that additional costs of £19,700 could be incurred for a population of 500,000.

1 Introduction

1.1 *Supporting implementation*

1.1.1 The NICE clinical guideline on Head injury is supported by the following implementation tools available on our website

www.nice.org.uk/guidance/CG176

- costing tools
 - a costing report; this document
 - a local costing template; a spreadsheet that can be used to estimate the local cost of implementation
- the discharge advice produced for the original guideline CG56
- baseline assessment tool; assess your baseline against the recommendations in the guidance in order to prioritise implementation activity, including clinical audit
- clinical audit tool for ambulance services; measure current practice against the guidance and identify areas in which practice can be improved. NICE have also worked with the Trauma Audit and Research Network (TARN) to ensure that their dataset includes the new recommendations.

1.2 *What is the aim of this report?*

1.2.1 This report provides estimates of the cost impact per 500,000 population arising from implementation of guidance on head injury in England. These estimates are based on assumptions made about current practice and predictions of how current practice might change following implementation.

1.2.2 This report aims to help organisations plan for the financial implications of implementing NICE guidance. The guideline replaces NICE clinical guideline 56 (published 2007). NICE clinical guideline 56 replaced NICE clinical guideline 4 (published 2003). The costs of implementing NICE clinical guideline 56 are assumed to have been incurred and the costing work for the new guideline

focused on areas that were identified as being changes to current practice.

1.2.3 This report does not reproduce the NICE guideline on head injury and should be read in conjunction with it (see www.nice.org.uk/guidance/CG176).

1.2.4 The costing template that accompanies this report is designed to help those assessing the resource impact at a local level in England, Wales or Northern Ireland.

1.3 *Epidemiology of head injury*

1.3.1 Head injury is defined as any trauma to the head other than superficial injuries to the face. It is the most common type of trauma seen in emergency departments, estimated to represent 10% of all emergency department cases or around 1 million people each year in the UK².

1.3.2 Other estimates suggest as many as 1.2 million people attend emergency departments in England with a recent head injury each year (NICE, 2013), while Hospital Episode Statistics (HES) data on the number of accident and emergency (A&E) attendances in England indicates that there were around 700,000 emergency department attendances for head injury in 2011/12 (The Information Centre for Health and Social Care, 2013a).

1.3.3 For the purposes of this costing model a mid-point between the higher and lower estimates (950,000 attendances per year in England) has been used. This is equivalent to around 8,500 emergency department attendances per 500,000 population. The effect of varying this baseline figure is modelled in the sensitivity analysis (section 4).

² A Kay, G Teadsdale (2001) . Head injury in the United Kingdom 25: 1210–1220
<http://rd.springer.com/article/10.1007/s00268-001-0084-6#page-1>

- 1.3.4 Of these attendances, between 33% and 50% are thought to be for children under the age of 16 (NICE, 2013). Using a mid-point of 41%, this is equivalent to around 3,500 children per 500,000 population, with the remaining 5,000 attendances per 500,000 population consisting of adults and young people aged 16 years and older.
- 1.3.5 The majority of head injuries will have no lasting consequences and need no specific treatment. However, some people experience ongoing symptoms (known as post-concussion syndrome) and a minority will require urgent intervention (such as neurosurgery). It is essential that injuries requiring such intervention are detected and acted on quickly to prevent further injury to the brain.
- 1.3.6 Because most people with head injuries do not need any intervention it is neither feasible nor sensible to perform a CT head scan on everyone who has a head injury. A number of clinical decision rules have therefore been developed that help clinicians to identify people who are at risk and need a CT head scan.
- 1.3.7 People with head injuries may also sustain bony and/or soft tissue injuries to the cervical spine. When imaging is required, the first-line test will either be a series of cervical spine X-rays or a cervical spine CT scan.
- 1.3.8 The 2007 version of the NICE guideline employed a modified version of the Canadian cervical spine rule, which suggested that plain X- rays should be the initial mode of imaging of the cervical spine unless the patient was undergoing a CT head scan, in which case the initial mode of cervical spine imaging should also be CT.

1.4 Current service provision

- 1.4.1 The previous head injury guidelines produced by NICE resulted in CT scanning replacing skull radiography as the primary imaging for assessing head injury.

- 1.4.2 The revised recommendations are concerned with the uncertainty in the early care of people with head injuries, focusing on how best to manage head injuries in certain groups of patients, such as those on anticoagulants and those with significant but non-surgical traumatic brain injury.
- 1.4.3 The updated recommendations also include revised criteria for imaging of the cervical spine in adults.
- 1.4.4 According to the expert clinical opinion of the guideline development group (GDG), these recommendations are expected to increase the number of CT head and cervical spine scans performed.

2 Costing methodology

2.1 Process

- 2.1.1 We use a structured approach for costing clinical guidelines (see appendix A).
- 2.1.2 We have to make assumptions in the costing model. These are tested for reasonableness with members of the GDG and key clinical practitioners in the NHS.
- 2.1.3 Local users can assess local cost impact, using the costing template as a starting point, and update assumptions to reflect local circumstances.

2.2 Scope of the cost-impact analysis

- 2.2.1 The guideline offers best practice advice on head injury.
- 2.2.2 The guidance does not cover the exclusions below. Therefore, these issues are outside the scope of the costing work.

- People with other traumatic injuries to the head who are outside of the current definition of head injury, including people with superficial injuries to the eye or face.
- Rehabilitation or long-term care of people with head injuries.
- Areas addressed in the 2007 guideline that have not been reviewed in the new guideline including: pre-hospital assessment, advice and referral to hospital; immediate management at the scene and transport to hospital; involvement of the neurosurgical department; discharge and follow-up; admissions and observation; radiation exposure practice.

2.2.3 We worked with the GDG and other professionals to identify the recommendations that would have the most significant resource-impact (see table 1). Costing work has focused on these recommendations.

Table 1 Recommendations with a significant resource impact

Recommendation	Recommendation number	Guideline key priority?
<p>Children who have sustained a head injury and have only 1 of the risk factors in recommendation 1.4.10 (and none of those in recommendation 1.4.9) should be observed for a minimum of 4 hours after the head injury. If during observation any of the risk factors below are identified, perform a CT head scan within 1 hour.</p> <ul style="list-style-type: none"> • Glasgow coma scale (GCS) score less than 15. • Further vomiting. • A further episode of abnormal drowsiness. <p>A provisional written radiologist's report should be made available within 1 hour of the scan being performed. If none of these risk factors occur during observation, use clinical judgement to determine whether a longer period of observation is needed.</p>	1.4.11	✓
<p>For patients (adults and children) who have sustained a head injury with no other indications for a CT head scan and who are having warfarin treatment, perform a CT head scan within 8 hours of the injury. A provisional written radiologist's report should be available within 1 hour of the scan being performed.</p>	1.4.12	✓
<p>For adults who have sustained a head injury and have any of the following risk factors, perform a CT cervical spine scan within 1 hour of the risk factor being identified:</p> <ul style="list-style-type: none"> • GCS less than 13 on initial assessment. • The patient has been intubated. • Plain X-rays are technically inadequate (for example, the desired view is unavailable). • Plain X-rays are suspicious or definitely abnormal. • A definitive diagnosis of cervical spine injury is needed urgently (for example, before surgery). 	1.5.8	✓

<ul style="list-style-type: none"> • The patient is having other body areas scanned for head injury or multi-region trauma. • The patient is alert and stable, there is clinical suspicion of cervical spine injury and any of the following apply: <ul style="list-style-type: none"> - age 65 years or older - dangerous mechanism of injury (fall from a height of greater than 1 metre or 5 stairs; axial load to the head, for example, diving; high-speed motor vehicle collision; rollover motor accident; ejection from a motor vehicle; accident involving motorised recreational vehicles; bicycle collision) - focal peripheral neurological deficit - paraesthesia in the upper or lower limbs. <p>A provisional written radiologist's report should be made available within 1 hour of the scan being performed.</p>		
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2.2.4 The above 3 recommendations in the guideline have been identified as key priorities for implementation, and all 3 are also considered to have significant resource impact.

2.2.5 The A&E tariffs in the PbR national tariff include the costs of imaging, including CT scans. Commissioners will bear the cost of any increased admissions.

2.2.6 Implementing the other 7 recommendations that are considered to be key priorities for implementation is not expected to lead to a significant cost impact (see table 2).

Table 2 Key priority for implementation recommendations with no significant resource impact

Recommendation	Decision
<p>Transport patients who have sustained a head injury directly to a hospital that has resources to further resuscitate them and to investigate and initially manage multiple injuries. All acute hospitals receiving patients with head injury directly from an incident should have these resources, which should be appropriate for a patient's age [1.2.14]</p>	<p>This is not considered to have a significant cost impact as it is thought that, as part of the ambulance trust's protocol, this would already be happening in the majority of cases.</p>
<p>For adults who have sustained a head injury and have any of the risk factors indicated in recommendation 1.4.7 in the NICE guideline 176, perform a CT head scan within 1 hour of the risk factor being identified. A provisional written radiology report should be made available within 1 hour of the scan being performed. [1.4.7]</p> <p>For children who have sustained a head injury and have any of the risk factors in recommendation 1.4.9 in the NICE guideline 176, perform a CT head scan within 1 hour of the risk factor being identified. A provisional written radiology report should be made available within 1 hour of the scan being performed. [1.4.9]</p> <p>For children who have sustained a head injury and have more than one of the risk factors in recommendation 1.4.10 in the NICE guideline 176 (and none of those in recommendation 1.4.9), perform a CT head scan within 1 hour of the risk factors being identified. A provisional written radiology report should be made available within 1 hour of the scan being performed. [1.4.10]</p>	<p>The main change from the previous guideline is the request for a written report. Expert clinical opinion is that the production of provisional written reports can be absorbed within the existing role of the radiologists and therefore will not present a significant cost impact.</p>
<p>A clinician with training in safeguarding should be involved in the initial assessment of any patient with a head injury presenting to the emergency department. If there are any concerns identified, document these and follow local safeguarding procedures appropriate to the patient's age [1.3.11]</p>	<p>It is not thought this will result in a significant cost impact as it is assumed safeguarding training is already in place.</p>
<p>Give verbal and printed discharge advice to patients with any degree of head injury who are discharged from an emergency department or observation ward, and their families and carers. Follow recommendations in Patient experience in adult NHS services [NICE clinical guideline 138] about providing information in an accessible format. [1.9.7]</p> <p>Printed advice for patients, families and carers</p>	<p>This is not anticipated to have a significant cost impact as it is assumed that written material is already available in most areas.</p>

should be appropriate for the age of the patient and include details specified in recommendation 1.9.8 in the NICE guideline 176 . [1.9.8]	
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2.2.7 We have limited the consideration of costs and savings to direct costs to the NHS that will arise from implementation. We have not included consequences for the individual, the private sector or the not-for-profit sector. If applicable, any realisable cost savings arising from a change in practice have been offset against the cost of implementing the change.

2.3 **General assumptions made**

2.3.1 The costing model is based on estimates of the current number of emergency department attendances for head injury and how these will be affected by the new recommendations in the guideline. The costs of implementing NICE clinical guideline 56 are assumed to have been incurred and the costing work for the new guideline focused on areas that were identified as being changes to current practice.

2.3.2 Table 3 summarises the number of emergency department attendances for head injury per 500,000 population as described in section 1.3.

Table 3 Emergency department attendances for head injury in England per 500,000 population

Age	Proportion of head injuries	Number
Under 16 years	41%	3,506
16 years or older	59%	5,045
Total	100%	8,551

2.3.3 The GDG's opinion is that the new recommendations will lead to an increase in the number of CT head and cervical spine scans being carried out.

2.4 *Basis of unit costs*

- 2.4.1 If a national tariff price or indicative price exists for an activity this has been used as the unit cost.
- 2.4.2 Using these prices ensures that the costs in the report are the cost to the clinical commissioning group (CCG) of commissioning predicted changes in activity at the tariff price, but may not represent the actual cost to individual trusts of delivering the activity.

3 Significant resource-impact recommendations

3.1 *Criteria for performing a CT head scan – observing children for a minimum of 4 hours after head injury*

Background

- 3.1.1 Recommendation 1.4.11 (see table 1 above) recommends that children who have sustained a head injury and have only 1 of the risk factors in recommendation 1.4.10 (and none of those in recommendation 1.4.9) should be observed for a minimum of 4 hours after the head injury. If during observation any of several risk factors are identified, a CT head scan should be performed within 1 hour.
- 3.1.2 The opinion of the GDG was that this recommendation relates to children who currently are not being observed or scanned. Implementing the recommendation is therefore expected to result in an increase in the number of children being admitted for observation along with an increase in the number of CT head scans being performed.

Assumptions made

- 3.1.3 The opinion of the GDG was that currently 1–2% (mid-point 1.5%) of children presenting at emergency departments with a head injury are being observed. This is equivalent to 53 children per 500,000

population. Following implementation of the guidance this is expected to increase to around 5% of children (175 per 500,000 population).

- 3.1.4 The GDG's opinion is between 3% and 9% of the children being observed will be admitted to hospital for further observation or tests. Using a mid-point of 6% this is equivalent to 3 children per 500,000 population under current practice, and 11 children per 500,000 population following implementation of the guidance.
- 3.1.5 It is assumed that 14.1% of children being observed will have a CT head scan (Dunning et al. 2006). This is equivalent to 7 children per 500,000 population under current practice, and 25 children per 500,000 population following implementation of the guidance.
- 3.1.6 The cost of an emergency admission (£379) is the 2013/14 national tariff for healthcare resource group (HRG) HA83C (Head Injury without CC non-elective tariff), while the cost of a CT head scan (£78) is assumed to be the indicative 2013/14 national tariff for RA08Z (CT scan, one area, no contrast).

Cost summary

- 3.1.7 The net cost of implementing the recommendation is summarised in table 4.

Table 4 net cost of implementing recommendation 1.4.11 per 500,000 population

	Unit cost	Current		Proposed		Change	
		Number	Cost (£)	Number	Cost (£)	Number	Cost (£)
Children admitted	£379	3	1,195	11	3,985	8	2,790
CT head scans	£78	7	580	25	1,930	18	1,350
Totals			1,775		5,915		4,140

Other considerations

- 3.1.8 Increasing the number of children with head injury who are observed is expected to reduce the number of clinically important brain injuries that are undetected following initial investigations. This may lead to longer term savings for the NHS.

3.2 *Criteria for performing a CT head scan – patients having warfarin treatment*

Background

- 3.2.1 Recommendation 1.4.12 recommends that for patients (adults and children) who have sustained a head injury with no other indications for a CT head scan and who are having warfarin treatment, a CT head scan should be performed within 8 hours of the injury. A provisional written radiologist's report should be made available within 1 hour of the scan being performed.
- 3.2.2 Performing a CT head scan in these patients who, under the previous NICE guideline would have been discharged, will therefore increase the number of people who will receive a CT head scan.
- 3.2.3 This is expected to reduce the number of people with an intracranial bleed that remains undetected after initial investigations, which would lead to delayed treatment for the bleed. This should also therefore reduce the number of patients in whom delayed treatment would have had long-term negative implications (NICE, 2013).

Assumptions made

- 3.2.4 The current proportion of patients who attend an emergency department and have a CT head scan is assumed to be between 8% and 22%, based on a study by Mooney et al. (2010). Using a mid-point of 15% this is equivalent to around 1,280 scans per 500,000 population. A study by Fabbri et al. (2004) states an

additional 0.8% of all emergency department attendances would receive a CT head scan if the criteria were to include coagulopathy (history of bleeding, clotting disorder or current treatment with warfarin). The future proportion of attendances that have a CT head scan is therefore assumed to be 15.8%. This is equivalent to around 1,350 scans per 500,000 population.

3.2.5 The cost of a CT head scan for patients having warfarin treatment is assumed to be £86 (RA09Z CT scan, one area with post contrast only, national tariff 2013/14).

3.2.6 It is assumed that the number of hospital admissions remains the same following implementation of this recommendation since any potential changes cannot be modelled accurately.

Cost summary

3.2.7 The net cost of implementing the recommendation is summarised in table 5.

Table 5 net cost of implementing recommendation 1.4.12 per 500,000 population

	Unit cost	Current		Proposed		Change	
		Numbers of scans	Cost (£)	Numbers of scans	Cost (£)	Numbers of scans	Cost (£)
CT head scans	£86	1,283	110,306	1,351	116,189	68	5,883

Other considerations

3.2.8 Patients on warfarin are more likely to have a cerebral bleed with more minor injury. It is believed that all patients on warfarin presenting to an emergency department with head injury, no matter how minor, should have their international normalised ratio (INR) measured. There is an increased risk of bleeding as the INR rises (Keeling et al. 2011).

3.2.9 A reduction in the number of people receiving delayed treatment for an intracranial bleed is likely to lead to a reduction in the use of

NHS resources and potential savings since this is expected to lead to improved outcomes for these people. It is not possible to quantify these savings per 500,000 population.

3.3 *Criteria for performing a CT cervical spine scan in adults*

Background

- 3.3.1 Recommendation 1.5.8 recommends that for adults who have sustained a head injury and have any of the defined risk factors (see table 1), a CT cervical spine scan should be performed within 1 hour of the risk factor being identified.
- 3.3.2 This recommendation widens the criteria for people receiving a CT cervical spine scan from the previous guidance and is therefore expected to increase the number of people receiving a CT cervical spine scan. One of the additional criteria is if the person is alert and stable, there is clinical suspicion of cervical spine injury and the person is aged 65 years or older.

Assumptions made

- 3.3.3 The opinion of the GDG is 1% of the current proportion of adults who attend an emergency department have a CT cervical spine scan. This is equivalent to 50 scans per 500,000 population.
- 3.3.4 The GDG's opinion is that the new recommendation will lead to an increase in the number of CT cervical spine scans to between 2% and 5%. Using a midpoint of 4% the future proportion of attendances that have a CT cervical spine scan is equivalent to around 200 scans per 500,000 population.
- 3.3.5 The cost of a CT cervical spine scan is assumed to be £89 (RA11Z CT, two areas without contrast, national tariff 2013/14).
- 3.3.6 For each additional adult receiving a CT cervical spine scan, it is assumed that under current guidance these people would receive a cervical spine X-ray. Therefore, following implementation of the

updated guidance it is assumed these people would no longer receive a cervical spine X-ray.

3.3.7 The cost of a cervical spine X-ray is assumed to be £25 (2013/14 national tariff non-mandatory price, direct access plain film X-ray).

3.3.8 It is assumed that the number of hospital admissions remains the same following implementation of this recommendation since any potential changes cannot be modelled accurately.

Cost summary

3.3.9 The net cost of implementing the recommendation is summarised in table 6.

Table 6 net cost of implementing recommendation 1.5.8 per 500,000 population

	Unit cost	Current		Proposed		Change	
		Number	Cost (£)	Number	Cost (£)	Number	Cost (£)
CT cervical spine scans	£89	50	4,490	202	17,960	151	13,470
Cervical spine X-rays	£25					-151	-3,784
Totals							9,686

Other considerations

3.3.10 Increasing the number of adults receiving a CT cervical spine scan is expected to reduce the number of clinically important cervical spine injuries that are undetected following initial investigations. This may lead to longer term savings for the NHS.

3.4 Benefits and savings

Implementing the clinical guideline may result in the following savings and benefits:

- A reduction in the number of clinically important brain injuries and cervical spine injuries that are undetected following initial investigations. As well as the obvious benefit to patients, this may also reduce treatment costs due to earlier identification of significant injuries. People admitted to hospital may have features suggesting skull fracture or have evidence of brain damage. Most recover without specific or specialist intervention, but others experience long-term disability or even die from the effects of complications that could potentially be minimised or avoided with early detection and appropriate treatment.
- A reduction in the number of incorrect diagnosis of important brain injuries and cervical spine injuries (which would lead to clinical management of head injury) could prevent future emergency admissions for head injury. This could save commissioners between £400 and £3,100 per admission.

4 Sensitivity analysis

4.1 Methodology

- 4.1.1 There are a number of assumptions in the model for which no empirical evidence exists; these are therefore subject to a degree of uncertainty.
- 4.1.2 Appropriate minimum and maximum values of variables were used in the sensitivity analysis to assess which variables have the biggest impact on the net cost or saving. This enables users to identify the significant cost drivers.
- 4.1.3 It is not possible to arrive at an overall range for total cost because the minimum or maximum of individual lines are unlikely to occur simultaneously. We undertook one-way simple sensitivity analysis, altering each variable independently to identify those that have greatest impact on the calculated total cost.

4.1.4 Appendix B contains a table detailing all variables modified, and the key conclusions drawn are discussed below.

4.2 *Impact of sensitivity analysis on costs*

Variation in the number of head injuries presented at emergency departments

4.2.1 The incidence of people attending emergency departments with a head injury is uncertain. The baseline assumption of 1.71% leads to a cost impact of £19,700 per 500,000 population. Varying the incidence from 1.5% to 2% leads to a cost impact of £17,300 and £23,000 respectively, a difference of £5,700.

Variation in the number of CT scans in patients on warfarin

4.2.2 The future practice for patients receiving CT scans while having warfarin treatment is based on a study by Fabbri et al. (2004). The baseline assumption of 15.8% leads to a cost impact of £19,700 per 500,000 population. Varying the proportion of CT head scans from 15.4% to 16.2% leads to a cost impact of £16,800 and £22,700 per 500,000 population respectively, a difference of £5,900.

Variation in the number of CT cervical scans in adults

4.2.3 The future practice for adults receiving CT cervical scans is based on the expert clinical opinion of the GDG. The baseline assumption of 4% leads to a cost impact of £19,700 per 500,000 population. Varying the proportion of CT cervical scans from 2% to 5% leads to a cost impact of £13,300 and £22,900 per 500,000 population respectively, a difference of £9,600.

5 Impact of guidance for commissioners

5.1.1 It is not expected that there will be a significant delay in implementing the new imaging recommendations. Costs will therefore be incurred immediately following publication of guidance.

- 5.1.2 The A&E tariffs in the payment by results (PbR) national tariff include the costs of imaging, including CT scans. Commissioners should seek assurance that providers have implemented the updated clinical guideline. Commissioners will bear the cost of any increased admissions.
- 5.1.3 Where a patient is admitted to hospital following an emergency department attendance, both the relevant A&E and non-elective tariffs are payable by commissioning organisations (Clinical Commissioning Groups).
- 5.1.4 The admission of patients with serious head injury is within PbR; however, the critical care element is not. Any transfer of funds to neuroscience units for critical care will therefore need to be negotiated locally.
- 5.1.5 Treatment of patients with head injury is expected to fall into programme budgeting category 16X, problems due to trauma and injury.
- 5.1.6 The main commissioner for the guidance is expected to be clinical commissioning groups (CCGs). Any resulting neurosurgery as a result of head injury is commissioned by NHS England.

6 Conclusion

6.1 *Total cost per 500,000 population*

- 6.1.1 Using the significant resource-impact recommendations shown in table 1 and assumptions specified in section 3 we have estimated the annual impact of implementing these recommendations to be a cost of £19,700 per 500,000 population. Table 7 shows the breakdown of cost of each significant resource-impact recommendation.

Table 7 Resource impact of implementing guidance per 500,000 population

Resource impact area	Cost impact per 500,000 population (£'000)
Criteria for performing a CT head scan – observing children for a minimum of 4 hours after the head injury	4.1
Criteria for performing a CT head scan – patients having warfarin treatment	5.9
Criteria for performing a CT cervical spine scan in adults	9.7
Total	19.7

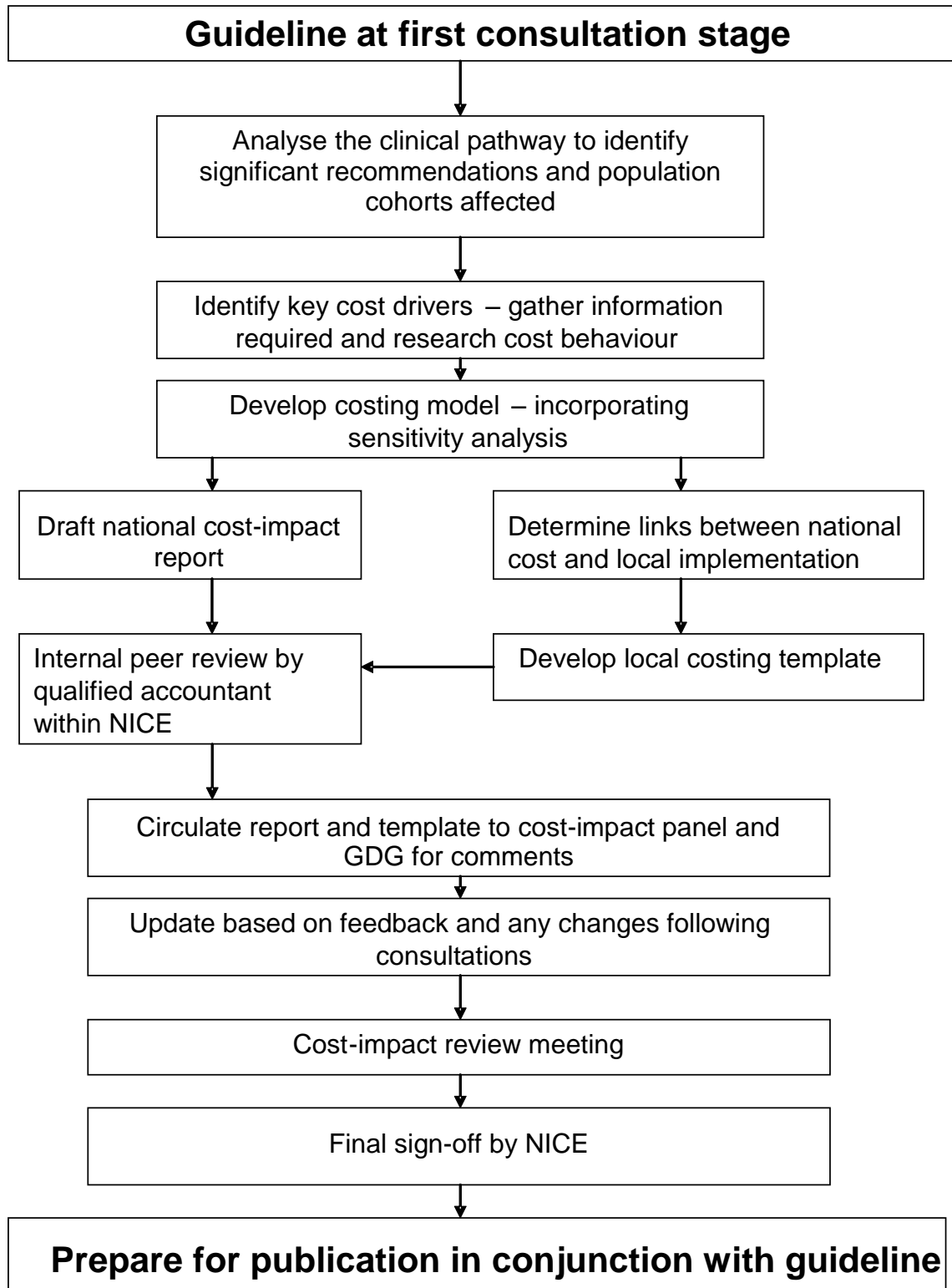
6.1.2 The costs presented are estimates and should not be taken as the full cost of implementing the guideline.

6.1.3 Costs are expected to be incurred immediately following publication of guidance.

6.2 Next steps

6.2.1 The local costing template produced to support this guideline enables organisations such as clinical commissioning groups or health boards in Wales and Northern Ireland to estimate the impact locally and replace variables with ones that depict the current local position. A sample calculation using this template showed that a population of 500,000 could expect to incur additional costs of £19,700. Use this template to calculate the cost of implementing this guidance in your area.

Appendix A. Approach to costing guidelines



Appendix B. Results of sensitivity analysis

Table 1 Individual variable sensitivity

	Baseline value	Minimum value	Maximum value	Recurrent costs			Change (£000's)
				Baseline costs (£000's)	Minimum costs (£000's)	Maximum costs (£000's)	
1. Number of head injury attendances at emergency department	1.71%	1.50%	2.00%	19.7	17.3	23.0	6
2. Proportion of children receiving CT head scan after observation	14.1%	10.0%	20.0%	19.7	19.3	20.3	1
3. Proportion receiving CT head scan	15.8%	15.4%	16.2%	19.7	16.8	22.7	6
4. Proportion receiving CT cervical spine scan	4.0%	2.0%	5.0%	19.7	13.3	22.9	10

Appendix C. References

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